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INSTITUT SUPÉRIEUR D'ÉCONOMIE ET DE MANAGEMENT
GREDEG UMR 6227 DU CNRS

Habilitation à Diriger des Recherches
Discipline: Sciences Economiques

Présentée et soutenue publiquement par

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Le 18 janvier 2011

Intermédiation Financière et Activité Économique

Une contribution à l'analyse de l'innovation et de l'instabilité financières

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I. PRÉSENTATION DES TRAVAUX DE RECHERCHE

Introduction

Les travaux que je présente dans le cadre de cette habilitation à diriger des recherches s'organisent autour d'un thème principal: l'analyse de la relation entre intermédiation financière et activité économique. Ce choix est étroitement lié à l'observation de faits empiriques qui, depuis plusieurs décennies, soulignent le rôle majeur joué par les comportements des intermédiaires financiers sur la forme des fluctuations économiques.

Ainsi, ma **thèse de Doctorat** (*Nasica [1], 1995*) et mon ouvrage ***Finance, Investment and Economic Fluctuations*** (*Nasica [2], 2000*) ont pour objet principal l'analyse des phénomènes d'instabilité économique et financière observés entre le milieu des années soixante et le milieu des années quatre-vingt-dix¹. Ces travaux m'ont amené à mettre en relief les difficultés rencontrées par les modèles macroéconomiques les plus utilisés, incarnés durant cette période par la synthèse classico-keynésienne puis par la Nouvelle Economie Classique, à rendre compte de ces phénomènes en raison du rôle secondaire voire inexistant accordé aux intermédiaires financiers dans ce type de formalisations².

¹ Pour ne citer que le cas de l'économie américaine, rappelons pour mémoire que celle-ci a connu depuis la Seconde Guerre mondiale de nombreuses crises financières: "credit crunch" de 1966, affaire de la Penn Central en 1970, faillite de la Franklin National Bank en 1974, crise de l'argent en 1980, krach boursier d'octobre 1987, problèmes posés par le renflouement du système des caisses d'épargne en 1990-91. De même, le ralentissement de la croissance que les pays de l'OCDE ont tour à tour subi au début des années quatre-vingt-dix apparaît, dans une large mesure, relié à l'évolution de leur endettement au cours de la décennie quatre-vingt.

² Avec le recul, dix ans plus tard, une critique similaire peut être adressée aux modèles dynamiques d'équilibre général en univers stochastique (*Dynamic Stochastic General Equilibrium*, DSGE, Woodford, 2003), qui se sont imposés dans le monde académique, et plus encore dans les départements de recherche des banques centrales (Avouyi-Dovi et al., 2007) ou au FMI (Botman et al., 2008). Ces modèles sont utilisés afin d'évaluer les conséquences des chocs de politique économique, mais aussi en matière de prévision macroéconomique. Or, ces approches n'accordent qu'une place squelettique aux systèmes financiers ou à l'intermédiation financière (Spaventa, 2009). Ils ne peuvent pas traiter de tout un ensemble de phénomènes comme la procyclicité du crédit ou des niveaux de levier financier, dont la dernière crise en date,

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Ce constat m'a amené à centrer mes recherches sur les analyses développées par des économistes qui, au contraire, placent les comportements bancaires et les problèmes d'instabilité financière au centre de leur approche. Ces travaux ne relèvent pas d'un courant de pensée homogène. Ils sont plutôt le fait d'économistes fondant leur argumentation sur un ensemble d'hypothèses et d'outils analytiques sensiblement différents. La principale différence entre ces diverses approches concerne l'environnement décisionnel des agents économiques et en particulier des banques.

Ainsi, une première famille de travaux considère les imperfections sur les marchés financiers, et en particulier les asymétries d'information, comme la cause centrale d'instabilité financière. C'est le cas notamment des modèles néo-keynésiens d'accélérateur financier (Bernanke, Gertler et Gilchrist, 1999).

Un second type d'approche obtient des résultats similaires en utilisant des outils méthodologiques différents. Dans ces travaux, l'environnement décisionnel est caractérisé par une incertitude forte plutôt que par des asymétries d'information. Les travaux de Minsky (1975, 1982, 1986) s'inscrivent dans cette perspective. Son approche reprend les thèmes principaux du "fondamentalisme" keynésien (rôle de l'incertitude et des comportements qu'elle engendre, instabilité dynamique des économies de marché, rôle de la monnaie et incidence des comportements de préférence pour la liquidité). Cependant, si les idées de Keynes ont indéniablement marqué l'œuvre de Minsky, ce dernier semble difficilement classable dans tel ou tel courant de pensée. Ses travaux sont en effet fortement influencés par d'autres courants théoriques et d'autres auteurs, en particulier Fisher (1933), Kalecki (1937) et Schumpeter (1951a).

Ces influences diverses ont conduit Minsky à construire une théorie originale des cycles d'affaires, souvent qualifiée d'"hypothèse d'instabilité financière", parfois de "*Wall Street Paradigm*". L'hypothèse d'instabilité financière est fondée sur une conception endogène et financière des fluctuations économiques qui s'oppose trait pour trait à la vision d'une économie harmonieuse, auto-régulée et constamment équilibrée caractérisant la Nouvelle Economie Classique. Cette hypothèse renvoie à deux types de phénomènes caractérisant, selon l'auteur, l'évolution des économies financièrement sophistiquées. Le premier phénomène fait référence à un processus endogène de transition vers une fragilisation financière croissante de l'économie. Le second caractérise le passage d'une situation financièrement fragile à une situation de récession puis de crise économique de forte amplitude.

Comme l'ont souligné des économistes de premier plan (par exemple Goodhart, 2010 ou Roubini et Mihm, 2010), la crise financière récente repose

celle de 2007-2009, a de nouveau révélé qu'ils jouaient un rôle central dans la genèse de l'instabilité financière.

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en grande partie sur des mécanismes similaires à ceux étudiés par Minsky. Cependant, la complexité et la richesse de l'analyse de Minsky, l'accent porté sur les aspects institutionnels de l'activité économique, associés à une absence totale de formalisation de sa part, n'ont pas facilité la compréhension de son approche et expliquent en grande partie la désaffection relative dont a fait l'objet sa théorie des fluctuations.

Une première conclusion de mes travaux (**Nasica [1] 1995, [2] 2000, [22] 1998a, [24] 1996**) était qu'un rapprochement entre les modèles néokeynésiens et l'approche de Minsky pouvait être envisagé afin d'améliorer la compréhension du rôle des banques dans les phénomènes d'instabilité financière. L'intérêt principal des premiers étant de fournir des fondements microéconomiques solides à l'existence de contraintes financières sur les décisions d'investissement et de financement tandis qu'un apport majeur de la théorie de Minsky est de mettre en relief le rôle joué par les comportements bancaires en situation d'incertitude dans l'émergence d'une fragilité et d'une instabilité financières endogènes.

J'ai montré que ce rapprochement avait été en partie réalisé par des modèles d'instabilité financière apparus au début des années quatre-vingt-dix³. Deux grandes idées caractérisent en effet ces modèles. La première est que les variations des fondamentaux réels de l'économie (technologie, préférences ou dotations initiales) ne sont pas les seuls - ni même les principaux - facteurs d'instabilité de l'activité économique. Dans ces modèles, les variables caractérisant la structure financière de l'économie jouent un rôle central dans l'apparition et/ou l'amplification des fluctuations économiques. La deuxième idée est que ces modèles revendentiquent une vision endogène – ou tout au moins non totalement exogène – des fluctuations économiques. Les cycles apparaissent bien souvent, en l'absence de tout choc exogène, comme le résultat de comportements rationnels d'agents évoluant sur des marchés des produits et financiers où l'information est imparfaite et où les relations entre les différentes variables économiques ne sont pas linéaires.

Le modèle non linéaire de Delli Gatti, Gallegati et Gardini (1993a) offre une bonne illustration de cette génération de modèles. Il peut être considéré comme une synthèse entre l'analyse de Minsky et des travaux néo-keynésiens de Greenwald et Stiglitz (1993). En effet, ce modèle retranscrit fidèlement l'une des idées phares de l'approche de Minsky: la succession de phases de stabilité relative et d'instabilité auxquelles sont soumises les économies de marché contemporaines est induite principalement par des processus endogènes et des phénomènes financiers. La mise en évidence de cycles à la Minsky dans le modèle repose en grande partie sur la prise en compte de relations comportementales fondées sur divers résultats centraux des modèles

³Delli Gatti, Gallegati et Gardini (1993a, 1993b), Delli Gatti et Gallegati (2000), Skott (1994), Franke et Semmler (1992), Keen (1995), Arena et Raybaut (2000).

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néo-keynésiens. En particulier, les contraintes financières dues aux asymétries d'information ont une influence considérable sur l'investissement et donc sur l'émergence et le développement des fluctuations économiques. Néanmoins, contrairement à la plupart des travaux néo-keynésiens, le déclenchement d'une crise n'est pas obligatoirement lié à un choc nominal exogène affectant la production via son impact sur la richesse nette des agents économiques. Dans ce modèle, les asymétries d'information sur les marchés du crédit et des actions contribuent à créer une dynamique instable de manière complètement endogène.

Néanmoins, ma **deuxième conclusion** est que ce rapprochement effectué dans ces modèles entre les approches néo-keynésiennes et minskyennes demeurerait incomplet. En effet, à mes yeux, ces travaux négligent deux dimensions importantes de la relation entre intermédiation financière et activité économique.

Premièrement, elles sous-estiment le rôle joué par les politiques de stabilisation contracycliques. Or, les crises financières observées au cours des dernières décennies se caractérisent par le fait que les autorités de régulation ont mobilisé divers outils de stabilisation afin d'endiguer ou de prévenir les phénomènes d'instabilité financière. Quelles que soient les politiques mises en place (politique prudentielle, intervention de prêteurs en dernier ressort, déficits publics), le résultat est toujours le même: il se crée une véritable dynamique institutionnelle qui vient s'imbriquer dans les dynamiques réelle et financière de l'économie et modifier les résultats engendrés par ces dernières. Les fluctuations économiques observées prennent alors la forme de cycles d'affaires "tronqués" (c'est le cas par exemple lorsque ces politiques de stabilisation empêchent pendant une période relativement longue l'éclatement d'une crise financière ou d'une dépression profonde). D'un point de vue théorique, cela signifie que la modélisation de l'instabilité financière ne peut pas faire abstraction de ces mécanismes de stabilisation et raisonner comme si les cycles économiques et financiers résultaient seulement des comportements adoptés par les agents économiques privés.

Deuxièmement, elles négligent le lien entre intermédiation financière et innovation. En effet, les crises financières passées et, plus généralement, les fluctuations de l'activité économique sont étroitement liées à l'émergence d'innovations affectant soit l'économie réelle soit la finance elle-même. L'histoire économique suggère que les intermédiaires financiers jouent un double rôle dans la genèse et le développement des processus d'innovation. Ils permettent tout d'abord d'accompagner et de favoriser le développement des innovations dans le domaine industriel et commercial. Il y a cent ans, Schumpeter (1911) soulignait déjà le lien étroit existant entre le développement incessant du crédit bancaire et les innovations tant technologiques qu'organisationnelles. Parallèlement, les intermédiaires financiers affectent le fonctionnement de l'activité économique car ils sont

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eux-mêmes des innovateurs. Ils innovent à la fois pour s'adapter aux nouveaux besoins de financement de l'économie et pour maintenir ou renforcer leurs marges. Ainsi au 19^{ème} siècle, les grandes banques d'investissement, en modifiant leurs pratiques et en favorisant les grandes opérations de fusion dans l'industrie, ont garanti la stabilité de leurs revenus face aux épisodes récurrents de concurrence sauvage sur les prix. De la même manière, plus près de nous, l'émergence et le développement de nouvelles formes d'intermédiation financière, comme le capital-risque, apparaissent en grande partie comme une réponse aux demandes de financement émanant de firmes en création ou de jeunes entreprises technologiques qui ne peuvent être satisfaites par les moyens de financement traditionnels (banques ou marchés financiers). Les banques ont également été à l'origine de bon nombre d'innovations financières, dont certaines ont été considérées comme des facteurs clés dans la dernière crise financière⁴.

Face à ce double constat, j'ai décidé d'articuler mes travaux de recherche autour de deux axes: l'étude du lien entre politiques de stabilisation et instabilité financière d'une part (**Partie 1**) et l'analyse de la relation entre intermédiation financière et innovation d'autre part (**Partie 2**). Ces thèmes font l'objet d'approfondissements dans le cadre de travaux en cours qui sont synthétisés dans la dernière partie de cette présentation (**Partie 3**).

⁴ Citons l'adoption du *Financial Services Modernization Act*, en novembre 1999, signifiant l'abandon du *Glass Steagall Act*, mis en place en 1933, et qui établissait une frontière étanche entre les banques de dépôts, accordant des crédits, et les banques d'investissement, intervenant sur les marchés d'actifs. Sa suppression a contribué à la titrisation des crédits et à la redistribution en chaîne des risques au moyen de nouveaux supports structurés, les CDO notamment, ou en recourant aux dérivés de crédits de type CDS. On peut également rappeler l'adoption par le système bancaire de nouvelles normes comptables IFRS qui évaluent les actifs selon la *fair value* et créent des effets déstabilisants dans les bilans bancaires.

1. Politiques de Stabilisation et Instabilité Financière

Depuis plus de deux siècles, deux conceptions de l'évolution de l'activité économique s'opposent. Pour reprendre la distinction effectuée par Schumpeter, il faut distinguer les économistes qui considèrent que

"the economic process is essentially non-oscillatory and that the explanation of cyclical as well as other fluctuations must be sought in particular circumstances (monetary or other) which disturb that even flow and those holding that the economic process itself is essentially wave like - that cycles are the form of capitalist evolution" (Schumpeter, 1951b, p. 252).

Dans cette section, je présente un ensemble de travaux que j'ai publiés au cours des dernières années dont le point commun est de montrer que la modélisation des fluctuations économiques peut emprunter une troisième voie non mentionnée par Schumpeter. Elle consiste à analyser la dynamique macroéconomique comme le résultat d'une interaction permanente entre, d'une part, des mécanismes endogènes potentiellement porteurs d'instabilité et, d'autre part, des mécanismes institutionnels visant à stabiliser cette dynamique endogène.

Dans un premier temps, je m'attache à montrer que la problématique de l'introduction de mécanismes stabilisateurs dans la modélisation de l'instabilité économique est déjà présente dans les tout premiers travaux publiés de Minsky et constitue un élément central de son Hypothèse d'Instabilité Financière (point 1.1). Je présente ensuite un modèle original permettant de mieux comprendre la manière dont l'un de ces mécanismes stabilisateurs, les déficits publics, influence les phénomènes d'instabilité financière (point 1.2).

1.1. LES THWARTING SYSTEMS : ÉLÉMENT CENTRAL (MAIS NÉGLIGÉ) DES MODÈLES D'INSTABILITÉ FINANCIÈRE

"Les institutions, les régulations et les contraintes sont le reflet de tentatives plus ou moins conscientes visant à empêcher les conditions initialement instables de dégénérer en chaos. Dans le système économique actuel, le but des interventions est de prévenir la dégradation et le retournement des conditions macroéconomiques. En effet, une dégradation macroéconomique envoie un signal négatif à l'ensemble des marchés et des retournements rapides des variables macroéconomiques augmentent le degré d'ignorance des agents sur la signification des signaux émis par le marché" (Minsky, 1992, p. 11-12).

Comme je l'ai souligné ci-dessus, l'intérêt principal des travaux visant à modéliser l'Hypothèse d'Instabilité Financière est de retranscrire assez fidèlement la dimension financière de la théorie de Minsky, c'est-à-dire sa conception endogène des fluctuations économiques fondée sur sa théorie financière de l'investissement. Néanmoins, ces travaux ne reflètent que partiellement l'approche de Minsky. En effet, dans leur grande majorité, ils négligent un aspect important de la conception minskyenne des cycles d'affaires: le rôle joué par les mécanismes institutionnels de stabilisation de l'activité.

J'ai donc axé une partie de mes recherches sur cette dimension de la théorie de Minsky en privilégiant, dans un premier temps, une approche orientée histoire de l'analyse économique (**Nasica [6] 1999a et [2] 2000**). Cela m'a conduit à m'intéresser aux travaux sur la modélisation des cycles d'affaires développés par l'auteur à la fin des années cinquante (Minsky, 1957a et 1959). Dans ces travaux, Minsky développe une analyse qui se situe dans le prolongement des modèles d'interaction entre le multiplicateur et l'accélérateur élaborés quelques années plus tôt par Hicks (1950) et Goodwin (1951). En particulier, lorsqu'on compare la forme générale du modèle de Hicks et celle proposée par Minsky, il y a une grande similitude entre les deux approches. Dans les deux cas, les auteurs ont choisi de prendre en compte les non-linéarités (et donc de modéliser des fluctuations persistantes) en introduisant dans leur formalisation des contraintes à l'expansion ou à la dépression, sous forme de "planchers" et de "plafonds".

Néanmoins, cette similitude apparente masque en réalité une différence d'interprétation sensible de la part des deux auteurs. Elle repose essentiellement sur la signification exacte que chacun d'eux entend donner aux contraintes qui stabilisent la dynamique de l'économie. Dans le modèle

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de Hicks, l'existence de ces contraintes est justifiée par le sens commun: l'investissement réel ne peut être négatif, d'où l'existence d'un plancher (déterminé par la croissance de l'investissement autonome et le montant des investissements de remplacement). Par ailleurs, production, consommation et investissement sont limités par les ressources disponibles en ressources naturelles et travail, et par les progrès de la productivité. D'où l'existence d'un plafond.

Chez Minsky, il en va tout à fait différemment. Certes, ce dernier ne nie pas que de telles contraintes puissent influer sur le niveau de l'activité économique. Néanmoins, il ne pense pas que leur rôle soit primordial pour expliquer les cycles économiques. Selon lui, les planchers et plafonds reflètent avant tout l'ensemble des mécanismes institutionnels (qualifiés de *thwarting systems*) mis en place par les autorités publiques afin de maintenir l'amplitude des fluctuations économique à l'intérieur de limites supportables. Dans l'analyse de Minsky, ces mécanismes prennent la forme de déficits publics (supposés maintenir le niveau des profits et des revenus au niveau macroéconomique) et d'interventions de prêteur en dernier ressort des banques centrales.

L'idée originale développée par Minsky est donc que ces *thwarting systems* ont pour principale fonction de modifier, lors de périodes de forte expansion ou de forte dépression (ou pour raisonner en termes nominaux, lors de périodes de forte inflation ou déflation), les conditions initiales qui déterminent la dynamique future du système économique: une dépression (ou une déflation) est ainsi transformée, grâce à un plancher de type institutionnel, en reprise modérée, puis explosive, qui viendra elle-même buter sur un plafond institutionnel. Les fluctuations économiques observées apparaissent ainsi comme le fruit de ces rebonds répétés de la dynamique économique entre plafonds et planchers mis en place par les autorités publiques.

Ainsi, l'étude des tout premiers travaux de Minsky m'a permis de tirer deux conclusions intéressantes qui ont fortement influencé mes recherches ultérieures.

La **première conclusion** relève de l'histoire de l'analyse économique. L'analyse de Minsky permet, contrairement aux modélisations linéaires sans contraintes de type oscillateur de Samuelson, de rendre compte de la complexité des fluctuations économiques caractérisées par la succession de périodes de "croissance régulière, de cycles, de booms ou de dépressions" (Minsky, 1959). En outre, à la différence des modèles linéaires avec butoirs à la Hicks qui font abstraction des *thwarting systems* institutionnels, elle facilite la compréhension du rôle joué par les interventions des autorités de régulation sur la dynamique économique.

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La **deuxième conclusion** est que les écrits de Minsky des années cinquante soulignent également le caractère incomplet des modélisations récentes de l'instabilité financière puisque, négligeant le rôle des mécanismes institutionnels stabilisateurs, ces travaux analysent les cycles macroéconomiques comme une succession mécanique de phases du type : fragilisation financière croissante → crise financière → retour progressif à une structure financière robuste et, finalement, reprise économique.

Dans mes recherches ultérieures, il m'a donc semblé utile de proposer des modélisations de l'instabilité financière prenant explicitement en compte le fait que les fluctuations macroéconomiques observées résultent de l'interaction entre les processus endogènes d'instabilité financière et les politiques de stabilisation contracycliques.

Le modèle que je présente dans la section suivante répond explicitement à cette exigence. A ce titre, il peut être considéré comme une tentative de formalisation des mécanismes d'interaction dynamique financière/dynamique institutionnelle étudiés mais non formalisés par Minsky.

1.2. DÉFICITS PUBLICS ET INSTABILITÉ FINANCIÈRE

Dans la théorie de Minsky, l'investissement est le déterminant essentiel de l'activité économique. Cet investissement est fortement influencé par le montant des profits agrégés (réalisés et anticipés)⁵. Les autorités publiques se doivent donc de limiter la variabilité des profits. Pour ce faire, elles peuvent utiliser l'outil du déficit budgétaire qui, en soutenant la demande globale lorsque l'investissement privé fléchit, va permettre de fixer une borne inférieure (un plancher, pour conserver le vocabulaire des modèles linéaires avec contraintes) aux profits agrégés. En d'autres termes,

"La politique budgétaire sera stabilisatrice si une insuffisance de l'investissement privé conduit rapidement à un déficit budgétaire et si une explosion de l'investissement entraîne rapidement un excédent budgétaire" (Fazzari et Minsky, 1984).

Pour Minsky, cette stabilisation des profits réalisés et des profits anticipés est cruciale pour garantir la pérennité du système économique. Elle permet en particulier de maintenir la viabilité des structures d'endettement, et donc le niveau de l'investissement privé. Ainsi, dans sa théorie, la présence d'un gouvernement influent (*big government*), caractérisé par une politique budgétaire très sensible aux variations des profits globaux est-elle nécessaire

⁵Cf. notamment Minsky (1986), chapitres 7 et 8.

pour améliorer la stabilité de l'économie. Cependant, Minsky ne propose pas lui-même de modèle capable de comprendre précisément la manière dont ces déficits influencent le degré de stabilité financière d'une économie.

Dans un article publié dans le *Journal of Post Keynesian Economics* (**Nasica et Raybaut, [9] 2005**) nous proposons un modèle "à la Minsky" qui prend explicitement en compte l'influence de la politique de dépenses publiques sur la relation entre finance, investissement et fluctuations économiques.

Par rapport aux autres modèles minskyens d'instabilité financière, notre modèle présente deux caractéristiques originales.

Tout d'abord, nous intégrons l'idée que la politique budgétaire (et donc le déficit public) est très sensible aux variations de l'investissement privé. Cette caractéristique de son approche est prise en compte à travers une variable représentant le ratio déficit public/dépense privée. Ce ratio est déterminé de manière endogène et est négativement relié à l'investissement privé. La dérivée de ce ratio représente le degré de flexibilité de la politique budgétaire face à une variation de l'investissement privé.

La seconde originalité du modèle consiste à prendre en compte l'environnement décisionnel incertain privilégié par Minsky à travers une variable représentant la "confiance" des agents économiques qui influence l'investissement. Dans le modèle, l'évolution de la confiance est déterminée à la fois par des facteurs objectifs et subjectifs.

En effet, comme je le souligne dans mon ouvrage (**E. Nasica, [1] 2000**) et dans une contribution plus récente (**E. Nasica, [4] 2010a**) le banquier minskyen fonde son comportement sur des variables endogènes objectives et sur des éléments déterminés de manière conventionnelle ou subjective. Les variables objectives jouent dans la formation des anticipations puisqu'"une augmentation des débiteurs pour qui il devient difficile voire impossible de remplir leurs engagements financiers incitera les banquiers à accroître leur scepticisme vis à vis des nouvelles demandes de prêts, [...] et à diminuer l'offre de financement bancaire" (Minsky, 1986, p. 118). Il est intéressant de remarquer que l'on retrouve cette même idée dans le *Traité des Probabilités* de Keynes (1921) où la détermination de la probabilité logique, c'est-à-dire du "degré de croyance rationnelle" assigné à une proposition (*primary proposition*), est fonction des données objectives tirées de l'expérience⁶.

A cet aspect objectif de la formation des anticipations des banquiers vient se greffer une composante subjective. Dans l'analyse de Minsky, elle implique que les résultats réalisés (par exemple au niveau des remboursements des prêts) peuvent modifier les décisions bancaires en matière d'octroi de crédits, indépendamment de leur adéquation aux

⁶ J'ai par ailleurs examiné plus profondément l'analyse des comportements rationnels en situation d'incertitude proposée par Keynes en 1921 dans son *Traité des Probabilités* dans une contribution récente (**E. Nasica et J. Kregel, [3] 2011**).

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anticipations des banques. Cela signifie en particulier que même si les réalisations effectives viennent simplement confirmer les anticipations des banques, il est probable que ces dernières, encouragées par une confiance accrue dans leur processus de formation des prévisions, modifieront à la hausse le montant des prêts octroyés. De manière analogue, cela signifie que plus la période durant laquelle les ratios d'endettement de l'économie se maintiennent à un certain niveau sans provoquer de crise financière est longue, plus il est probable que les banques réviseront à la hausse le degré maximum d'endettement (de leur propre bilan et de leurs emprunteurs potentiels) qu'elles jugent prudent d'accepter.

Ici encore, on peut rapprocher ce raisonnement de l'argumentation keynésienne du *Traité des Probabilités*. En effet, Keynes souligne que lorsqu'il n'est pas possible de déterminer le degré de croyance rationnelle, alors un autre élément, le "poids du raisonnement" ("weight of the argument"), c'est-à-dire la quantité d'information pertinente à la disposition de l'agent économique, devient l'élément clé dans la formation des anticipations. Dans ce cas, ce sont l'expérience individuelle de chaque agent économique et les "esprits animaux" qui déterminent le moment auquel le poids du raisonnement attaché à une proposition est suffisant pour la faire dominer sur les autres.

Dans notre modèle, les facteurs objectifs sont représentés par les erreurs sur les anticipations de profits (l'écart entre profits réalisés et anticipés). L'idée étant qu'en situation d'incertitude, lorsque les profits réalisés atteignent ou dépassent les profits espérés, le levier d'endettement effectif des firmes est plus faible que le levier anticipé et la structure financière qui en découle est plus solide que prévue. La confiance des emprunteurs en est renforcée et cela se traduit par une hausse du degré maximum d'endettement jugé prudent et par un accroissement de l'investissement. En revanche, lorsque les profits réalisés sont inférieurs aux prévisions, et que les engagements financiers deviennent plus difficiles à honorer, la confiance des emprunteurs s'étiole et des ratios d'endettement qui étaient jugés auparavant prudents sont alors considérés comme risqués, ce qui conduit à freiner l'activité d'investissement.

Les éléments subjectifs qui affectent également la confiance dans le modèle traduisent le fait que l'état de la confiance peut, dans une certaine mesure, varier indépendamment de l'adéquation des résultats aux anticipations. Nous reprenons ici l'idée de Minsky rappelée ci-dessus (proche de l'hypothèse de myopie au désastre utilisée par Guttentag et Herring, 1984) selon laquelle la confiance des agents économiques augmente (et, avec elle, les niveaux maximum d'endettement jugés acceptables) au fur et à mesure que le souvenir de la dernière crise s'éloigne.

L'analyse de la dynamique du modèle met en évidence deux **résultats** intéressants. Tout d'abord, si l'on se place dans le cas idéal (qualifié dans le modèle d'état stationnaire "Nirvana") où la structure financière est neutre, où

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le degré d'optimisme des investisseurs ne joue pas et où il n'y a pas d'incertitude, alors le système est naturellement stable: on converge toujours vers l'état stationnaire. Dans ce cas, il n'est pas nécessaire de mettre en place une politique de stabilisation par les déficits.

En revanche, dans un environnement "minskyen", où les décisions d'investissement dépendent de la structure financière, de l'incertitude et de la confiance des agents économiques, la stabilité du système n'est pas automatique. Elle nécessite non seulement que l'Etat intervienne via une politique contracyclique par les déficits mais aussi que la sensibilité de cette politique aux variations de la demande privée dépasse un certain seuil. Dans le cas contraire, l'économie est instable et le modèle peut engendrer des phénomènes de crise économique et financière comparables à ceux envisagés par Minsky.

Nous illustrons ce résultat via une simulation numérique qui montre qu'il existe bien une valeur seuil de la sensibilité de la politique budgétaire telle que si on est en-dessous de cette valeur, la dynamique du système est instable tandis que si l'on se situe au-delà de ce seuil, la dynamique est stable et on converge vers l'état stationnaire.

En **conclusion**, on peut dire que le modèle atteint son objectif principal qui était de montrer que, si on utilise les hypothèses faites par Minsky, les choix de financement en situation d'incertitude créent de l'instabilité qui ne peut être contrecarrée que par des politiques de stabilisation suffisamment réactives.

Ce modèle a un autre intérêt: il met en relief une limite importante de l'argumentation de Minsky. En effet, si l'on se réfère aux conclusions du modèle, la dernière crise financière aurait dû éclater en Europe, où la sensibilité de la politique budgétaire aux variations de l'activité est relativement faible et non, comme cela a été pourtant le cas, aux Etats-Unis où cette sensibilité est élevée. L'une des raisons qui peut expliquer ce résultat est que Minsky néglige deux facteurs importants des phénomènes récents d'instabilité financière: les nouvelles formes d'endettement des ménages, d'une part, et le surendettement des Etats, d'autre part. Cela ouvre aussi certainement la voie à de nouvelles pistes de recherche.

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“Financial institutions and practices enter our circle of problems in three ways: they are “auxiliary and conditioning”; banking may be the object of entrepreneurial activity, that is to say, the introduction of new banking practices may constitute enterprise; and bankers (or other “financiers”) may use the means at their command in order to embark upon commercial and industrial enterprise themselves (for example John Law)” (Schumpeter 1951a, p. 153).

Cette Section est consacrée à la présentation de mes travaux axés sur l'étude de la relation entre intermédiation financière et innovation. Je présenterai tout d'abord des contributions qui relèvent du champ de l'histoire de l'analyse économique. Il s'agit en effet de rendre compte de l'analyse des innovations bancaires menée d'une part par Schumpeter (point 2.1) et par Minsky (point 2.2). Comme nous le verrons, en insistant sur la nature fondamentalement entrepreneuriale de l'activité bancaire, les deux approches présentent des points communs importants. Elles se rejoignent également sur la manière dont les deux auteurs mettent en relief les interactions entre les comportements d'innovation des banques et les mutations de leur environnement institutionnel. Ces approches s'éloignent en revanche sensiblement dans leurs conclusions relatives à la capacité des innovations bancaires à pérenniser ou, au contraire, fragiliser le système économique.

Dans la dernière partie de la présentation (point 2.3), je présenterai un article portant sur une forme particulière d'innovation, le *private equity* ou capital-investissement, dont l'émergence et l'essor sont directement liés à la nécessité des intermédiaires financiers d'adapter leurs stratégies d'investissement aux imperfections d'information spécifiques aux firmes composant leurs portefeuilles d'investissement.

2.1. INNOVATIONS BANCAIRES ET FINANCEMENT DE L'INNOVATION

Mes travaux sur Schumpeter s'intéressent au rôle des banques dans sa théorie. Ils ont donné lieu à plusieurs contributions à colloques et à deux publications, l'une dans un ouvrage édité par Routledge (**E. Nasica, [5] 2002a**) et l'autre dans un article publié dans *l'European Journal of the History of Economic Thought* (**A. Festré et E. Nasica, [7] 2009**).

Ces publications sont originales pour deux raisons. Tout d'abord, elles mettent en évidence le rôle central, ainsi que la nature entrepreneuriale et innovatrice des banques dans l'analyse de l'auteur autrichien. Cette façon d'aborder l'approche de Schumpeter est originale car, bien souvent, les analystes de son œuvre considèrent que les entrepreneurs y jouent le rôle principal tandis que les banques sont reléguées au second plan avec un rôle relativement passif.

L'autre originalité de mes travaux est de montrer que cette façon de caractériser le banquier n'est pas le fruit du hasard. Elle reflète au contraire parfaitement l'environnement industriel et financier spécifique à la période durant laquelle Schumpeter écrit sa *Théorie de l'Evolution Economique*. Je vais préciser successivement ces deux aspects de mon travail.

2.1.1. Le banquier, acteur central du processus d'innovation

Dans ma contribution intitulée "Financing economic activity: Schumpeter vs Keynes" (**E. Nasica, [5] 2002a**), j'étudie l'analyse du financement de l'activité économique développée par Schumpeter en la comparant à celle de Keynes. Cette comparaison m'a permis d'obtenir plusieurs **résultats** intéressants.

Je montre tout d'abord que les deux approches présentent un certain nombre d'analogies. En effet, les deux auteurs partagent une vision similaire du fonctionnement des économies de marché. Dans leurs travaux, les conclusions des économistes Classiques relatives à la neutralité de la monnaie et à la dichotomie entre les secteurs réel et monétaire sont rejetées sans ambiguïté. Les deux auteurs mettent au contraire l'accent sur le rôle central des variables monétaires et financières dans l'analyse des fluctuations économiques. Cette convergence de vues s'exprime essentiellement à trois niveaux.

Premièrement, ils utilisent une méthode similaire pour montrer que l'introduction de la monnaie dans le raisonnement économique modifie les caractéristiques d'une économie de marché. Cette similitude apparaît clairement lorsqu'on compare d'une part la distinction keynésienne du début des années trente entre une économie "neutre" et une économie "monétaire de production" et d'autre part la distinction de Schumpeter entre le circuit stationnaire et le processus de développement économique. Ensuite, les deux

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auteurs s'opposent à la conception classique du taux d'intérêt en tant que rémunération de l'abstinence. Pour eux, le taux d'intérêt est un phénomène monétaire. C'est le prix de la renonciation à la liquidité pour Keynes et, pour Schumpeter, c'est une fraction du profit monétaire de l'entrepreneur et donc également une variable monétaire. Enfin, Schumpeter, comme Keynes, rejette la théorie quantitative de la monnaie. Dans sa théorie du développement économique, la monnaie prend la forme d'un crédit bancaire endogène dont les variations induisent des modifications dans les prix relatifs et des effets de redistribution.

En dépit de ces similitudes, les deux approches présentent également des différences significatives. Elles sont liées aux hypothèses et aux résultats relatifs au statut des marchés financiers et des taux d'intérêt. L'analyse de Schumpeter diffère très sensiblement de la conception keynésienne des marchés financiers et des taux d'intérêt développée dans la *Théorie Générale*. En effet, pour l'auteur autrichien, les marchés financiers ne jouent qu'un rôle secondaire par rapport au marché du crédit. Dans son approche, le rôle du taux d'intérêt à court terme (l'intérêt payé aux banques sur les liquidités à court terme qu'elles fournissent aux entrepreneurs emprunteurs) est beaucoup plus important que le rôle du taux d'intérêt à long terme (l'intérêt payé par les firmes sur les obligations à long terme). La raison principale en est que, pour Schumpeter, le revenu se répartit entre salaires, intérêts et profits. Dans ces conditions, les paiements d'intérêts aux banques induisent un transfert de richesse du secteur industriel au secteur financier de telle sorte que le taux d'intérêt à court terme apparaît comme une "taxe" sur les profits et donc un frein au développement économique. Il y a donc, chez Schumpeter, prééminence du financement bancaire sur les autres formes de financement.

Ce rôle clé joué par les banques apparaît de manière encore plus nette lorsqu'on s'intéresse à la manière dont les innovations sont financées au cours de la phase de développement. Tout d'abord, ce sont les banquiers qui sélectionnent les projets qui seront financés et déterminent le montant des crédits accordés aux entrepreneurs. Ce faisant, ils permettent à l'économie de quitter l'état stationnaire pour entrer dans sa phase d'innovation et de développement. C'est la raison pour laquelle le banquier schumpéterien peut être qualifié d'"éphore", du nom de magistrats de Sparte qui contrôlaient et orientaient l'activité des rois.

La deuxième raison est que, chez Schumpeter, les banquiers sont, eux-mêmes, des innovateurs. Ils innovent d'abord pour répondre aux nouveaux besoins de financement exprimés par les entrepreneurs. Ils favorisent ainsi le développement des innovations dans le domaine industriel et commercial. Mais les banquiers innovent aussi parce qu'ils sont eux-mêmes des entrepreneurs. L'innovation financière est donc l'un des moyens qu'ils utilisent pour acquérir un pouvoir de marché et des rentes de monopole qui ne disparaîtront qu'avec la propagation des innovations.

2.1.2. Les pratiques bancaires, reflet et moteur de l'environnement industriel et financier

Le deuxième volet de mon analyse concerne l'influence exercée par l'environnement industriel et financier sur les écrits de Schumpeter relatifs aux banques. Lorsque Schumpeter écrit sa *Théorie de l'Evolution Economique* au début du 20ème siècle, les banquiers doivent s'adapter à un système économique qui se transforme à un rythme particulièrement soutenu. Dans l'article publié dans *l'European Journal of the History of Economic Thought* (**Festré et Nasica, [7] 2009**), nous effectuons un rapprochement entre l'analyse de Schumpeter et les différentes formes de capitalisme qui se succèdent à cette période.

Nous montrons ainsi que sa vision des banques est tout d'abord influencée par l'environnement associé au capitalisme "industriel" qui démarre au début du 19ème siècle. Celui-ci se caractérise par l'émergence d'institutions financières capables de mobiliser les capitaux nécessaires au financement des vagues successives d'innovation de la Révolution Industrielle. Tandis que le commerce continue à être financé par le crédit commercial, les investissements dépendent alors essentiellement des marchés financiers. Or, les acteurs principaux sur ces marchés sont les banquiers d'investissement comme Rothschild ou Morgan par exemple, qui interviennent comme courtiers et comme négociateurs. C'est de cette manière qu'ils financent les investissements à long terme et qu'ils jouent leur rôle d'éphores, c'est-à-dire de personnages-clé dans le financement de l'innovation et de la croissance.

Mais Schumpeter n'ignorait pas que le capitalisme industriel donnait lieu à des épisodes récurrents de concurrence sauvage sur les prix. Cette situation nouvelle a amené les banquiers d'investissement à réagir, et à innover, pour protéger leurs revenus. Les comportements bancaires qui en ont découlé ont alors ouvert la voie à une nouvelle forme de capitalisme, le capitalisme "bancaire", à partir de la fin du 19^{ème} siècle. Aux Etats-Unis, par exemple, cela a conduit les banques d'investissement à financer les grandes opérations de fusions qui ont débouché sur la création d'ATT ou de General Electric. Le même phénomène avait été observé quelques années plus tôt en Allemagne avec le rôle de banque universelle joué par les *Kreditbanken* à la fois créancières et actionnaires des grandes firmes industrielles. Cette phase de capitalisme bancaire apparaît ainsi comme la plus représentative du caractère entrepreneurial des banquiers et, comme on l'a vu, elle semble avoir fortement influencé l'analyse de Schumpeter.

2.2. INNOVATIONS BANCAIRES, PROCYCLICITE DES TAUX D'INTERET ET INSTABILITE FINANCIERE

Une grande partie de mes travaux sur Minsky (**Nasica, [1] 1997a et [4] 2010a**) a consisté à étudier son analyse des comportements bancaires. La principale raison qui m'a incité à m'intéresser à ce volet de son travail est que les commentateurs de son approche ont, dans leur grande majorité, sous-estimé ou mal interprété un élément essentiel de son analyse des cycles, à savoir le rôle primordial joué par la dynamique des intermédiaires financiers sur la stabilité de l'activité économique. Or, je considère que, loin d'être d'importance secondaire, ce domaine particulier de la recherche de Minsky est un élément central de son hypothèse d'instabilité financière car il permet de comprendre l'évolution, au cours de la phase d'expansion économique, des taux d'intérêt sur le marché monétaire qui sont une variable clé de sa théorie des cycles. Plus précisément, mon argumentation vise à expliquer que la transition d'une phase d'expansion économique et de fragilité financière à une phase de crise s'explique essentiellement par le caractère procyclique des taux d'intérêt qui est lui-même directement lié aux comportements innovateurs des banques sur le marché monétaire.

Pour ce faire, je me suis intéressé au tout premier article publié par Minsky, "Central Banking and Money Market Changes" (Minsky, 1957). L'auteur y met en évidence le rôle central des comportements des banques commerciales sur le marché monétaire en raisonnant sous l'hypothèse d'une banque centrale menant une politique monétaire restrictive afin de limiter l'inflation en phase d'expansion économique. C'est précisément l'interaction entre cette politique et les comportements adoptés par les banques de second rang qui va déterminer la dynamique des taux d'intérêt et de la quantité de monnaie en circulation au cours de la phase ascendante du cycle.

Le mécanisme se déroule de la manière suivante. Les hausses de taux d'intérêt induites par la politique monétaire restrictive agissent comme un signal pour les opérateurs privés du marché monétaire, qui interprètent ces augmentations comme de nouvelles opportunités de profit. En particulier, dans le cas des banques commerciales, la hausse des taux d'intérêt induit, pour les établissements disposant de réserves excédentaires, une hausse du coût d'opportunité de ces encaisses oisives. Il est donc dans leur intérêt de prêter ces réserves sur le marché des fonds fédéraux.

Ainsi, la hausse des taux d'intérêt crée un environnement favorable à l'émergence et au développement d'innovations bancaires sur le marché monétaire avec un recours accru aux fonds fédéraux. Or, ces innovations ont une implication importante : elles augmentent la vitesse de circulation de la monnaie et, par là même, la quantité de monnaie en circulation (le volume des dépôts à vue augmentant pour un montant donné de monnaie centrale).

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Par conséquent, au cours de la période durant laquelle ces innovations bancaires se propagent, les effets de la politique monétaire restrictive sur le taux d'intérêt sont complètement contrecarrés tandis que la vitesse de circulation et l'offre de monnaie apparaissent comme infiniment élastiques. Dans un tel contexte, l'efficacité d'une politique monétaire de contrôle des agrégats monétaires est très faible et, pour réagir à des craintes inflationnistes, la banque centrale n'a d'autre solution que d'agir directement sur la liquidité bancaire. Elle va donc essayer de diminuer suffisamment les réserves afin de compenser l'augmentation de la vitesse de circulation. Cette réaction de la banque centrale aux comportements maximisateurs et innovateurs des banques commerciales a pour effet d'orienter de nouveau à la hausse le taux d'intérêt et, par conséquent de recréer, à terme, l'ensemble du processus d'innovation bancaire décrit ci-dessus.

En définitive, ce travail m'a permis de mettre en exergue trois **résultats** intéressants.

Il permet tout d'abord de mieux saisir l'originalité de l'analyse de Minsky au sein même de la théorie de la monnaie post-keynésienne fondée sur une approche "horizontaliste" dans laquelle toute hausse de la demande de monnaie augmente la quantité de monnaie d'équilibre, mais est sans effet sur le taux d'intérêt, où l'offre de monnaie est endogène et s'adapte complètement et passivement à la demande de monnaie et dans laquelle les taux d'intérêt sont déterminés de manière exogène par la banque centrale. Chez Minsky au contraire, les comportements des banques commerciales en réaction aux opportunités de profit et à la politique menée par la banque centrale ne permettent pas à cette dernière de fixer le taux d'intérêt au niveau qu'elle juge désirable. L'évolution de ce taux dépend en effet fortement de la succession de phases de stabilité et d'instabilité institutionnelle induite par les comportements innovateurs des banques commerciales. La conception horizontaliste de l'offre de monnaie est donc rejetée dans le schéma minskyen et il est possible de mettre en évidence un taux d'intérêt qui ne soit pas totalement exogène au sein d'une approche endogène de la monnaie.

Le second résultat intéressant que je mets en relief est que le taux d'intérêt apparaît également procyclique : les hausses de taux d'intérêt reflètent le processus dynamique qui s'instaure entre les innovations des banques commerciales et les réactions sous forme de politique monétaire restrictive de la banque centrale au cours de la phase d'expansion de l'activité économique. Ce résultat est particulièrement important car il permet d'expliquer le passage de la phase de fragilité à la phase d'instabilité, essentiel dans la compréhension de l'hypothèse d'instabilité financière.

Enfin, cet article permet de rapprocher l'analyse de Minsky et celle de Schumpeter. En effet, dans les deux approches, les comportements bancaires sont à l'origine d'une certaine forme d'instabilité économique.

Néanmoins, cette instabilité n'est pas de même nature chez les deux auteurs. Il y a un siècle, Schumpeter avait une vision extraordinairement moderne du rôle des banques en mettant en évidence leurs activités de marché, leur participation active à la gouvernance des entreprises et leur activité innovatrice. Dans son analyse, on peut dire que les banques sont à l'origine d'une instabilité physiologique, au sens où, on l'a vu, en s'adaptant aux évolutions du système, elles rendent possible sa pérennité et son développement, comme le font aujourd'hui les banques d'investissement ou les organismes de capital-risque par exemple.

Chez Minsky, au contraire, on peut parler d'instabilité pathologique dans la mesure où les comportements bancaires ont tendance à fragiliser (en favorisant la dégradation des bilans des agents économiques) puis à rendre instable (en jouant un rôle clé dans le processus de hausse procyclique des taux d'intérêt) le système économique. Son approche peut alors être utilisée pour mieux comprendre certaines dimensions des crises passées, et notamment de la plus récente, où les innovations initiées par les banques et l'évolution procyclique des leviers d'endettement ont joué un rôle déterminant.

2.3. EVOLUTION DES MODES DE FINANCEMENT ET NOUVELLES FORMES D'INTERMEDIATION : L'EXEMPLE DU *PRIVATE EQUITY*

Cette dernière Section est consacrée à la présentation d'une forme particulière d'innovation, le *private equity* ou capital-investissement, dont l'émergence et l'essor sont directement liés à la nécessité des intermédiaires financiers d'adapter leurs stratégies d'investissement aux imperfections d'information spécifiques aux firmes composant leurs portefeuilles d'investissement.

En effet, les firmes recourant à ce type de financement possèdent des caractéristiques spécifiques qui rendent leur activité particulièrement incertaine. En premier lieu, elles sont fréquemment positionnées sur des marchés en fort développement, émergents, voire à créer au moment où l'entreprise est financée. En second lieu, leurs produits se situent généralement soit dans la phase de conception soit dans la phase de lancement. Troisièmement, l'activité de ces firmes est bien souvent fondée sur la mise en œuvre et la gestion d'actifs immatériels (savoir-faire, développement technologique) qui jouent un rôle primordial dans l'essor de la firme mais sont difficilement quantifiables et négociables. Or, ces actifs immatériels, à la différence d'actifs physiques, peuvent difficilement servir de collatéraux au sens de garanties tangibles qui jouent en général le rôle de réducteurs d'incertitude et d'asymétrie d'information dans les relations de

financement. Toutes ces raisons impliquent que le marché du capital-investissement est caractérisé par des problèmes aigus d'asymétries d'information, voire d'incertitude forte, entre les entreprises financées et les organismes de capital-risque (Tykova, 2007; Gompers et Lerner, 2004).

Face à cet environnement décisionnel particulier, les capital-risqueurs sont conduits à adopter des stratégies d'investissement spécifiques. Dans cette perspective, dans l'article intitulé "Incertitude, rationalité et confiance dans les choix d'investissement : une analyse de la relation entre marchés financiers et capital-risque" (**Nasica, [8] 2007a**), je m'intéresse plus particulièrement à la manière dont les capital-risqueurs modifient leurs choix de portefeuille en réaction à des signaux provenant des marchés financiers.

La littérature consacrée aux déterminants du capital-risque insiste en effet sur la relation positive existant entre le montant des fonds investis dans cette activité et la situation prévalant sur les marchés financiers [Black et Gilson (1988); Gompers et Lerner (1998); Jeng et Wells (2000); Gompers et alii (2005)].

Cependant, au début des années 2000, la relation entre marchés financiers et activité de capital-risque apparaît beaucoup moins claire : les comportements d'investissement des capital-risqueurs semblent s'être sensiblement et durablement déconnectés de l'évolution des marchés financiers.

Notre objectif est d'expliquer ce phénomène à travers un modèle en termes de rationalité limitée qui utilise une argumentation proche de celle utilisée, d'une part par Heiner (1983) et, d'autre part, par Kahneman et Tversky (1982). Le modèle formalise les comportements d'investissement d'une société de capital-risque (SCR dans la suite) dans des start-up technologiques. Il met en évidence les raisons pour lesquelles cette SCR peut, en adoptant certaines règles de décisions rationnelles en situation d'incertitude, modifier sensiblement le volume et la forme de ses investissements au cours du temps. Plus précisément, ce modèle caractérise les comportements des capital-risqueurs par deux traits distinctifs : le premier est une sur-réaction de la part des intervenants sur le marché du capital-risque qui les conduit à diminuer brutalement et sensiblement la pondération du facteur marchés financiers dans leur processus de décision d'investissement ; le deuxième est une rigidification des comportements des capital-risqueurs conduisant ces derniers à répéter de période en période le même type de comportement en matière d'investissement, induisant par là même une déconnexion entre les choix d'investissement et l'évolution des performances du marché financier.

En rapprochant les résultats du modèle théorique de ceux de l'analyse statistique que nous avons menée dans le cas français, nous mettons en évidence une rupture dans les comportements d'investissement des capital-risqueurs au cours des dernières années. Tout d'abord, au cours de la période 1999-2002, on observe, conformément à la littérature, une corrélation

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positive entre marché financier et investissement en capital-risque. Sur cette période, l'indice boursier observé, l'ITCAC, est une variable explicative fortement significative traduisant une influence très sensible de l'évolution du marché financier des valeurs technologiques sur l'investissement en capital-risque.

Cependant, à partir de 2003, l'indice de référence du marché financier n'est plus une variable explicative significative : malgré l'évolution à nouveau favorable de cet indice, l'investissement en capital-risque au sens strict ne redémarre pas et l'essentiel des fonds continue à être orienté vers les entreprises plus matures, essentiellement sous forme de capital-reprise/transmission. En d'autres termes, le comportement d'investissement des sociétés de capital-risque semble s'être déconnecté de l'évolution du marché financier. Notre modèle fournit une explication à cette rupture dans les comportements : malgré l'évolution favorable de l'indice boursier, le souvenir du e-krach reste encore présent dans les esprits des investisseurs et l'effet-mémoire associé à l'heuristique de disponibilité utilisée par les capital-risqueurs maintient leur estimation de la probabilité de réalisation d'un événement défavorable à un niveau élevé. Dans ces conditions, en dépit de l'amélioration de la confiance, l'offre des capital-risqueurs est peu flexible vis-à-vis des demandes de financement des start-up en phase de démarrage et l'évolution du marché financier ne joue plus un rôle déterminant dans les décisions d'investissement.

3. Perspectives de Recherche et Travaux en Cours

Mes perspectives de recherche visent à approfondir les deux axes étudiés dans mes publications antérieures : l'étude de la relation entre politiques de stabilisation et instabilité financière, d'une part, et l'analyse de l'activité de capital-investissement, d'autre part.

Pour illustrer mes recherches en cours, je présente ci-dessous deux contributions récentes non encore publiées. La première analyse la manière dont la politique prudentielle influence l'instabilité financière (point 3.1). La seconde étudie une stratégie caractéristique de l'activité des organismes de capital-risque : la syndication de leurs investissements (point 3.2).

3.1. POLITIQUE PRUDENTIELLE ET INSTABILITÉ FINANCIÈRE

Dans une contribution collective récente (**Bruno, Cartapanis, Nasica, [12] 2010b**), je me suis intéressé à la relation entre politique prudentielle et instabilité financière. L'objectif de ce travail est double. Il vise d'une part à expliquer la dynamique des bilans bancaires et de la fragilité financière de l'économie susceptible d'en découler. Il vise d'autre part à analyser les conséquences de l'introduction d'un ratio de levier indépendant du risque dans la réglementation prudentielle du secteur bancaire.

L'ampleur de la crise financière de 2007-2008 et de ses conséquences sur l'activité économique et l'emploi ont en effet ravivé le débat sur les origines de la fragilité et de l'instabilité financière ainsi que sur les moyens à mettre en œuvre pour contrecarrer ce type de phénomènes. Un phénomène explicatif de la crise relativement peu étudié est l'accroissement significatif des niveaux de levier bancaire dans les 4-5 ans ayant précédé la crise de l'été 2007 et la panique de l'automne 2008, notamment pour les principales banques européennes ou pour les banques d'investissement américaines.

Cette hausse du leverage avant la crise et du *deleveraging* pendant son déclenchement expliquent la conversion du G20 et de l'ensemble des superviseurs à l'introduction d'un ratio de levier dans les dispositifs prudentiels, en considérant qu'il y a là un instrument complémentaire vis-à-

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vis des ratios prenant en compte le risque, qui ne saurait se substituer, mais au contraire se combiner, aux ratios de risques pondérés du Pilier I de Bâle II ou de Bâle III en cours de préparation. Ce nouveau ratio mesure les fonds propres de base Tier 1 en pourcentage des actifs augmentés des expositions hors bilan et des instruments dérivés. Le Comité de Bâle a choisi un ratio de levier minimal de 3 %, et donc un multiplicateur de fonds propres maximal de 33. La mise en place à titre expérimental devrait débuter en janvier 2013, et au terme de différentes phases d'ajustement, entre 2015 et 2017, ce ratio deviendra impératif, au sein du Pilier I de Bâle III, en janvier 2018 (*BIS Annual Report 2010-2011*).

Ce durcissement des dispositifs prudentiels a donné lieu à de vifs débats. Ils opposent principalement les lobbies bancaires qui soulignent les effets potentiellement nocifs sur la croissance économique des réglementations prudentielles qui s'appliqueront bientôt aux banques. L'augmentation des capitaux propres réglementaires et la limitation des multiplicateurs de fonds propres exposeraient les économies concernées à un risque d'augmentation du prix du crédit, voire à un rationnement du crédit, susceptibles de limiter fortement le financement de la croissance (*Institute of International Finance, 2010*). En revanche, le Comité de Bâle et le Conseil de Stabilité Financière ont publié en 2010 deux études de simulation dont les résultats diffèrent sensiblement des estimations réalisées par l'*Institute of International Finance* puisqu'ils trouvent que l'impact négatif sur la croissance des pays développés de la nouvelle réglementation prudentielle devrait être très modeste.

Notre papier essaye d'apporter quelques éléments de réflexion théoriques permettant d'éclairer ces débats. Pour ce faire, nous avons élaboré un modèle qui montre que la fragilité financière peut être engendrée par les décisions optimales de maximisation des profits des banques alors même que ces dernières satisfont les exigences réglementaires fixées par l'accord de Bâle II. Notre modèle repose sur l'hypothèse de firmes hétérogènes en termes de rendements espérés *ex ante* des projets. Ces firmes ont besoin d'une unité de capital à la première période afin d'investir. Nous supposons que les projets des firmes sont soumis à un choc macroéconomique à la seconde période, de telle sorte que le rendement réalisé *ex post* des projets est différent de leur valeur anticipée *ex ante*. Les firmes n'ont pas accès aux marchés financiers et empruntent la totalité de leurs capitaux auprès d'une banque unique. Cette opération est garantie par un actif détenu par les firmes qui sert de collatéral. Les ressources de la banque sont constituées, d'une part, de ses fonds propres, dont le montant est déterminé par l'application d'un modèle d'évaluation des risques fondé sur la méthode IRB (*Internal Ratings Based*) et, d'autre part, des dépôts des investisseurs individuels bénéficiant de la garantie de l'Etat et rémunérés au taux sans risque.

A la première période, la banque décide du nombre de projets qu'elle finance de manière à maximiser la rentabilité de ses fonds propres compte tenu du risque, c'est-à-dire son RORAC (*Return on Risk Adjusted Capital*).

Nous supposons un environnement décisionnel exempt de toute imperfection de l'information entre la banque et les firmes : la banque connaît parfaitement les caractéristiques *ex ante* des firmes et les rendements réalisés des projets des firmes (après la réalisation du choc macroéconomique) sont observables sans coût par la banque. Dans ce cadre, nous montrons qu'il existe une valeur d'équilibre du taux d'intérêt débiteur qui maximise le RORAC de la banque et qui détermine son niveau de levier financier (mesuré par son multiplicateur de fonds propres) d'équilibre.

Trois **résultats principaux** découlent de notre analyse.

Premièrement, nous montrons que le niveau de levier d'équilibre choisi par la banque est une fonction croissante de la valeur espérée des collatéraux des firmes à la seconde période. Par conséquent, il existe une relation procyclique entre le prix de l'actif utilisé comme collatéral, le montant de crédit offert par la banque et son niveau de levier financier d'équilibre. Ce résultat est dans la lignée de travaux relativement anciens développés par des auteurs qui, de Thornton (1802) à Minsky, relient explicitement comportements bancaires, montée endogène de l'endettement et instabilité financière. Par rapport à cette littérature, l'originalité de notre travail est de montrer que même dans des conditions "idéales" d'environnement économique (information parfaite, phase d'expansion économique, anticipations optimistes, hausse des prix d'actifs, rationalité des agents économiques au sens standard du terme), un processus de fragilité financière procyclique fondé sur la relation entre prix des actifs et cycle du crédit bancaire peut se développer.

Deuxièmement, nous mettons en évidence une relation non linéaire entre le niveau de levier bancaire et la fragilité financière définie comme le seuil critique du choc macroéconomique à partir duquel la banque fait faillite. Plus précisément, nous identifions une valeur optimale du levier financier qui minimise la fragilité financière. Cela nous permet de distinguer deux zones qualifiées respectivement de "zone d'équilibre inefficace" et de "zone d'équilibre avec *trade-off*". Dans la première zone, des niveaux élevés de fragilité financière sont associés à des valeurs faibles des leviers et de l'offre de crédit bancaires. Au contraire, la zone de *trade-off* se caractérise par un niveau élevé de fragilité financière, de leviers bancaires et d'offre de crédit. Ce résultat est intéressant car il nous permet de mieux comprendre l'impact potentiel de la nouvelle régulation prudentielle mise en place dans le cadre de Bâle III et qui prévoit, comme nous l'avons rappelé, un multiplicateur de fonds propres plafond. Le modèle montre que si les autorités de régulation fixent cette valeur plafond à un niveau trop bas, l'économie se retrouvera dans la zone d'équilibre inefficace cumulant les handicaps : faible croissance en raison de la faible disponibilité du crédit et forte instabilité financière liée à des leviers bancaires élevés. En revanche, une valeur trop élevée du levier bancaire plafond permettra certes de bénéficier d'une disponibilité du crédit

importante mais cette stimulation de la croissance se fera forcément au détriment de la stabilité financière.

Enfin, le dernier résultat du modèle est que la valeur optimale du levier financier qui minimise la fragilité financière dépend de la valeur du taux d'intérêt fixé par les autorités monétaires. Par conséquent, la politique prudentielle ne peut s'exprimer indépendamment des options choisies en matière de politique monétaire. Ce faisant, notre papier vient compléter les travaux empiriques récents qui démontrent la significativité du lien spécifique entre les taux d'intérêt directeurs fixés par les banques centrales et la prise de risque des banques, que ce soit l'approche en termes de *risk-taking channel* (Calomiris, 2009) ou encore les études économétriques menées au FMI et à la BCE (de Nicolo et al., 2010).

3.2. PRIVATE EQUITY, COMPÉTENCES ET SYNDICATION

Comme nous l'avons rappelé plus haut, le marché du capital-investissement est caractérisé par des problèmes d'asymétries d'information entre les entreprises financées et les organismes de capital-risque. Afin d'atténuer les effets de ces asymétries, les organismes de capital-risque ont recours à différents mécanismes de sélection et de contrôle, parmi lesquels la due diligence (Gorman and Sahlman, 1989), le financement par étapes (Sahlman, 1990), la syndication (Manigart et al. 2006), la participation aux conseils d'administration des entreprises financées (Lerner, 1995) ou des contrats incitatifs tels que les stock-options (Sahlman, 1990).

Dans une contribution récente (**Dufour, Nasica, Torre, [11] 2011**), nous examinons un type particulier de mécanisme de sélection et de contrôle fréquemment utilisé par les capital-risqueurs : la syndication, c'est-à-dire le fait que plusieurs capital-risqueurs investissent conjointement dans un projet donné⁷. Une syndication est composée d'un capital-risqueur chef de file (leader) qui est à l'origine de la relation avec l'entreprise financée. Celui-ci recherche et invite d'autres investisseurs (partenaires) à participer à l'opération d'investissement syndiquée.

Lorsqu'on observe des opérations syndiquées, il apparaît que ces opérations présentent une hétérogénéité importante. Cette hétérogénéité porte à la fois sur la nature des compétences de leurs membres et sur la nature des investisseurs (apporteurs de capitaux) qui les financent. Certains syndicats associent par exemple un leader et des partenaires ayant des niveaux d'expérience et/ou de spécialisation différents alors que d'autres syndicats sont composés de membres ayant des compétences similaires. De même,

⁷ Ce travail se situe dans le prolongement de mes travaux précédents sur le capital-investissement et notamment **Nasica et Torre, [14] 2008a et [13] 2010c**.

certaines syndications sont financées par des banques tandis que d'autres le sont par des investisseurs institutionnels (compagnies d'assurance, fonds de pension, fonds de fonds ...).

L'objectif de notre travail est de montrer que cette hétérogénéité est liée aux compétences spécifiques des capital-risqueurs leaders qui conditionnent la forme optimale d'association entre leaders, capital-risqueurs partenaires et apporteurs de capitaux⁸.

Une première étape de notre travail a consisté à mettre en évidence un certain nombre de faits stylisés relatifs à cette problématique. Pour ce faire, nous avons constitué une base de données⁹ portant sur le marché français du capital-risque. Ce choix est en partie lié à la part relativement importante d'opérations syndiquées en France¹⁰. L'analyse de ces données nous a permis de mettre en relief, d'une part, les formes de syndication et d'autre part les formes de financement privilégiées sur ce marché.

En ce qui concerne les formes de syndication, l'étude des données suggère que les choix de syndication sont influencés par deux paramètres : le niveau d'expérience du capital-risque leader d'une part et le niveau de rentabilité des projets d'investissement d'autre part. Ainsi, nous avons observé que si le leader est inexpérimenté, il aura tendance à s'associer à un syndicat de capital-risqueurs spécialisés. Les faits stylisés indiquent également que

⁸ Certains auteurs mettent en relief le rôle des compétences dans l'efficacité des investissements en capital-investissement et dans l'efficacité des choix de syndication. En revanche, très peu de travaux se sont intéressés à la relation entre le type de compétences des capital-risqueurs et leurs choix optimaux de syndication, à l'exception notable de l'article de Casamatta et Haritchabalet (2007) qui montrent que la syndication est reliée négativement au niveau d'expérience des capital-risqueurs. Cette idée est par ailleurs confirmée par les résultats empiriques obtenus dans le cas de l'industrie allemande du capital-investissement par Hopp et Rieder (2011). Toutefois, ces travaux n'étudient pas l'influence des compétences spécifiques d'un capital-risqueur sur la forme optimale de partenariat qu'il peut mettre en place avec les autres membres d'un syndicat. Par exemple, ils n'analysent pas s'il est plus intéressant pour un capital-risqueur expérimenté de s'associer avec un syndicat de capital-risqueurs expérimentés ou bien avec un syndicat composé de capital-risqueurs spécialisés. Par ailleurs, à notre connaissance, il n'y a pas de travaux qui s'intéressent, comme nous le faisons ici, au lien existant les sources de financement et la forme de syndication choisie.

⁹ Les informations relatives à la structure de l'actionnariat des capital-risqueurs et aux caractéristiques des firmes financées ont été collectées à partir de la base Diane ; celles relatives à l'expérience et à la spécialisation des capital-risqueurs à partir des informations publiées par les capital-risqueurs eux-mêmes. L'analyse statistique a finalement porté sur 1989 entreprises financées par capital-investissement et 198 organismes de capital-risque. Nous avons enfin identifié 226 syndicats associés à 144 leaders différents.

¹⁰ 50% des investissements en capital-investissement étaient syndiquées en France en 2009, contre 40% en Europe (*EVCA Yearbook Data*, 2010).

lorsque le leader est expérimenté, son choix en matière de syndication dépend de la rentabilité des projets financés : plus les rendements sont faibles, plus le leader choisit des syndicats expérimentés, plus les rendements sont élevés, plus il se tourne vers des syndicats spécialisés.

En ce qui concerne les formes de financement, l'analyse de la base de données montre que la nature de la source de financement est directement liée au niveau de spécialisation des capital-risqueurs leaders. Les faits stylisés indiquent que si le leader est peu spécialisé, il tend à être financé par une banque, tandis que lorsqu'il est très spécialisé, les principaux pourvoyeurs de fonds sont des investisseurs institutionnels.

L'objectif de notre papier est de développer un modèle théorique qui vise à analyser les raisons pour lesquelles les caractéristiques des compétences des leaders influencent à la fois les formes de partenariat en termes de compétences à l'intérieur des syndicats et la nature des pourvoyeurs de fonds finançant ces opérations syndiquées.

Dans ce modèle, nous supposons qu'il existe une hétérogénéité au niveau des compétences des capital-risqueurs leaders (supposés plus ou moins expérimentés et spécialisés), des compétences des syndicats (expérimentés ou spécialisés) ainsi qu'au niveau de la nature des investisseurs (banques ou investisseurs institutionnels).

Sous ces hypothèses, le modèle analyse le comportement d'un capital-risqueur leader d'une opération syndiquée. Celui-ci doit déterminer les modalités optimales de financement (à travers le choix des investisseurs) et de partenariat (à travers le choix du syndicat) associées à un projet d'investissement financé sur deux périodes (une phase de démarrage puis une phase de développement du projet).

La résolution du programme d'optimisation du modèle met en relief l'aspect central des compétences des capital-risqueurs dans les choix de syndication. Le résultat le plus intéressant du modèle est de montrer que ces choix dépendent non seulement du niveau mais également de la nature des compétences.

En effet, une première conclusion est que le niveau d'expérience du leader est un déterminant important des choix de syndication car il influence la forme de partenariat au sein du syndicat. Si le leader est peu expérimenté, la solution optimale consiste à se syndiquer avec des capital-risqueurs spécialisés, et ce, quel que soit le niveau de spécialisation du leader. En revanche, si le leader est expérimenté, l'éventail des partenariats optimaux est plus large et le choix dépendra du rendement espéré des projets. Si les projets ont un rendement espéré relativement faible, la solution optimale associe un leader expérimenté à un syndicat expérimenté. Des rendements plus élevés conduisent au contraire le leader à s'associer à un syndicat spécialisé. Ces résultats sont donc en adéquation avec les faits stylisés mis en évidence dans le cas du marché français.

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La seconde conclusion est que le niveau de spécialisation du leader est également un facteur crucial dans les choix de syndication car il détermine la nature des pourvoyeurs de fonds qui financent l'opération syndiquée. Les solutions optimales associent les leaders peu spécialisés à des banques et les leaders très spécialisés à des investisseurs institutionnels. Le modèle montre également que cette relation entre spécialisation et source de financement n'apparaît que si les pourvoyeurs de fonds sont actifs ("hands-on" pour reprendre la terminologie généralement utilisée dans le capital-risque). Dans le cadre du modèle, cela signifie que les banques et les investisseurs institutionnels utilisent le mécanisme de rémunération qui les relie au leader pour inciter ce dernier à choisir la forme de syndication optimale de leur point de vue.

Lorsqu'on compare ces résultats théoriques à la situation prévalant sur le marché français du capital-risque, le modèle suggère que le capital-investissement en France se caractérise par un mode de gouvernance *hands-on* des capital-risqueurs par leurs pourvoyeurs de fonds. En effet, les observations tirées de notre base de données mettent en relief le lien étroit entre sources de financement et niveau de spécialisation des leaders bénéficiaires de ces capitaux. Cette gouvernance active exercée par les pourvoyeurs de fonds pourrait être en partie due au fait qu'au cours des dernières années, en Europe, la part des capital-risqueurs indépendants a augmenté significativement au détriment de la part des capital-risqueurs captifs. Dans le cas de la France, le phénomène est particulièrement marqué puisque, entre le début et la fin de la dernière décennie la part des captifs est passée de 20% à seulement 0.7% en 2009 (*EVCA Yearbook*, 2010). Par conséquent, de moins en moins de relations de financement entre pourvoyeurs de fonds et capital-risqueurs s'établissent dans le cadre de relations entre société-mère et filiale. Dans ce contexte, les apporteurs de capitaux doivent utiliser de manière plus active les mécanismes financiers incitatifs centrés sur les performances afin d'aligner les stratégies d'investissement – au premier rang desquelles la syndication – des capital-risqueurs indépendants qu'ils financent avec leurs propres objectifs. Ce faisant, comme le montre notre modèle, chaque type de pourvoyeur de fonds est conduit à privilégier le capital-risqueur leader qui maximise l'efficacité du mécanisme de rémunération utilisé : comme dans le cas français, les banques financeront de préférence les capital-risqueurs les moins spécialisés et les investisseurs institutionnels se tourneront au contraire vers les plus spécialisés.

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III. SÉLECTION DE PUBLICATIONS

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14. Thwarting systems and institutional dynamics: or how to stabilize an unstable economy

Eric Nasica

INTRODUCTION

Starting in the middle of the 1950s, and for the next forty years, Hyman Minsky developed an original business cycle theory based on an endogenous and financial conception of economic fluctuations, and more specifically, on the ‘financial instability hypothesis’.¹ The complexity and the richness of Minsky’s analysis, associated with an almost total lack of formalization on his part, has not made the understanding of his approach any easier. It somewhat also explains the comparative disregard with which his theory of fluctuations has been considered until recently.

In the last ten years, various economists have begun to consider this problem worth tackling and have attempted to provide a modeled version of the financial instability hypothesis. With this aim in view, they have been using analytical methods derived from mathematical work on nonlinear and chaotic dynamical systems.² The results obtained have been very stimulating. In their models, nonlinearities combined with relations depicting financial arrangements are not assumed in an *ad hoc* fashion. Actually, nonlinearities allow a good description of the behaviors Minsky analyses in his theory of investment. More than anything else, these models quite faithfully account for one of the essential aspects contained in Minsky’s approach, namely that the economy is subject to ‘financial dynamics’, insofar as it evolves along a succession of phases of comparative stability and instability. The idea being that, contrary to what is asserted by new classical economists, this succession of phases is induced by endogenous processes and financial phenomena.

However, a closer examination of Minsky’s analysis leads one to consider these nonlinear models with a critical eye or at least to suggest a substantial enrichment of their assumptions. Indeed, these models neglect another essential aspect of the financial instability hypothesis, an aspect I propose to call ‘institutional dynamics’. The latter characterizes the influence of institutional

mechanisms and of the interventions of public authorities on the dynamics of market economies. These institutional factors affect the nature of the business cycle in a way that is ambivalent. On the one hand, they act as ‘thwarting systems’ whose purpose is to counteract and to contain the naturally explosive amplitude of economic fluctuations. On the other hand, they themselves can change into and become factors of instability and inefficiency.

In this chapter, it is shown that this ambivalence of institutional factors appears early in Minsky’s first works, more precisely in the late 1950s. The argument is developed in two main steps. First, on the basis of Minsky’s analysis, I investigate the actual form that fluctuations analysis can take, explicitly including the institutional context that governs interactions between economic agents (section 1). I then look at the reasons why the stabilizing effects of a given institutional structure are not immutable. In order to remain effective, the institutional structure must, on the contrary, change endogenously in response to actions by private agents in the economy (section 2).

1 THWARTING SYSTEMS OR THE NEED TO ‘STABILIZE AN UNSTABLE ECONOMY’³

For Minsky, the various institutional mechanisms that make up contemporary market economies are central features in determining economic fluctuations. Their role is to ‘halt’ and then correct the dynamic process at the origin of the economy’s ‘endogenous’ behavior, which is assumed to be incoherent. Concretely, this procedure amounts to introducing new initial conditions into the system and therefore modifying the behavior of markets and altering the parameters entering into economic agents’ decisions. This means of characterizing the change in economic activity is interesting on more than one count. First it ties back in with and supplements a certain type of model of business cycles developed in the 1950s (section 1.1). Secondly, it provides a relevant theoretical framework within which to analyze the role of stabilizing institutional mechanisms occurring in contemporary financially sophisticated economies (section 1.2).

1.1 Reinterpreting Growth Models with ‘Ceilings and Floors’

The business cycle models proposed by Minsky in the late 1950s⁴ drew heavily on models of interaction between the multiplier and the accelerator developed some years previously by Hicks⁵ and Goodwin.⁶ Being aware of the inherent limits of linear macroeconomic models of the type proposed by Samuelson⁷ and of the fundamentally nonlinear nature of economic activity, Hicks and Goodwin

introduced constraints into business cycle models, to act as bounds to expansion or depression. Now, mathematically, this procedure comes down to introducing what can be termed ‘type-1’ nonlinearity into the model. Type-1 nonlinearity is thus defined by the introduction of constraints which the unstable solutions of a linear structure system run up against.

In view of the obvious kinship between these growth models with constraints and Minsky’s approach, it seems necessary to recall briefly the main assumptions underlying them and the way they generate economic fluctuations. However, it seems more judicious, if we are to highlight the effects of institutional mechanisms, to present these models in a slightly different form from that initially proposed by their authors and given in the standard textbooks on macroeconomic dynamics.

This particular presentation, which is the one utilized by Minsky himself, consists in highlighting the influence of ‘initial conditions’ (and their variations) on the movement of time series generated in linear models with constraints. Resorting to this type of reasoning has the advantage of emphasizing that the shape of the paths obtained in these models is the outcome of dynamic processes divided into a series of stages. At each stage, the values taken by an economic variable serve as the initial conditions in determining the next value. A dynamic process is then termed ‘unconstrained’, in Minsky’s terminology,⁸ when the initial conditions of the following stage are generated endogenously by the process itself. In contrast with this, any process wherein the initial conditions of the next stage differ (because of influence from features exogenous to the process) from those that the process would have generated naturally are said to be ‘constrained’. Type-1 nonlinearity therefore appears in the form of functions defined ‘piecemeal’, the specificity of which is to undergo variations when new initial conditions are defined.

Having made this preliminary remark, we can examine briefly the general behavior of models of interaction between the multiplier and the accelerator. These are usually characterized by a consumption function of the form $C_t = aY_{t-1}$ [a standing for the marginal rate of consumption and Y_t denoting the net national product in period t] and by an induced investment function of the form: $I_t = b(Y_{t-1} - Y_{t-2})$ [where b represents the accelerator]. When introduced into the equilibrium condition $Y_t = C_t + I_t$, these relations yield a second-order linear difference equation:

$$Y_t = (a + b)Y_{t-1} - bY_{t-2} \quad (14.1)$$

This latest equation means that when the value of the reaction coefficients a and b and the values of Y_{t-1} and Y_{t-2} (the initial conditions) are known, it is possible to determine recursively any solution Y_n (where n is a previous or

subsequent period) to the system. In addition, we know that the solution to (14.1) is of the form:

$$Y_t = A_1 U'_1 + A_2 U'_2 \quad (14.2)$$

where U_1 and U_2 are the roots of the associated characteristic equation $U^2 - (a + b)U + b = 0$ and A_1 and A_2 are constants depending on the value of parameters a and b and on the initial conditions.⁹

Solving equation (14.2) yields different types of dynamics depending on the value of the parameters, namely: (a) monotonic convergence of net national product toward an equilibrium value (if the roots are real and of absolute values less than unity); (b) damped fluctuations: the system is stable and converges towards the long-term equilibrium level of Y_t by values that are alternately less than and greater than this equilibrium value (if the roots are complex and their modulus is less than unity); (c) explosive fluctuations: the amplitude of fluctuation of national output increases around the equilibrium value at each period (if the roots are complex and their modulus is greater than unity); (d) instability in the form of monotonic divergence or regular explosive growth, the national product diverging increasingly from the equilibrium level (if the roots are real and greater than unity in absolute value).

Unlike Samuelson’s analysis,¹⁰ which investigates the range of different solutions set out above, Hicks concentrates exclusively on parameter values which when combined give either accelerated growth, or amplified fluctuations [cases (c) and (d) above]. Hicks therefore situates his approach in a configuration such that both roots U_1 and U_2 are greater than unity with $U_1 > U_2 > 1$. He further assumes that there is a maximum growth rate (‘ceiling’) of the economy which we shall note as g (this gives therefore $Y_t = Y_0 e^{gt}$ when the ceiling is effective) and the dominant root U_1 is very much greater than the growth rate of the ceiling income. Finally, both roots U_1 and U_2 are such that $U_1 > U_2 > g > 1$.

Under these assumptions, the economy would evolve in the following way. Let us suppose that the economy is initially defined in such a way that it generates two consecutive incomes Y_0 and Y_1 ($Y_1 > Y_0$) such that both these incomes are less than their corresponding ‘ceilings’ and that, in addition, $U_1 > Y_1/Y_0 > U_2$. These initial conditions determine positive coefficients A_1 and A_2 (with, in addition, A_2 being much greater than A_1 because U_1 is assumed to be much greater than $g^{(1)}$). Equation (2), characterizing the dynamics of the system, then generates an explosive type evolution over time.

However, after a certain time, let us say the period n , the income generated in accordance with equation (14.2) finishes by levelling out at a higher value than the ceiling corresponding to that period. At that juncture, the constraint becomes effective and the income realized is no longer determined by the

previous equation (14.2) (specifying the unconstrained dynamics) but, for two successive periods, by the equation:

$$(14.3) \quad Y_1 = gY_0$$

This takes us back to a situation where $Y_1/Y_0 = g < U_2$. The prominent feature is that the coefficient A_1 of the dominant root U_1 will change sign and become negative in the new solution equation (14.2) which will prevail. This change in sign indicates the start of the ‘rebound’ of the path against the ceiling, i.e. the turnaround point of the cycle. A cumulative depression process results from this. The economy is henceforth subjected to change that is guided essentially by the negative term of increasing absolute value: $A_1(U_1)^g$.

This explosive downward movement of income can only be slowed if there is a lower limit, a ‘floor’, to counter the process generated by the unconstrained dynamics, as with the ceiling examined above. As in Hicks’s model, the floor may consist in setting a maximum value of disinvestment by firms. When this maximum value is reached, the realized value Y_t is different from that obtained with equation (14.2) previously. A new solution equation then determines the change in the economy. This new equation is characterized this time by a negative and comparatively large coefficient A_2 and by a positive and comparatively small coefficient A_1 . As in the previous case, there then comes a point where the cycle reverses. A new expansion phase arises, which is initially moderate and then explosive. It continues until the economy ‘rebounds’ again on the ceiling for the reasons described previously and so on and so forth.

When we compare the general form of Hicks’s model with that of the models proposed by Minsky in the late 1950s, the two approaches look very similar. In both cases, the authors have opted to take nonlinearities into account by introducing constraints on booms or slumps, in the form of ‘floors’ or ‘ceilings’. These models are therefore capable, as we have just seen, of generating persistent fluctuations from an unstable solution of the Samuelson model.

Nonetheless, this apparent similarity conceals a marked difference in interpretation between the two economists. This difference depends mainly on the exact sense each gives to the constraints that stabilize the dynamics of the economy. In Hicks’s model, commonsense justifies the existence of these constraints: real investment cannot be negative, hence the existence of a ‘floor’ (determined by the growth of autonomous investment and the size investment due to depreciation). In addition, output, consumption and investment are limited by the bounded availability of natural resources, labor and productivity gains. Hence the existence of a ‘ceiling’.

Things are very different for Minsky. Of course, Minsky does not deny that such constraints can influence the level of economic activity. Nevertheless, he

does not think they are primordial in explaining the cyclic dynamics observed in market economies. He argues that floors and ceilings reflect primarily the set of institutional mechanisms set up by public authorities in order to confine the amplitude of economic fluctuations within reasonable bounds. This is why Minsky terms these institutional arrangements ‘thwarting systems’.

The original idea developed by Minsky is therefore that the main purpose of these thwarting systems is to modify the initial conditions governing the future evolution of economic time series during phases of explosive expansion or cumulative depression (or to speak in nominal terms, during periods of intense inflation or deflation). As we have emphasized, such changes in ‘initial conditions’ have the effect of inverting the sign of the dominant root of the equation that solves the oscillator model. Consequently, the movement of the economy ends up slowing down and reverting to the opposite direction. Depression or deflation is thus converted by an ‘institutional’ type floor, into a moderate and then explosive recovery, which in turn runs up against an ‘institutional ceiling’. The time series observed thus appear to be the outcome of incessant ‘rebounds’ of economic dynamics, hitting alternatively the ceilings and floors generated by the institutional thwarting mechanisms set up in the economy.

Such a model, explicitly integrating the role of institutions on the changes in economic activity is interesting in more than one way. First, unlike Samuelson’s oscillator type unconstrained linear models, it accounts for the complexity of changes of capitalist economies over time that Minsky highlighted. This evolution is made up of ‘steady growth [when $U_1 > g > U_2$], cycles [when $U_1 > U_2 > 1$], booms, or depressions [when $g > U_1$]’. In other words, this linear model with constraints ‘exhibits the features of chaotic models, including the sensitivity of the time series that is generated to initial conditions’.¹³

Secondly, unlike usual linear models with constraints which spirit away institutional thwarting systems,¹⁴ this model makes it easier to understand the role played by institutional changes and interventions by public authorities on economic dynamics. In Minsky’s model, the policy and institutional dependence of the floors and ceilings can be made quite precise. The ‘incoherence’ of economic paths [in particular the occurrence of explosive, amplified changes leading to either very large values (even infinite) or... negative values] inherent in unconstrained linear models can thus be countered by setting up institutional thwarting mechanisms. Under these circumstances, ‘business cycles can result either from the values of the “U”s” being complex, from regular interventions that contain the economy between “floors and ceilings” if the “U”s” are greater than one, and from introductions of energy from outside if the “U”s” are less than one’.¹⁵

In Minsky’s approach, the concrete stabilizing procedures of economic activity that are able to lay down new initial conditions and to contain the

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 amplitude of time series are essentially the concern of the government, via its budgetary policy, and of the central bank, through its role as lender-of-last-resort.

1.2 ‘Big Government’, Lender-of-last-resort and Stabilizing Economic Activity

Minsky views budget deficit and interventions by the central bank as lender-of-last-resort (the Fed in the US) as extremely effective instruments with which to stabilize economic fluctuations. Even if they do not lead to a situation of full employment, these instruments help limit variability to the fall in income and liquidity during economic recessions and during the onset of a financial crisis. Let us consider the role of budget deficit first. In Minsky's theory, investment is the essential determinant of economic activity. This investment is largely influenced by aggregate (realized or anticipated)¹⁶ profits. It follows, he emphasizes, that ‘*a main aim of policy is to constrain the variability of profits*’.¹⁷

Now, recalls Minsky, in a closed economy, these aggregate profits are, in accordance with the approach utilized by Kalecki,¹⁸ equal to the sum of investment and of budget deficit. Consequently, this deficit, by supporting aggregate demand when private investment flags, allows a lower limit (a ‘floor’ to continue with the vocabulary of linear models with constraints) for profits, wages and current production prices.¹⁹ In other words, ‘*policy will be stabilizing if a shortfall of private investment quickly leads to a government deficit and a burst of investment quickly leads to a budget surplus*’.²⁰ This stabilization of actual and expected profits is crucial to ensure the continuity of the economic system. It is utilized in particular to maintain the viability of debt structures and therefore the level of private investment. In fact, ‘*once rational bankers and business men learn from experience that actual profits do not fall when private investment declines, they will modify their preferred portfolios to take advantage of the stability of profits*’.²¹

Thus the presence of a ‘big government’, characterized by a budgetary policy that is very sensitive to variations in overall profits is necessary to improve the stability of the economy. Nonetheless, isolated action of this type of policy may prove insufficient during periods of economic turmoil. True, public deficits partly offset the reduction in profit flows resulting from a fall in investment and in this way maintain current production prices and consumer goods prices. However, these deficits do not make it possible to counteract directly, during an economic crisis, the drop in another type of price, and one which is essential in Minsky's investment theory, namely the price of capital assets. This latter price is dependent upon the amount of money in circulation but also on more subjective variables such as liquidity preference, the debt level that is judged acceptable or the expected profits of different agents in the economy.²²

It is necessary then to turn, as a supplementary step, toward a second type of ‘institutional thwarting mechanism’, the role of the central bank as lender-of-last-resort.²³

The main purpose of this type of intervention is to counter the ‘debt deflation’ phenomena or at least the different forms of financial instability that contemporary market economies have experienced, especially in the last decade. In the case of the US, which Minsky gives precedence to, one obviously thinks of the financial market crash of October 1987, the Federal Savings and Loan Insurance Corporation (FSLIC) debacle and the extreme fragilization of junk bond markets. Through their sheer scale and the difficulties experienced in correcting them, these different examples emphasize the idea that the stability of the current financial system cannot be based exclusively on government budgetary policy.

For Minsky these phenomena also emphasize the necessity for an extended interpretation of the role of lender-of-last-resort. This is why he distinguishes three aspects of this type of intervention in his approach.²⁴ First, in the event of insufficient funds on the money market (generally synonymous with substantial falls in the value of claims utilized by agents to obtain liquidities), the central bank must intervene by increasing the amount of money in circulation. Secondly, during the financial restructuring period that follows a crisis, the central bank must take care to favor recourse to long-term rather than short-term borrowing by acting accordingly on interest rates. Finally, the central bank is responsible for guiding the development of the financial system, both through regulations and through banking system controls so that the impact of ‘speculative’ banking operations (notably excessive recourse to liability management) can be restricted.

There is no denying that, in the last twenty years, the ‘endogenous’ aspect of central bank policy has been considerably reinforced, in accordance with the approach advocated by Minsky and contrary to the claims of the monetarist school.²⁵ Its function as lender-of-last-resort has extended constantly to new institutions and new instruments.²⁶ By the end of the 1960s, the Fed had to intervene to protect the municipal bond market. In 1970 it had to guarantee the commercial paper market. In the 1980s it had to intervene during the foreign debt crisis, during the Continental Illinois bankruptcy and during the financial market crash. In each of these situations, the Fed (which is supposed to follow a ‘monetarist’ policy) provided liquidity and was compelled to validate to some extent many risky financial practices.

The analysis of institutional constraints of the system thus marks the clear opposition between Minsky's approach and the ‘Smithian’ conception of economic behavior characterizing current business cycle theories of neo-classical inspiration. The idea highlighted by this author is that the institutional structure of contemporary economies contains a number of regulatory mechanisms, which are exogenous to the market, whose actions prevent the free

exercise of the internal dynamics of the economic system. In this context, each specific institutional structure will have the effect of producing realized values (asset values, income flows) that are different from those that would have been determined by unconstrained internal dynamics. The central bank in particular intervenes almost daily on the money and financial markets in its activity as lender-of-last-resort. The main implication of these interventions is to prevent the present results obtained on these markets from becoming the initial conditions that will govern future dynamic processes. Thus when the central bank intervenes in the money market to shore up a failing financial institution or to stabilize the foreign exchange market, the values of the interest rate, of asset prices or of exchange rates will differ from the values determined by the working of the market alone.

2 THE AMBIVALENCE OF INSTITUTIONAL THWARTING SYSTEMS

The line of argument developed in the previous section implies that in the long run, the satisfactory working of the economy is dependent on the ‘accuracy’ of the regulating structure set up by the public and monetary authorities. Now, the effects of an intervention structure are not immutable: its capacity to stabilize the amplitude of economic fluctuations and to compel market agents to undertake moderately risky actions varies greatly over time. This is so because ‘profit-seeking agents learn how a regulatory structure operates and because regulation means that some perceived opportunities are not open to exploitation, there are incentives for agents to change their behaviour to evade or avoid the constraints’.²⁷

This means that some institutional interventions and mechanisms, that were initially stabilizing, may change into factors of instability and inefficiency. One need only recall the Savings and Loan debacle and the powerlessness of the FSLIC when confronted with problems of financial instability in the 1980s to be persuaded of this: a regulation and intervention structure which was at first effective can begin to backfire if the political and institutional decision-makers do not take adequate account of the behavior of market agents in response to the institutional changes they are up against.

This basic aspect of the effects of interaction between market dynamics and institutional dynamics appears to be a key element in Minsky’s cycle theory. This issue was investigated in depth by the author’s very first publication titled ‘Central Banking and Money Market Changes’.²⁸

In that paper Minsky develops an approach based on a money supply function reflecting, on the one hand, complex interactions between the central bank and

private banks on the money market and on the other hand the institutional dynamics derived from such interaction. In order to examine the role of commercial bank behavior on the money market, the author reasons firstly on the assumption that the central bank conducts a restrictive monetary policy. He argues that if economic expansion generates fears of inflation, the monetary authorities may be led to apply this type of policy, which is liable to entail interest rate rises which reflect, during such periods of upturn in activity, ‘*a vigorous demand for financing relative to the available supply*’.²⁹ Minsky then envisages two cases: the first consists in reasoning on a stable institutional environment. In this case Minsky acknowledges that ‘*a tight money policy will be effective and the interest rate will rise to whatever extent is necessary in order to restrict the demand for financing to the essentially inelastic supply. [...] This can be represented as a positive sloped curve between velocity and the interest rate*’.³⁰

This assumption of institutional stability is, however, not the one that the author favors, having regard to the major changes occurring on the money market in the early 1950s, characterized in particular by the substantial development and boom in the federal funds market and ‘repurchase agreements’. Minsky contends that these changes reflect ‘institutional instability’ which is driven mainly by the maximizing and innovating behavior adopted by commercial banks.

Restating and supplementing the analysis of Schumpeter³¹ (1951) on the question, Minsky emphasizes that the search for market power is a fundamental determinant in innovation: banks are viewed as enterprising firms that innovate to improve their profitability. The idea behind this is that as financial institutions innovate, the financial system changes, imagining new ways of financing the maximizing behavior of other institutions. Consequently, the innovators who develop new financial instruments, new financial usages and new financial institutions are rewarded in the form of monopoly rents which vanish only with the propagation of the innovations. More specifically, the mechanism studied by Minsky in 1957 works as follows. Interest rate rises act as a signal for the private operators in the money market who interpret these increases as new opportunities for profit. In particular, in the case of commercial banks, the interest rate rise induces an increased opportunity cost of idle balances for those establishments with excess reserves on hand. It is therefore in their interest to lend such reserves on the federal funds market. Likewise, banks with deficit reserves can take advantage of the gap between interest rates on federal funds and the discount rate; the former, observes Minsky, being never greater than the latter.³² For identical reasons, non-bank financial institutions such as government bond houses are encouraged to borrow through repurchase agreements from nonfinancial corporations. This operation is made easier in periods of high interest rates, the non-financial corporations turning away from non remunerated demand deposits and therefore seeks to place their funds in more profitable liquid assets.³³

To sum up, the rise in interest rates creates a favorable environment for the emergence and development of institutional innovations. Now, these innovations have an important implication: they increase the velocity of money and, in itself, the quantity of money on offer to potential borrowers.

There are two essential reasons behind this fundamental relationship that emerges between increased velocity and increased quantity of money. First, it is clear that the increased recourse by banks to the federal funds market produces an increase in the volume of demand deposits for a given amount of central bank money: '*a given volume of reserves now supports more deposits*'.³⁴ Secondly, the innovation process described implies henceforth that for a given volume of demand deposits, banks increase the amount of loans granted to firms.³⁵ Commercial bank assets undergo two important changes: (1) a fall in the proportion invested in short-term government bonds, such as Treasury Bills; this is a consequence of the rising share being held by nonfinancial corporations following the increase in rates; and (2) reduction in loans granted to government bond houses which are increasingly financed, as we have seen, from these nonfinancial corporations through repurchase agreements. It can be seen then why Minsky rightly assimilates these different changes in bank balances generated by the innovation process to an increase in bank reserves³⁶ and why the velocity and the quantity of money vary jointly during the expansion phase of economic activity.

These different changes on the money market therefore engender institutional instability which is reflected concretely by a shift to the right in the relationship linking interest rates and the velocity of money. This leads eventually to an upward stepped money supply curve similar to that in Figure 14.1.

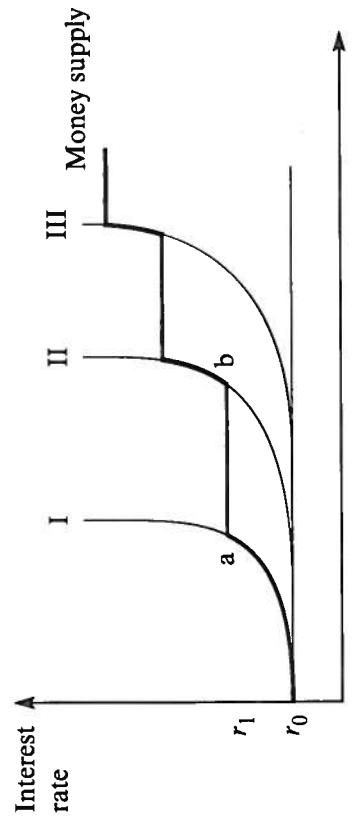


Figure 14.1 Institutional dynamics and interest rates

The increasing parts of the curve represent the effect on the interest rate of a restrictive monetary policy in a stable institutional environment. However, this movement does not last indefinitely: interest rate rises (from r_0 to r_1) generate profit opportunities, innovations on the money market and therefore institutional instability reflected by the shift of curve I to II. This gives rise to a horizontal plateau (a – b) characterizing the period during which institutional innovation propagates.

During this period, the effects of the restrictive monetary policy on the interest rate are completely offset while the velocity and the supply of money seem to be infinitely elastic. As Minsky emphasizes, in such a context, the effectiveness of monetary policy for controlling monetary aggregates is very low and, to react to inflationary fears, the central bank has no other solution than to act directly on banking system liquidity. It therefore tries to reduce reserves sufficiently to offset the increase in the velocity. This reaction by the central bank to the maximizing and innovating behavior of commercial banks has the effect of directing interest rates up again, and consequently, recreating eventually the entire process described above, hence the succession over time of increasing portions and horizontal plateaux as shown in Figure 14.1.

In this way, the behavior of commercial banks in response to profit possibilities and to the policy conducted by the central bank does not allow the central bank to set the interest rate at the level it judges desirable. The change in the interest rate is largely dependent upon the series of phases of institutional stability and instability induced by the behavior of commercial banks in response to stabilization policies conducted by the monetary authorities.

This interest rate also appears to be 'pro-cyclic': on the assumption used here, the interest rate rises simply reflect the dynamic process that is set up between the innovations of commercial banks and the reactions in the form of restrictive monetary policy of the central bank during the expansion phase of economic activity. The rise in interest rates on the money market and the institutional innovations of the commercial banks finish up by fragilizing the banks' balance sheets. This fragilization leads to increased preference for liquidity on the part of banks and revaluation of what are deemed acceptable debt ratios for borrowers. Accordingly, banks are led to restrict their lending policy on the credit market. This is reflected in the fall of the supply of finance and in the increase of interest rates on the market for loans. Greater financial constraints are then liable to have dramatic consequences in terms of economic and financial instability if they arise in an economy dominated by agents with an already fragile financial structure.³⁷

These problems which are inherent to intervention by the monetary authorities, much as the difficulties encountered by organizations such as the FSLIC in the US, are not, however, an argument in favor of '*laissez-faire*' or for rejecting institutional thwarting systems. On the contrary, they suggest the conclusion that

*'intervention cannot be frozen in time but must adapt as institutional and usage evolution takes place; successful capitalism requires both a structure of regulation and a sophisticated awareness of the way profit seeking drives the evolution of structures and behaviour.'*³⁸ In other words, while '*thwarting systems are analogous to homeostatic mechanisms which may prevent a system from exploding'*,³⁹ they are not mechanical for all that.

In this context, any incapacity of the public authorities to interpret correctly the change in their economic environment and more particularly to take account of the consequences of their interventions on the behavior of private agents can have harmful consequences on macroeconomic dynamics. Three types of difficulties are liable to arise.

A first problem arises when policy-makers have to rely on the data drawn from time series generated, precisely, by a potentially explosive system that is constrained by interventions and institutional mechanisms. These data may give the misleading impression that they result from a 'naturally' stable dynamic process and cannot suitably support policy-making. In a setting of this sort, economists and policy-makers may mistakenly conclude that a system is endogenously stable and that institutional thwarting mechanisms are useless. In addition, once the problems of macroeconomic instability have seemingly been eliminated, the public authorities may become prone to take measures in order, for example, to improve the microeconomic efficacy of the system. In finance, scrutiny of contemporary market economies shows that such a policy usually takes the form of a process of deregulation and of slackening of the constraints (notably in balance sheet management) weighing on the operators of the money and financial markets. The periods of great financial instability experienced by Western countries and by Japan in the early 1990s emphasize the adverse effects induced by this quest for microeconomic effectiveness to the detriment of the stability of the system as a whole. Events have provided a harsh reminder that, in accordance with Minsky's approach, inflexible and short-sighted action by the public authorities leads to a weakening of the stabilizing mechanisms set up in the past and to the creation of an environment conducive to the triggering of a financial crisis.

Secondly, Minsky emphasizes that the large injections of liquidity associated with interventions by the government and monetary authorities are inflationary, as they inject purchasing power into the economy more quickly than they encourage the creation of new production.⁴⁰ The combination of fragility of the system and anti-deflationary intervention therefore introduces an inflationary bias into the economy. The problem is that it is very difficult to control inflation in 'financially sophisticated' economies. Cost inflation acts on the price level of current output. Now, as Kregel⁴¹ shows, monetary policy appears to be an overwieldy instrument for combating inflation and may aggravate recession and lead to increased unemployment. This policy appears *a priori* more effective

for controlling 'speculative inflation' of the prices of capital assets by acting directly on variables such as interest rates and financial system liquidity which are directly involved in determining this type of price. Nevertheless, the effect of a restrictive monetary policy on the prices of assets remains difficult to predict accurately: these prices also depend to a large extent on potentially volatile expected profits in an uncertain environment. Consequently, any attempt by the monetary authorities to hold down inflation (e.g. interest rate rises) on the financial markets may well force expectations to be revised downward and trigger behavior leading to marked instability of the system.

Thirdly, it is clear that even if actions taken by public authorities can offset financial instability in the short run, they do not necessarily drive the economy toward a stable situation of full employment. Their interventions also tend to validate fragile financial structures that have come into existence and, as an effect, to sustain or even amplify the problems associated with such structures. This is so because rational agents, observing a rise in the level of financial fragility at the macroeconomic level, will be prone to adopt financial behavior that will become increasingly risky, and engage in more debt. Such behavior is explained essentially by the fact that potential costs associated with risky financial practices of private agents are, to a very large extent, 'socialized': it is the task of the public authorities (the government, the central bank) rather than of the private agents themselves to absorb the costs inherent in the increase of the budget deficit or intervention as lender-of-last-resort.

Finally, the inclusion of the role of institutional mechanisms implies that Minsky's theory does not simply describe the cycle as a mechanical phenomenon of succession of phases of the type: increasing financial fragility → financial crisis → gradual return to a more safety and soundness of the financial system. This is so because, as a rule, financial crises thwarted by institutional mechanisms do not develop all their effects (debt-deflation, widespread bankruptcies, disappearance of agents with more fragile financial structures, etc.). As a consequence, the natural tendency towards greater financial fragility is temporarily mitigated but is in no way reversed. Fragilization on the contrary takes the form of a sustained trend, permanently transforming the fundamentals of the economy and behavior of agents within the system. Such a tendency, in an economy that is becoming increasingly fragile in the long run, makes it necessary then for there to be greater frequency and extent of actions taken by the public authorities aimed at offsetting the emergence of instability until the time comes when the crisis can no longer be contained, as is noted by Minsky. Thus in 'financially sophisticated' economies on which Minsky concentrates, the natural tendency of the system to generate periods of great instability may be controlled in part by thwarting systems. Nevertheless, such systems cannot lead to a stable equilibrium with full employment. Downward instability (debt-deflation) tends to transform under the effect of institutional thwarting processes

set up by the public authorities into upward instability (characterized by a sustained trend toward excessive borrowing, increased interest rates and persistent inflationary pressures).

CONCLUSION

For more than two centuries, there have been two opposing conceptions of the evolution of economic activity. In his memorial of Wesley Mitchell, Schumpeter distinguishes between those economists who hold that '[...] *the economic process is essentially non-oscillatory and that the explanation of cyclical as well as well as other fluctuations must be sought in particular circumstances (monetary or other) which disturb that even flow*' and those holding that the '*economic process itself is essentially wave like – that cycles are the form of capitalist evolution*'.⁴²

The analysis in this work, while it does not fundamentally challenge this distinction, shows that it must nevertheless be substantially completed if the institutional factors that constitute contemporary market economies are to be integrated explicitly in business cycle analysis. The taking into consideration of the institutional dimension of economic dynamics emphasizes that there is room within contemporary analyses of economic fluctuations for a new family of business cycle theories. It would fit somewhere in between the purely exogenous conceptions of New Classical Economics and those purely endogenous ones underpinning recent nonlinear models. It implies that the economic process is not 'essentially non-oscillatory' just as it is not 'essentially wave-like'. This different way of analyzing fluctuations is stimulating for many reasons.

First, it allows one to explain the complexity of the evolution of contemporary economies. Such modeling can incorporate both steady growth and regular business cycles as possible transient characterizations of economic time series, but, in addition, it does not exclude the emergence of the potentially 'incoherent' (or chaotic) dynamics created by the interaction of economic agents. Accordingly, the effective character of the transformation of potential incoherence into realized incoherence is dependent, mainly, on the various institutional thwarting systems characterizing the economic system under consideration.⁴³

This kind of approach also has the merit of renewing the treatment of the relations between institutions and economic activity, which is something that we do not find in traditional macroeconomic models. In New Classical Economics, it is postulated that governmental institutions can only disturb the operation of otherwise clearing markets. On their side, Keynesians of the IS-LM synthesis consider economic policy as entirely exogenous. The analysis referred to in this chapter shows on the contrary that the public authorities (the government, the central bank) react in an endogenous way to the behavior of

private agents. They thus create a true 'institutional dynamics' which interweaves with the real and financial dynamics of the economy and changes the 'unconstrained' results of the latter two.

The essential consequence of this permanent interaction between institutions and markets is that the economic system never reproduces itself identically.⁴⁴ In this context, the emplacement of adequate institutional thwarting mechanisms becomes extremely complex and demands increased vigilance on the part of the public authorities. Vigilance is necessary as the stabilization processes put in place at a certain time may eventually prove to be highly destabilizing. The 'institutional' changes imposed by the public authorities on the initial conditions of dynamic processes generate constrained time series or, more precisely, 'truncated' business cycles. The same is notably true when stabilizing mechanisms that have been instituted have the effect of guarding, for a comparatively long period, against a financial crisis or a deep depression. In this case, stability becomes destabilizing: private agents tend to become less risk averse and to adapt their maximizing behavior to the new institutional structure that gradually comes to prevail, thereby gradually undermining the stabilizing capacity of this structure, which causes the effects of the crisis to be amplified when it eventually breaks out. The extent of the problems raised by the bailings out of the US Savings and Loans Associations and more recently the difficulties faced by the central banks and the International Monetary Fund in containing the crisis in the Asian markets are painful evidence of this idea. They also strongly underline the need for contemporary business cycle theorists to integrate the institutional dimension of economic fluctuations into their analyses, in accordance with the view developed by Hyman Minsky.

NOTES

1. See Minsky (1975, 1982, 1986).

2. For instance, we have Franke and Semmler (1989), Skott (1995) or Delli Gatti and Gallegati (1993).

3. To cite the title of one of the main works of Minsky (1986).

4. Minsky (1957a, 1959).

5. Hicks (1950).

6. Goodwin (1951).

7. In the linear model of Samuelson (1939), regular, self-sustaining oscillations appear only for very special values of parameters characterizing the multiplier and accelerator. Apart from these values, the model is not very satisfactory for explaining the occurrence of self-sustaining fluctuations and accounting for the evolution of the different economic series, where, as is known, irregular fluctuations with hardly any damping are observed. This mismatch between empirically observed fluctuations and theoretical results of linear models emphasizes an absolutely general property of this type of formalization: its inability to account for persistent fluctuations, i.e. fluctuations that are neither damped nor amplified.

8. Ferri and Minsky (1992).

9. If m is the effective growth rate of income, then for any two successive dates chosen as initial conditions, $Y_1 = mY_0$. This therefore gives (since $Y_1 = A_1U_1 + A_2U_2$ and $Y_0 = A_1 + A_2$):

$$A_1 = (m - U_2) + (U_1 - U_2)Y_0$$

$$A_2 = (U_1 - m) / (U_1 - U_2)Y_0$$

Assuming that values a and b are such that $U_1 > U_2 > 1$ (i.e. the case of explosive time series in an unconstrained system), it follows that:

$$U_1 > U_2 > m, \text{ therefore } A_1 < 0 \text{ and } A_2 > 0$$

whereas

$$U_1 > m > U_2, \text{ therefore } A_1 > 0 \text{ and } A_2 > 0.$$

10. Samuelson (1939).
 11. Cf. footnote 9. This characteristic implies that during the early periods (t small), the weight of U_2 is predominant in determining the dynamic evolution whereas during subsequent periods, it is the root U_1 that tends to dominate. It ensues that the income growth rate finishes by converging towards U_1 when t goes to infinity.
 12. Minsky (1959, p. 134).
 13. Ferri and Minsky (1989, p. 138).
 14. Such as Hicks's model examined earlier but also Goodwin's (1951) model, based on a non-linear accelerator.
 15. Ferri and Minsky (1989, p. 137).
 16. Cf. in particular Minsky (1986, Chapters 7 and 8).
 17. Fazzari and Minsky (1984, p. 107).
 18. Kalecki (1971).
 19. For an analysis of the relationship between profits and the fixing of wages and current production prices, cf. Ferri and Minsky (1984) and Minsky (1986, Chapter 7).
 20. Fazzari and Minsky (1984, pp. 107–8).
 21. Minsky (1992, p. 12).
 22. Cf. Minsky (1975, 1986).
 23. In the US, the central bank includes not only the Federal Reserve system but also the different insurance-deposit organizations.
 24. Minsky (1986).
 25. On this point, see the useful paper by Friedman (1992).
 26. Cf. Woinilower (1987).
 27. Minsky (1992, p. 17).
 28. Minsky (1957b).
 29. Ibid. p. 163.
 30. Ibid. p. 172.
 31. Schumpeter (1951a).
 32. Minsky (1957b, p. 164).
 33. As Minsky points out, in mid 1956, nonfinancial corporation funds became the major source of financing for government bond houses.
 34. Minsky (1957b, p. 171).
 35. Ibid. p. 163.
 36. Ibid. p. 170.
 37. For a more extensive development of this point, see Nasica (1997).
 38. Minsky (1992, pp. 17–18).
 39. Ferri and Minsky (1992, p. 84).
 40. Cf. Friedman (1992). This reflects a problem that Minsky often pointed out: the necessity for the Federal Reserve to act as lender-of-last-resort may often be incompatible with its other objectives, in particular with keeping the inflation rate down.

41. Kregel (1992).
 42. Schumpeter (1951b, p. 252).
 43. The necessity to integrate the ‘institutional’ dimension and the thwarting systems is not really taken on board in recent non-linear models of the financial instability hypothesis with the notable exception of the model proposed by Keen (1995).
 44. Consideration of institutional dynamics is thus akin, from the point of view of its consequences on the decision-making environment, to the ‘crucial decisions’ of Shackle (1955) and the non-ergodic stochastic processes of Davidson (1982–3).
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1.2. Déficits publics et instabilité financière :

Nasica, E. et Raybaut, A. (2005) “Profits, Confidence and Public Deficits : Modeling Minsky’s Institutional Dynamics”, *Journal of Post Keynesian Economics*, Volume 28, Number 1, Fall, p. 136-154.

Profits, confidence, and public deficits: modeling Minsky's institutional dynamics

Abstract: In this paper, we present a Minskian model that deals explicitly with the influence of the institutional dynamics on the relation between finance, investment, and economic fluctuations. We show that stabilization policy can be efficient in certain cases—namely, when fiscal policy is sensitive enough to variations in private investment. In contrast, the economy is unstable when the deficit constraint is not flexible enough. These results, which echo recent debates and proposals on budget deficit rules in the Economic and Monetary Union, are fully consistent with the way Minsky considered that public authorities should "stabilize an unstable economy."

Key words: confidence, Minsky, public deficit.

Starting in the mid-1950s, and for the next 40 years, Hyman P. Minsky developed an original business cycle theory based on an endogenous conception of economic fluctuations and, more specifically, on the "financial instability hypothesis" (Minsky, 1982, 1986). This hypothesis relates to two types of phenomena characterizing the changes in "financially sophisticated economies." The first is the endogenous process of transition toward greater financial fragility. The second is the transition from financial fragility to recession.

The absence of modeling has sometimes made the consistency of Minsky's arguments difficult to check. Indeed, the implications of the interaction that takes place between real and financial factors are closely

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Journal of Post Keynesian Economics / Fall 2005, Vol. 28, No. 1 135
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0160-3477/2005 \$9.50 + 0.00.

dependent on the way the dynamic structure of Minsky's "financially sophisticated economies" is specified—namely, the shapes of the functions and the values of the parameters describing them. These aspects appear difficult to take into account without reliance on at least some sort of formalization. Accordingly, in the past ten years, some scholars have endeavored to propose formalized interpretations of the financial instability hypothesis.

The main characteristic of these models is that they introduce financial structure variables (such as indebtedness ratios) into standard Keynesian macroeconomic frameworks. Under certain circumstances, these models (e.g., Atena and Raybaut, 2000; Dell'atti and Gallegati, 2000; Keen, 1995; Skott, 1994) produce fluctuations analogous to those imagined, but not modeled, by Minsky. Financial factors are indeed capable, in systems that are otherwise stable, of being at the origin of unstable endogenous dynamics. While the dynamics are strictly divergent in linear models, they can be more complex in nonlinear models and can lead to periodical or aperiodic trajectories (limit cycles or deterministic chaos).

However, a closer examination of Minsky's analysis leads us to consider these nonlinear models with a critical eye or, at least to suggest a more sophisticated framework. Indeed, these models neglect an essential aspect of the financial instability hypothesis, an aspect we propose to call "institutional dynamics." The latter encompasses the influence of institutional mechanisms and the intervention of public authorities on the dynamics of market economies. For Minsky, the various institutional mechanisms that are present in contemporary market economies play a central role in the unfolding of economic fluctuations. Their function is to slow down and adjust the dynamic process at the origin of the economy's endogenous and "incoherent" behavior. Two types of institutional agents exert a crucial influence on the dynamics of market economies: financial institutions (especially commercial banks) and public authorities.¹ This paper is centered on the role of public authorities.¹ In Minsky's approach stabilizing economic activity is essentially the concern of the

¹ Minsky's policy analysis is based on an "agenda for reform" that addresses four issues: "Big Government (size, spending, and taxing), an employment strategy, financial reform, and market power" (Minsky, 1986, p. 295). Our paper is focused on the first issue. For an analysis of other aspects of this agenda, see, for instance, Papadimitriou and Wray (1998), who also examine Minsky's proposals regarding bank regulation, tax reform, and poverty.

government, via its fiscal policy, and of the central bank, through its role as lender of last resort. Minsky views budget deficits and interventions by the central bank as lender of last resort as extremely effective instruments for stabilizing economic fluctuations. Even if full employment is not achieved, these instruments help limit the drop in income and liquidity that occurs during economic recessions and at the onset of a financial crisis. More precisely, the aim of this paper is to present a model that extends and completes recent models of financial instability by explicitly examining the influence of the institutional dynamics on the relation between finance, investment, and economic fluctuations.

Some Minskian foundations

As is well known, Minsky's theory of endogenous and financial instability is mainly based on his financial theory of investment founded on the "two-price" approach. In the model, investment decisions are thus depicted by the following function:

$$I_t = h(p_{k_t} - p_{l_t}), \quad (1)$$

where p_{k_t} and p_{l_t} stand, respectively, for the price of capital assets and of current production. Function $h(\cdot)$ is increasing, continuous, and positive in $y_t = p_{k_t} - p_{l_t}$, satisfying

$$\lim_{y \rightarrow -\infty} h(y) = 0^+ \text{ and } \lim_{y \rightarrow +\infty} h'(y) = 0. \quad (4)$$

The first price system (the supply price of investment output) is a mark-up on costs. In the aggregate, the main out-of-pocket costs that need to be recovered are wage costs. Thus, the price of current production will move in step with labor costs and depend on the ability of the suppliers of investment outputs to limit markup changes. We assume that labor costs and mark-ups are constant so that the price of current output is also constant. Hence, we write: $p_{l_t} = \hat{p}_l$.

The second price system refers to the prices of capital assets, and reflects the views of agents dealing in such assets with regard to the levels of gross profit flows. These prices thus reflect the expectations of market participants about the future of the economy—that is, future achievements of its various actors and future performances of financial markets. For Minsky, such future conditions are uncertain and cannot be appraised in terms of probabilistic risk. As a result, current asset prices mirror

both portfolio managers' views on the future evolution of aggregate profits and the margins of safety they require.

We consider that present investment decisions in period t depend only on discounted expected profits in the next period, Π_{t+1}^e . Therefore, we have:

$$p_{k_t} = \frac{\Pi_{t+1}^e}{1+i_t}, \quad (2)$$

where i_t is the discount rate that entrepreneurs apply to their expected profits.

Expectations dynamics are described by the following equation:

$$\Pi_{t+1}^e = \Pi_t^e + \alpha(\Pi_t - \Pi_t^e), \quad (3)$$

where $0 \leq \alpha \leq 1$.

The adaptive framework used here provides a rather simplified but relevant representation of Minsky's expectations analysis. It describes, as the author does, a sequential economy where, as agents make mistakes, they will be required to correct them over time, on the basis of what their actual observations are. The firm's discount rate is not constant but is endogenous and is given by

$$i_t = i^{*} + ax_t + b\varphi_t, \quad (4)$$

where i^{*} is the risk less interest rate determined by the central bank policy, φ_t refers to the borrower's risk, and x_t is an indicator of the state of confidence, and where $a < 0$ and $b > 0$ are two parameters.

Central bank policy, the borrower's risk, and the state of confidence play a central role in Minsky's theory of investment. The characteristics of each of these variables and the way they influence the discount rate (and thus the price of capital assets) may briefly be recalled.

Let us begin with the central bank. In Minsky's approach, one of the main purposes of this institution is to fight debt-deflation phenomena or the different forms of financial instability observed in market economies, especially since the mid-1980s.

According to Minsky, these phenomena underline the need for an extended interpretation of the role of lender of last resort (Minsky, 1986). For the sake of simplicity, in the model we focus only upon one type of intervention by the central bank: the stabilization of the price of capital

assets (the value of the claims agents exchange for liquidity) achieved by modifying the money supply and thus the degree of liquidity of the economy. This role of the central bank is captured indirectly via the interest rate i^* that depends negatively on the amount of money in circulation.²

The term $b\rho$ stands for the influence of the borrower's risk on the discount rate. The fact that parameter b is positive means that the greater is the borrower's risk, the greater the discount rate (i) that the firms apply to their expected profits. In Minsky's approach, borrowers face a specific risk because, beyond the amount that can be self-financed, investment implies financial costs that are inescapable, whereas the cash flows generated by production are unquestionably uncertain. Therefore, "the borrower's risk will increase as the weight of external or liquidity diminishing financing increases" (ibid., p. 191).

In other terms, the greater the $(I_t - \rho\Pi_t)$ gap (where ρ is the rate of retention of profits), the greater the borrower's risk (the smaller the margin of safety for managers and equity owners). The dynamics of the borrower's risk is thus depicted by the following equation:³

$$\varphi_t = \Phi(I_t - \rho\Pi_t). \quad (5)$$

where function Φ takes the shape depicted in Figure 1.

The last variable, x_t , influencing the discount rate is an indicator of the degree of optimism or pessimism of entrepreneurs—that is, of the state of confidence. Because it is assumed in Equation (4) that $a < 0$, the higher (smaller) the degree of confidence, the smaller (higher) is the discount rate applied to expected returns.

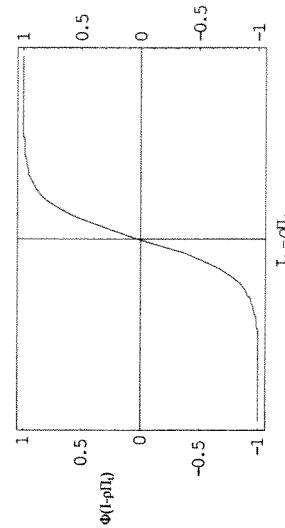
This variable x_t captures the role played by changes in long-term expectations in the emergence and recurrence of economic fluctuations.

² This is a rather simplified view of Minsky's analysis. Because of the way commercial banks react to profit opportunities and to the policy conducted by the central bank, the latter may find it difficult to set the interest rate at the level it deems desirable. Indeed, the evolution of this rate depends strongly on the succession of phases of institutional stability and instability induced by the active behavior of the commercial banks. For a more complete approach, see Vistica (1997).

³ It can be shown that the first derivative of retained profits with respect to investment is smaller than unity in a neighborhood of the stationary state of the model (see Appendix A). To that effect, the financial gap $I_t - \rho\Pi_t$ is procyclical, and, in accordance with Minsky's financial instability hypothesis, the borrower's risk will increase during an investment boom.

⁴ For Kregel (1976), considering long-period expectations as given is synonymous with reasoning in terms of a static and not a dynamic equilibrium.

Figure 1 Dynamics of the borrower's risk



This role is of utmost importance according to many Post Keynesian authors.⁴

However, far from being a purely psychological and subjective phenomenon, Minsky conceives of the modifications of the state of confidence as being based both on "objective" endogenous economic factors and on aspects determined in a conventional or "subjective" way. This is the reason why the dynamic change in x_t can be modeled by the following relation:

$$x_{t+1} = \theta x_t + (1-\theta)(\Pi_t - \Pi_t^e), \quad (6)$$

with $0 < \theta < 1$.

The term $(1-\theta)(\Pi_t - \Pi_t^e)$ indicates the influence of objective factors, represented here by profit expectations errors. Such an influence is highlighted by Minsky (ibid., pp. 193–194). In his approach, when investment and past decisions to invest are on the whole validated (i.e., when, $\Pi_t \geq \Pi_t^e$), confidence of economic agents is reinforced. Indeed, actual leverage of the aggregate balance sheet structure will be smaller than expected. Consequently, investors will come upon sounder balance sheets than predicted, meaning that there will be an "unused borrowing power," and subsequent financing conditions will become more favorable (ibid., p. 194). In Minsky's model, this leads to an increase in the maximum level of indebtedness that agents deem prudent, to a rise of investment, and to a boom.

Conversely, when actual profits are smaller than expected ones ($\Pi_t < \Pi_t^e$), confidence declines: indebtedness ratios formerly judged prudent

are henceforth considered dangerous. The adoption by businesses and by financial institutions of various defensive measures contributes then to a diminishing level of investment, thereby causing a recession and, possibly, economic depression.

The term θx_t refers to the role played by subjective elements in the formation of the state of confidence. It encapsulates the idea that agents can, to some extent, modify their long-term expectations independently of how their realized outcomes fit in with their expectations—that is, independently of economic fundamentals. According to Minsky, the longer the period during which no financial crisis occurs, the more economic agents are confident about the future and the more these agents will be likely to raise their estimates of the maximum level of indebtedness to which it is prudent to agree.

Let us finally suppose that total consumption is determined by $C_t = c[W + (1 - \rho)\Pi_t]$, where W refers to exogenous total wages, c is the propensity to consume, and ρ is the rate of retained profits. Then, the macroeconomic linkage relation given by Kalecki's (1971) accounting identity is written as

$$\Pi_t = \frac{I_t + D_t - (1 - c)W}{(1 - c(1 - \rho))}, \quad (7)$$

where $D_t = G_t - T_t$ stands for the public budget deficit. Consequently, a deficit, by upholding aggregate demand when private investment flags, establishes a lower limit, a floor, for profits.

According to Minsky, such stabilization of actual and expected profits is crucial to ensuring the continuity of the economic system. It is utilized in particular to maintain the viability of debt structures and therefore the level of private investment. In fact, "once rational bankers and business men learn from experience that actual profits do not fall when private investment declines, they will modify their preferred portfolios to take advantage of the stability of profits" (Minsky, 1992, p. 12).

The importance of "big government" (public-sector spending) in economic dynamics is so fundamental for Minsky that he divides the performance of the U.S. economy into two periods: a "small government" era from the end of the Civil War to the depression, and a "big government" era dating from World War II (Minsky, 1986). He provides a detailed analysis of how the deficit of "big government" was crucial in maintaining profits during the 1974–75 recession (*ibid.*, ch. 2).

For Minsky, the government reacts in an endogenous fashion to the behavior of private agents. This implies that the budget policy is sensi-

tive to variations in investment: "policy will be stabilizing if a shortfall of private investment quickly leads to a government deficit, and a burst of investment quickly leads to a budget surplus" (Fazzari and Minsky, 1984, p. 107).

The negative relation between the budget deficit and private investment is explicitly taken into account into our model. Accordingly, we assume:

$$D_t = \gamma(I_t)(C_t + I_t). \quad (8)$$

In this equation, $\gamma(I_t)$ is the ratio of the public deficit to private spending, $C_t + I_t$, where $\gamma(I_t)$ is a continuous, decreasing function of I_t , satisfying $-\sigma \leq \gamma(I_t) \leq \sigma$, with $0 \leq \sigma < 1$. Ratio $\gamma(I_t)$ is determined endogenously and is negatively related to investment. In this perspective, $\gamma'(I_t) = d\gamma(I_t)/dI_t$ can be regarded as the degree of flexibility of the budget deficit constraint $\gamma(I_t)$. The rest of the paper is devoted to the analysis of the role played by $\gamma'(I_t)$ on the dynamics of the economy.

Profits expectations, confidence, and economic stabilization

From the previous discussion, we derive two first-order differences equations in Π_t^e and x_t describing the dynamics of expected profits and of the state of confidence.

Accordingly, combining relations (1), (2), (4), and (5), we obtain:

$$I_t - h \left(\frac{\Pi_{t+1}^e}{1 + ax_t + b\phi(I_t - \rho\Pi_t)} - \hat{p}_t \right) = 0. \quad (9)$$

This expression determines implicitly the level of investment as a function of the level of expected profits Π_{t+1}^e for $t + 1$ and of the current state of confidence x_t . That is,

$$I_t = g(\Pi_{t+1}^e, x_t). \quad (10)$$

Substituting Equation (10) into the definition of current profits given by Kalecki's relation, the adaptive dynamics of expectations is written as

$$\begin{aligned} \Pi_{t+1}^e - (1 - \alpha)I_t^e \\ - \alpha \left[\frac{g(\Pi_{t+1}^e, x_t) + W \left[c \left(1 + \gamma(g(\Pi_{t+1}^e, x_t)) - 1 \right) \right]}{1 - c(1 - \rho) \left[1 + \gamma(g(\Pi_{t+1}^e, x_t)) \right]} \right] = 0. \end{aligned} \quad (11)$$

This implicit first-order difference equation in Π_{t+1}^e , Π_{t+1}^r , x_t^e , x_t^r determines the dynamics of expected profits Π_{t+1}^e . Hence, we have⁵

$$\Pi_{t+1}^e = f(\Pi_t^e, x_t), \quad (12)$$

Similarly, substituting Equations (7), (8), (10), and (12) into Equation (6), we obtain a first-order difference equation that gives the dynamics of the state of confidence x_t^r :

$$x_{t+1} = \theta x_t + (1-\theta) \left(\frac{\Psi(\Pi_t^r, x_t) + W[c(1+\gamma(\Psi(\Pi_t^r, x_t))) - 1]}{1 - c(1-\rho)[1 + \gamma(\Psi(\Pi_t^r, x_t))]} - \Pi_t^r \right), \quad (13)$$

where $\Psi(\Pi_t^r, x_t) = g(\theta\Pi_t^r, x_t)$.

It is therefore possible to characterize the stationary state $(\bar{\Pi}^e, \bar{x})$ of system (12)–(13). The following proposition is obtained.

Proposition 1: Assume that parameters ρ, i^, \hat{p}_t satisfy $h(0) = \rho(1 + i^*)\hat{p}_t$. Then the dynamical system (12)–(13) admits one stationary state such that $\hat{p}_k = p_1$ and $I_k = \bar{I}$.*

This "nirvana" stationary state is also characterized by perfect foresights, $\Pi^e = \bar{\Pi}$, and no risk, as $\bar{\varphi} = 0$. Consequently, agents are neither optimistic nor pessimistic, that is to say, $\bar{x} = 0$. Hence, we have $\bar{\Pi} = \bar{\Pi} = \bar{p}_t(1 + i^*)$.

See proof in Appendix B.

Let us now consider the dynamical properties of the model in a neighborhood of this stationary point. As will be shown, these dynamical properties are closely dependent on the values of $\gamma(\cdot)$, which captures the degree of flexibility of the countercyclical public deficits constraint. The following result is obtained:⁶

Proposition 2: The stationary state is locally asymptotically stable if and only if the public deficits constraint is countercyclical enough. That is to say if

$$\gamma_t(\cdot) < \Xi. \quad (14)$$

⁵ Assuming that the implicit function theorem applies.

⁶ Notice that since $\text{Det}(J^*) > 0$, the model can admit two complex eigenvalues, which may generate, for the relevant set of parameters, endogenous cycles. This issue will not be dealt with in this paper.

where $\gamma'(\cdot) < 0$, and

$$\Xi = \frac{[1 - c(1 - \rho)][(1 - c(1 - \rho))\bar{I} - 1]}{c\rho(W + (1 - \rho)\bar{I})}.$$

See proof in Appendix C.

Therefore, according to Proposition 2, an efficient stabilization policy is associated with a flexible countercyclical deficit constraint. These analytical findings can be illustrated with the following numerical example in which the investment function, the borrower's risk function, and budget deficit constraint are specified by

$$h(p_k - \hat{p}_t) = \text{Arc tan}\left[p_k - \hat{p}_t\right] + \frac{\pi}{2}$$

$$\Phi(I_t - \rho\Pi_t) = \text{Tanh}[I_t - \rho\Pi_t]$$

$$\gamma'(I_t) = -\sigma\text{Tanh}[I_t - \bar{I}].$$

This latter function becomes as follows for $\sigma = 0.15$ (see Figure 2). Wages are normalized to unity, $\hat{p}_t = h(0)/\rho(1 + i^*)$, and the other values of parameters are

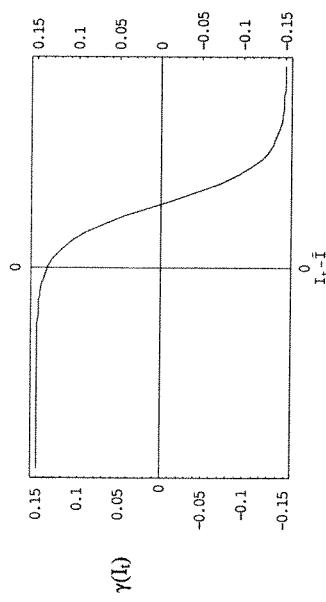
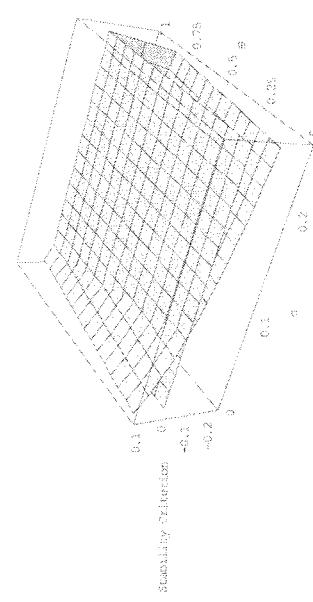
$$\{a, b, \alpha, \rho, \sigma, i^*\} = \{-0.25, 0.75, 0.15, 0.8, 0.8, 0.05\}.$$

Then, for $0 \leq \sigma \leq 0.25$ and $0 < \theta < 1$, Figures 3 and 4, illustrating Proposition 2, are obtained.

As we may recall, the economy is locally stable (unstable) when the criterion is negative (positive).⁷ Thus, it clearly appears that there exists a threshold value of σ , $\bar{\sigma}$. When $\sigma < \bar{\sigma}$, the economy is unstable and stable otherwise.

Our findings provide a rationale for an institutional design involving large deficits in periods of economic slump, leaving budget deficits cut off and possible surpluses to periods of sustained expansion. This result is in line with Minsky's argument on the role played by institutional

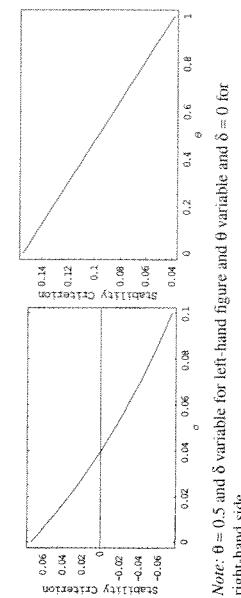
⁷ The criterion plotted here is $\text{Tr}(J^*) - 1 - \text{Det}(J^*) < 0$. It can be shown in these examples that the first condition $|\text{Det}(J^*)| < 1$ is always satisfied for the retained set of parameters.

Figure 2 Ratio of the public deficit to private spending**Figure 3** Stability criterion as a function of σ and θ 

scribing upper public debt and deficits limits. Accordingly, fiscal discipline is considered vital for ensuring macroeconomic stability and avoiding the risks of spillover. The classical principle underlying the Maastricht Treaty was that each member state might otherwise be inclined to spend and borrow too much, generating upward pressures on the Union-wide interest rates and downward pressures on the external value of the common currency. It was also understood that the loss of the exchange rate instrument at the national level should be accompanied by a greater role for automatic stabilizers to help economies adjust to asymmetric shocks and would make it "necessary to ensure that national budgetary policies support stability-oriented monetary policies" (European Commission, 1999, p. 113). This was the rationale underpinning the core commitment of the Stability and Growth Pact (SGP) procedure introduced in 1997, with the view of setting the "medium-term objective of budgetary positions close to balance or in surplus ... [and allowing] all Member States to deal with normal cyclical fluctuations while keeping the government deficit within the reference value of 3% of GDP gross domestic product" (*ibid.*, p. 113). As a result, member states have been implementing and regularly updating since 1999, national "stability programs," laying out a stability-oriented route to a balanced budget by, originally, 2004.⁹ The SGP was designed assuming that governments would accumulate surpluses in good times to ensure the smooth running

⁸ It also echoes recent debates and proposals on budget deficits rules in the Economic and Monetary Union (EMU).

Indeed, fiscal policies in EMU countries are constrained by the "excessive deficit procedure" of Article 104 of the Maastricht Treaty, pre-

Figure 4 Stability criterion as a function of σ and as a function of θ 

Note: $\theta = 0.5$ and δ variable for left-hand figure and θ variable and $\delta = 0$ for right-hand side.

⁹ As it was judged impossible to remedy the situation quickly in view of the poor growth prospects, the achievement of a balanced budget was suspended for three years—from 2003 to 2006—in several countries (Germany, Italy, Portugal, and France); if these countries reduced their budget deficits by 0.5 percent of GDP per year starting in 2003.

of automatic stabilizers in bad times. However, several countries—particularly the largest ones—did not reduce their deficits during the years of expansion. Indeed, the high-growth years (1999–2000) were not put to good use by France and Germany to significantly reduce their structural (cyclically adjusted) deficits, which reached 1.6 percent of GDP in 1999 and 1.4 percent in 2000 in France and, respectively, 0.6 percent and 0.9 percent in Germany. At the same time, in the United States, during the 1992–2000 expansion period, the federal budget balance moved from a serious deficit (5 percent of GDP) to a healthy surplus (1.7 percent of GDP) from a 4 percent deficit to a 1.3 percent surplus in cyclically adjusted terms) (INSEE, December 2001).

After the United States went into recession in the first half of 2001, the federal fiscal policy became extremely expansive. The federal budget deficit attained 1.5 percent of GDP in 2001 and 3.5 percent in 2003 (Congressional Budget Office March 2004 baseline projections). According to a recent study, from 2001 to 2003, the structural primary deficit variation—measuring the discretionary part of fiscal policies—reached 5.3 points of GDP in the United States.¹⁰ As a result of this contracyclical fiscal policy, the U.S. recession was surprisingly short and mild. According to the Bureau of Economic Analysis (BEA, 2005), real GDP increased by 1.6 percent in 2002 (compared to 0.8 percent in 2001) and reached 2.7 percent in 2003. In contrast, the euro-area fiscal policies constrained by the SGP were less expansive: from 2001 to 2003, the structural primary deficit variation was only equal to 0.8 percent of GDP.¹¹ Consequently, it is not surprising that euro-area growth fell from 3.5 percent in 2000 to 0.4 percent in 2003. According to the European Commission and the Organization for Economic Cooperation and Development (OECD), what fundamentally explains current difficulties of larger euro-area countries was their failure to reduce structural deficits during the years of high growth so as to protect themselves against a cyclical downturn. This is the reason why the 2003 Spring EcoFin Council endorsed the following new principles: the close-to-balance or in-surplus rule should apply not only within a medium-term horizon but in cyclically adjusted terms each year as well; countries that have yet to comply with this requirement will be committed to consolidate their fiscal position by at least 0.5 percent of GDP per year in cyclically adjusted terms; procyclical budgetary policies should be avoided, especially when growth conditions are favorable. Indeed, the adjustment of

the SGP does not resolve short-term problems of high deficit to GDP ratios in low-growth countries such as France and Germany, which will have to implement procyclical-restrictive-fiscal policies to meet these new requirements.

Concluding remarks

The aim of this paper was to propose a formalized version of Minsky's conception of institutional dynamics. The originality of our approach consisted in taking into account not only the financial aspects but also the institutional dimension of the financial instability hypothesis, because this issue has received scant treatment in recent formalizations. With this aim in view, we considered the role of the government, via its fiscal policy, and of the central bank, through its role as lender of last resort. The analysis of the dynamical properties of the model shows that the economy is unstable when the budget policy is not very sensitive to variations in private investment. In contrast, when the countercyclical deficit constraint is flexible enough, the economy is stabilized. The model could obviously be extended to take into consideration other important aspects of Minsky's writings, such as the existence of endogenous financial cycles or the ambivalence of institutional thwarting systems.¹² However, our main result, namely that an efficient stabilization policy requires the implementation of an institutional setup allowing large deficits in periods of recession, leaving balanced budgets and surplus policies to periods of sustained expansion, is fully consistent with the way Minsky considered that public authorities should "stabilize an unstable economy."

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¹² The effect of an institutional structure is not immutable: its capacity to stabilize the amplitude of economic fluctuations and to constrain market agents to undertake only moderately risky actions varies greatly over time. This means that some institutional interventions and mechanisms that were initially stabilizing may turn into factors of instability and inefficiency. On this point, see, for instance, Nasica (1999).

¹⁰ OFCE, October 2003, p. 3.
¹¹ OFCE, October 2003, p. 3.

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Appendix A: A complement on the borrower's risk

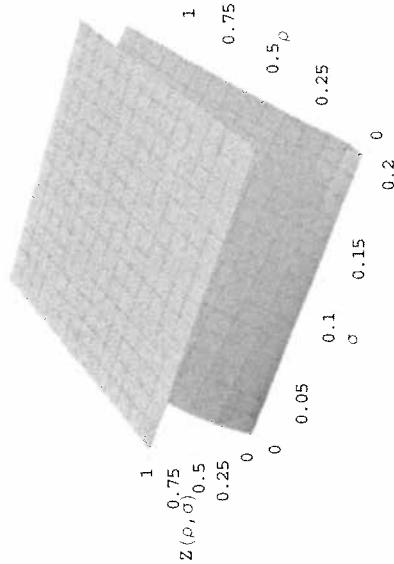
The first derivative of retained profits with respect to investment is given by the following expression:

$$Z = \frac{\rho(1 - c + c\rho + (1 + 2c(\rho - 1))\gamma[L_t]) + c(\rho - 1)\gamma[L_t]^2 + (I_t + c\rho_W)\gamma[L_t]}{(1 + c(\rho - 1) + c(\rho - 1)\gamma[L_t])}.$$

In Figure A1, this derivative evaluated in a neighborhood of the stationary state is plotted as a function $Z(\rho, \sigma)$ for the different relevant values of the rate of retention of profits ρ and of the degree of flexibility of the countercyclical public deficits constraint, σ .

It clearly appears in Figure A1 that in a neighborhood of the stationary state, the first derivative of retained profits with respect to investment $Z(\rho, \sigma)$, is smaller than unity. In this perspective, the financial gap $I - \rho\Pi$ is procyclical and, in accordance with Minsky's financial instability hypothesis, the borrower's risk will increase during an investment boom.

Figure A1 First derivative of retained profits with respect to investment



Appendix B: Proof of proposition 1

First, for $\bar{\Pi}^e \neq 0$ and $\bar{\Pi} \neq 0$, relation (11) evaluated at a stationary state directly implies

$$\bar{\Pi}^e = \bar{\Pi}.$$

Substituting this result into Equation (13), evaluated at a stationary state, gives $\bar{x} = 0$.

Second, using the fact that at the stationary state $\bar{p} = 0$, we have $\bar{I} = I^*$. In addition, since $\bar{p}_k = \hat{p}_I$, at a stationary state, we obtain

$$\bar{\Pi} = (1 + i^*) \hat{p}_I.$$

Finally, noticing that $\bar{p}_k = \hat{p}_I$ means that $\bar{I} = h(0)$, while $\bar{p} = 0$ means that $\bar{I} = \rho \bar{\Pi}$. Thus, condition $h(0) = \rho(1 + i^*) \hat{p}_I$ is required for consistency reasons.

Appendix C: Proof of proposition 2

The modulus of the two eigenvalues of the 2×2 Jacobian matrix J^* of the dynamical system, evaluated at the stationary state, lies inside the unit circle if and only if

$$|Det(J^*)| < 1 \quad (C1)$$

$$|Tr(J^*)| - 1 - Det(J^*) < 0. \quad (C2)$$

The elements of J^* evaluated at the stationary state are the following:

$$J_{11}^* = \frac{1 - \alpha}{1 - \frac{\alpha(1 + i^*)h'(0)\Gamma}{(1 + i^*)^2 + b\bar{\Pi}(1 - \rho)\Gamma}\Phi'(0)} \quad (C3)$$

$$J_{12}^* = \frac{-\alpha\bar{\Pi}h'(0)\Gamma}{(1 + i^*)^2 - h'(0)(\alpha(1 + i^*)\Gamma + b(1 - \rho)\Gamma)\Phi'(0)} \quad (C4)$$

with $a < 0$, $b > 0$, $\Phi'(0) > 0$, one can verify that¹³

¹³ Condition $\gamma'(.) > (c(1 - \rho) - 1)/c\rho(W + (1 - \rho)\bar{\Pi})$ is not restrictive because it simply implies that the ratio of the public deficit to private spending is bounded from above. In addition, we have $1/\rho > 1$. Indeed, specifying the investment function as in the numerical example below by $h(p_I - p) = Arc\tan(p_I - p) + \pi/2$, we obtain, at the stationary state, $h'(0) = 1$. Then, with $0 < \alpha < 1$, we have $(1 + i^*)\gamma'(c\bar{\Pi}'(0)) > 1$.

$$J_{22}^* = \theta + (1 - \theta)\Gamma \left(\frac{I'_{n_{t+1}}^* - J_{12}^* + r_{x_t}^*}{I'_{n_t^*}^*} \right),$$

where

$$I'_{n_{t+1}} = \frac{h'(0)}{(1 + i^*) \left(1 + \frac{b\bar{\Pi}h'(0)(1 - \rho)\Gamma\Phi'(0)}{(1 + i^*)^2} \right)},$$

$$I'_{n_t^*} = \frac{-a\bar{\Pi}h'(0)}{(1 + i^*) \left(1 + \frac{b\bar{\Pi}h'(0)(1 - \rho)\Gamma\Phi'(0)}{(1 + i^*)^2} \right)},$$

and where

$$\Gamma = \Pi'_I = \frac{1 - c(1 - \rho) + \gamma'(.) (W_{CP} + c(1 - \rho)\rho\bar{\Pi})}{(1 - c(1 - \rho))^2}.$$

Thus, we have

$$Det(J^*) = J_{11}^* \left(\theta + (1 - \theta)\Gamma_{x_t}^* \right) + (1 - \theta)J_{12}^* \quad (C3)$$

$$Tr(J^*) = J_{11}^* + \theta + (1 - \theta)\Gamma \left(I'_{n_{t+1}}^* - J_{12}^* + I'_{x_t}^* \right). \quad (C4)$$

Assuming that $\Gamma > 0$, necessitating that

$$\gamma'(.) > \frac{c(1 - \rho) - 1}{c\rho(W + (1 - \rho)\bar{\Pi})},$$

$$0 < \Gamma < \text{Min} \left\{ \frac{1}{\rho}, \frac{1+i^*}{ah(0)} \right\} \Leftrightarrow \left\{ I'_{n_{+1}} > 0, J'_{1_1} > 0, J'_{1_2} > 0 \right\}. \quad (\text{C5})$$

Consequently, it is obvious, since $0 < \theta < 1$, that condition (C5) implies

$$\text{Det}(J^*) > 0 \text{ and } \text{Tr}(J^*) > 0.$$

Hence, the stability criterion is written

$$\text{Det}(J^*) < 1 \quad (\text{C6})$$

$$\text{Tr}(J^*) - 1 - \text{Det}(J^*) < 0. \quad (\text{C7})$$

Substituting the values of J^*_{11} , J^*_{12} , $I'_{n_{e+1}}$ and of I'_{n_1} into Equations (20) and (21), we obtain the respective values of the determinant and of the trace at the stationary state:

$$\begin{aligned} \text{Det}(J^*) = \\ \frac{(1+i^*)^2(1-\alpha)\theta + \bar{h}'(0)(\alpha(\theta-1)\Gamma + b(1-\alpha)\theta(1-\rho\Gamma)\Phi'(0))}{(1+i^*)^2 - h'(0)(\alpha(1+i^*)\Gamma - b\bar{h}(1-\rho\Gamma)\Phi'(0))} \end{aligned}$$

$$\begin{aligned} \text{Tr}(J^*) = \\ \frac{(1+i^*)^2(\alpha-1-\theta) + h'(0)\left[\Gamma(a\theta(1+i^*) + a(1-\theta)\bar{h}) + b(\alpha-1-\theta)\bar{h}(1-\rho\Gamma)\Phi'(0)\right]}{(1+i^*)^2 - h'(0)(\alpha(1+i^*)\Gamma - b\bar{h}(1-\rho\Gamma)\Phi'(0))} \end{aligned}$$

and the two stability conditions become

$$\frac{(1+i^*)^2(1-\alpha)\theta + \bar{h}'(0)(\alpha(\theta-1)\Gamma + b(1-\alpha)\theta(1-\rho\Gamma)\Phi'(0))}{(1+i^*)^2 - h'(0)(\alpha(1+i^*)\Gamma - b\bar{h}(1-\rho\Gamma)\Phi'(0))} < 1 \quad (\text{C8})$$

$$\frac{\alpha(\theta-1)\left[(1+i^*)^2 - h'(0)((1+i^*)\Gamma - b\bar{h}(1-\rho\Gamma)\Phi'(0))\right]}{(1+i^*)^2 - h'(0)(\alpha(1+i^*)\Gamma - b\bar{h}(1-\rho\Gamma)\Phi'(0))} < 0. \quad (\text{C9})$$

Recalling we have assumed above that

$$0 < \Gamma < \text{Min} \left\{ \frac{1}{\rho}, \frac{1+i^*}{ah(0)} \right\},$$

the denominator in the two conditions, is positive. Thus, Equations (C8) and (C9) are equivalent to

$$\begin{aligned} (1+i^*)^2((1-\alpha)\theta - 1) - h'(0)b\bar{h}\Phi'(0) \\ < -h'(0)[\alpha(1+i^*) + a(\theta-1) + b\bar{h}\rho\Phi'(0)(1-(1-\alpha)\theta)] \end{aligned} \quad (\text{C10})$$

$$\alpha(\theta-1)\left[(1+i^*)^2 + h'(0)b\bar{h}\Phi'(0) - h'(0)(1+i^* + b\bar{h}\Phi'(0))\Gamma\right] < 0. \quad (\text{C11})$$

The first condition can be rewritten:

$$0 < \Gamma < \Gamma_1, \quad (\text{C10})$$

with

$$\Gamma_1 = -\frac{(1+i^*)^2((1-\alpha)\theta - 1) - h'(0)b\bar{h}\Phi'(0)}{h'(0)[\alpha(1+i^*) + a(\theta-1) + b\bar{h}\rho\Phi'(0)(1-(1-\alpha)\theta)]}. \quad (\text{C11})$$

The second condition can be rewritten:

$$0 < \Gamma < \Gamma_2, \quad (\text{C11})$$

with

$$\Gamma_2 = \frac{(1+i^*)^2 + h'(0)b\bar{h}\Phi'(0)}{h'(0)(1+i^* + b\bar{h}\Phi'(0))}.$$

Consequently, Γ meets conditions (C10) and (C11) if and only if

$$0 < \Gamma < \text{Min}\{\Gamma_1, \Gamma_2\}. \quad (\text{C12})$$

Therefore, one can infer there exists a positive threshold value of Γ ,

$$\hat{\Gamma} = \text{Min}\left\{\frac{1}{\rho}, \frac{1+i^*}{ah'(0)}, \Gamma_1, \Gamma_2\right\},$$

such that J^* has two stable roots, if and only if

$$0 < \Gamma < \bar{\Gamma}$$

Accordingly, recalling that

$$\Gamma = \frac{1 - c(1-\rho) + \gamma'_i(\cdot)(Wc\rho + c(1-\rho)\rho\bar{\Pi})}{(1 - c(1-\rho))^2},$$

condition (C13) finally becomes

$$\gamma'(\cdot) < \Xi,$$

where

$$\Xi = \frac{[1 - c(1-\rho)][(1 - c(1-\rho))\bar{\Gamma} - 1]}{c\rho[W - (1-\rho)\bar{\Pi}]}$$

Which completes the proof of Proposition 2.

2. Intermédiation financière et innovation

2.1. Innovations bancaires et financement de l'innovation (1)

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12 Financing economic activity

Schumpeter vs Keynes

Eric Nasica

Introduction

In this chapter we compare Schumpeter's and Keynes's views on the financing of economic activity. As will be seen, in section one, both economists share common ideas about the working and financing of market economies. In particular, both Keynes and Schumpeter reject the classical notions of the neutrality of money and the dichotomy of the real and the monetary sector, emphasising instead the role of monetary and financial variables in their respective explanations of economic fluctuations. However, the two approaches also display significant differences, most notably with regard to the importance attributed to specific financial variables and institutions for the financing of economic activity. Section two examines these differences and emphasises the originality of Schumpeter's analysis of banking.

The rejection of classical monetary theory

When comparing Schumpeter's and Keynes's monetary analyses, one can hardly miss the considerable degree of similarity between the two approaches: not only does the inclusion of money into their respective analytical frameworks produce similar insights in both cases, it is also at the root of a radical revision of the features of the economic system they examine.

In the preparatory drafts of the General Theory (GT) (Keynes 1973a, 1973b, 1979), Keynes makes a distinction between a 'co-operative' (or real-wage) economy and an 'entrepreneurial' (or money-wage) economy.¹ Schumpeter, too, draws a clear distinction between two situations: the circular flow and economic development.

Keynes's co-operative economy and Schumpeter's circular flow have two key features in common. First, even if money exists in these specific states, as with classical theory, it is simply regarded as a technical device for facilitating real exchange and is neutral with regard to the level of production. As Schumpeter points out, 'money has, in the circular flow, no other role than that of facilitating the circulation of commodities' (Schumpeter 1912 [1934]: 53). Second, the co-operative economy and the circular flow both describe what might be

called a 'static' economy. In the Schumpeterian circular flow, there are neither entrepreneurs nor capitalists, credit or interest: all factors potentially influencing the process of economic development are excluded from the analysis. In Keynes's co-operative economy decisions about production and distribution are made jointly by all producers in such a way as to maximise utility and consumption for all individuals and, at the same time, for society at large (Keynes 1979: 66, 77). In this economy, income is paid in kind or out of the output produced by the workforce, and Say's law necessarily holds true.

In both approaches, the departure from the static economy is made possible by introducing a more complex concept of money. In Keynes's analysis, this new type of money is a store of value; in Schumpeter's theory, it takes the form of credit. With this change in the nature of money, the economy becomes dynamic in that disequilibria (or underemployment equilibria) and fluctuations of economic activity are now possible.

In Keynes's approach, macroeconomic instability and disequilibria are a consequence of new patterns of behaviour characteristic of the entrepreneurial economy, such as the long-run demand for liquidity. These types of behaviour are a feature of the money-wage economy operating in an uncertain decision-making environment, in which Keynes was mainly interested. The mere existence of money as a store of value is likely to drive the economy towards a long-period of equilibrium characterised by lasting unemployment. Indeed, the decision not to purchase goods (that is, to adopt an attitude of saving and waiting) does not

necessitate a decision to have dinner or to buy a pair of boots a week hence or to consume at any specified date ... It is not a substitution of future consumption demand for current consumption demand – it is a net diminution of such demand.

(Keynes 1936: 218)

In Schumpeter's approach, the dynamic aspects of economic activity, such as innovation and development, are closely linked to the creation of money in the form of credit. Schumpeter regards credit creation by banks as the main source of finance, once the stationary economy of the circular flow is left behind and the analysis focuses on the process of economic development. More specifically, the meaning of credit, in this context, is that of 'new means of payment created ad hoc since the entrepreneurs have no means of their own and since there are – so far – no savings' (Schumpeter 1939: 111). These means of payment required by entrepreneurs in order to finance their innovations do not only include money as such. Schumpeter (1917/1918 [1956]: 168–71) provides a full list of such means of payments that includes 'commodities which in fact circulate as money', 'money made of a material the market price of which is less than the purchasing power of the monetary unit made of it', 'bank notes' but also 'current accounts and clearing accounts', 'the amount of all payments which are disbursements out of income and are handled exclusively by compensation' and,

finally, 'credit instruments and claim titles of all kinds, to the extent that they in fact perform the role of money'.

Money is therefore no longer a mere means of facilitating the circulation of commodities as in the circular flow: 'Not only a part but the whole of the exchange process can be settled by ... credit media' (Schumpeter 1912 [1934]: 53). This also implies Schumpeter's definition of the entrepreneur as the 'typical debtor' (*ibid.*: 101, 103). At first sight, this specific feature of the Schumpeterian entrepreneur, together with the fact that Schumpeter considers the diversion of finance from routine to innovative activities to be the main role of credit, suggests a certain affinity between his analysis and the writings of the Banking School.² However, on closer examination this interpretation ceases to be convincing. Not only does Schumpeter accept the idea of a possible autonomous effect of the quantity of money on the general price level (Schumpeter 1939: 546–7), suggesting that he would welcome a synthesis of the Banking and the Currency Schools, he has also made it clear himself in unambiguous terms that he does not regard his approach to be in complete accord with that embraced by the Banking School (Schumpeter 1917/1918 [1956]: 209).

However, it would also be quite difficult to include Schumpeter among quantity theorists, given his explicit and persistent rejection of the quantity theory of money (Schumpeter 1954: 1095–117). A detailed analysis of Schumpeter's main objections to the quantity theory of money has been provided by Graziani (1989) and Messori (1985, 1986), to which we refer the interested reader. In the present context it suffices to note a few main points. First, Schumpeter rejects any a priori concept of the quantity of money as a causal influence on prices.³ Second, he argues that, because of the existence of substitutes, and of credit and reserves in particular, a precise definition of the quantity of money is quite impossible.⁴ Third, it is equally impossible to provide a homogenous concept of the quantity of money or a unique notion of the velocity of circulation.⁵ Furthermore, money, not being a commodity, has no proper value (Schumpeter 1970 [1990]) and 'the traditional apparatus of supply and demand [cannot] be applied to the solution of the problem of money prices of commodities and of price levels' (Schumpeter 1939: 547). Schumpeter emphasizes that the 'reflected value' of money is rarely proportionate to the quantity of money because variations in the latter often imply variations in relative prices and redistribution effects.⁶ Finally, credit money supplied by banks depends crucially on entrepreneurial demand: without the entrepreneur there is no credit creation, and the effective volume of credit supplied changes according to shifts in demand.

Schumpeter also mentions the possibility of a twofold origin of finance. If the demand of enterprises for means of payment is not fully met, entrepreneurs may take recourse to accumulated non-banking savings, either through self-financing (by using profits accumulated in an earlier phase of economic development) or through the money market (Schumpeter 1912 [1934]: 199).

In essence then, Schumpeter regards the money supply not as an independent variable, but as one that varies endogenously in response to entrepreneurial action. While it remains true that, just as with the quantity

theory of money, the direction of causality runs from bank money to prices, changes in the former originate in entrepreneurial demand for credit required to finance innovations. Moreover, in the upswing, inflation (through changes in relative prices) also plays a part in changing the distribution of productive resources and of income: the Schumpeterian inflationary process results in a transfer of productive resources and a squeeze of the purchasing power of 'mature' producers.⁸

Schumpeter's analysis thus implies a drastic break with the quantity theory of money. In contrast to traditional monetary theory, he strongly emphasises that there is no dichotomy between real and monetary analysis and no neutrality of the money supply in the long run. In Schumpeter's own words,

[i]t cannot be argued that the effect is temporary and as such negligible. ... A monetary process, the creation of money which is only a 'claim ticket' and not also a 'receipt voucher', and the rise in prices to which it leads, become a powerful lever of economic development. ... It is the specifically capitalistic method of effecting economic progress.

(Schumpeter 1917/1918 [1956]: 205–6)

Keynes's analysis of banking, developed both prior to and following the publication of the *GT*, is similar to Schumpeter's in several respects. In *Treatise on Money* (TM), Keynes maintained that money takes the form of credit money, and he shared the idea that bank money – that is, deposits – is created in the form of loans and is not first collected from already existing deposits. In the introductory pages to the TM, he stresses over and over again that banking consists in the creation, and not the transfer, of liquidity (Keynes 1930: 25). Moreover, Keynes argues on several occasions that the money supply is not exogenously fixed (e.g. *ibid.*: 189). In Book 4 of the TM, he specifies the reasons why, in his view, the supply of bank money should be regarded as endogenous, emphasising, in particular, that an increase in the volume of global output requires substantial changes in the monetary sphere, that is, it 'requires the acquiescence of the banking authorities' (*ibid.*: 256). This thought is forcefully taken up again in his analysis of the credit cycle, which he concluded thus:

In countries (such as most of the continent of Europe) where the volume of money partly depends on the volume of suitable bills available to be discounted at the central bank, an increase in the volume of output has a direct tendency to produce some corresponding increase in the volume of circulating money.

(*ibid.*: 275 fn.)

The same ideas are developed in a series of articles published between 1937 and 1939 (Keynes 1937a, 1937b, 1938, 1939) when Keynes was defending his theory of the determination of income against criticisms by Ohlin and Robertson.⁷ In these articles, he insists both on the central role of banks in the financing of economic activity and on the endogenous nature of bank money:

'The finance of enterprises ... is mainly supplied by specialists, in particular by the banks' (Keynes 1937b: 219).

Immediately following this debate, Keynes slightly modified his position to the effect that, like Schumpeter, he highlighted the possibility of a twofold origin of finance and argued that the demand for finance could be met in either of two ways: (a) through banks creating new liquidity, or (b) through financial intermediaries bringing about an increase in the rate of interest and succeeding in making already existing liquidity available to enterprises.⁸

To sum up, in this first section, we have pointed to a number of important similarities in Keynes's and Schumpeter's analyses. In particular, it has been argued that both authors reject the dichotomy between a real and a monetary sector. They also agree that credit money created by banks plays a crucial role in the financing of economic activity. However, as asserted by Schumpeter himself, '[t]he reader should be on his guard against ... surface similarities' (Schumpeter 1939: 127 fn. 2) between Keynes's theory and his own. Paying heed to this warning, the next section focuses on other aspects of the relation between finance and production.

Interest rates, banking and economic activity

The argument outlined in this section is concerned with Keynes's and Schumpeter's analyses of the role played by specific financial tools and institutions in financing economic activity. As we shall see, it is here where the two authors differ considerably.

Short-term and long-term rates of interest

Keynes and Schumpeter coincide in their treatment of the rate of interest as a monetary phenomenon. In Chapter 17 of the *GT*, the liquidity preference theory – starting that the marginal efficiency of money is the premium to be paid for parting with money – effectively ensures that the rate of interest is determined in the money market; in Keynes's analysis the rate of interest is the price of liquidity.

The same monetary explanation of the rate of interest is also present in the approach of Schumpeter. He argues that 'interest attaches to money and not to goods' (Schumpeter 1912 [1934]: 158). Indeed, Schumpeter points out that if money [was] only an intermediate link, merely of technical importance, and [we] set about substituting for it the goods which are obtained with it and for which therefore in the last analysis interest is paid, we at once lose the ground from under our feet. ... [I]t is impossible to pierce the money veil in order to get to the premiums on concrete goods. If one penetrates through it one penetrates into a void.

(*ibid.*: 184)

In short, 'the money form [of interest] is not shell but kernel' (*ibid.*). Even so, the reason why, according to Schumpeter, the rate of interest is not a real but a monetary phenomenon differs from the explanation provided by Keynes. For Schumpeter, the monetary nature of interest derives from the fact that the rate of interest is a portion of, a 'tax', on monetary profits. However, the main difference between Keynes's and Schumpeter's perception of the rate of interest lies elsewhere. To see this, a broader comparison between Schumpeter's work and Keynes's analysis in the GT is called for.

To begin with, recall the main assumptions and conclusions of the GT regarding the status of money, financial markets and interest rates. As seen previously, money is essentially thought of as a store of value. While this interpretation is necessary to refute Say's law and to demonstrate the possibility of permanent unemployment, it also has further consequences for the analysis. In the first place, the concept of money as a pure financial asset – as 'fund-money' (Arena 1982: 434) – tends to be overemphasised at the expense of the role of 'circulatory' money (Arena 1985). Consequently, money as a store of value tends to overlook, even though not necessarily to exclude, what Robertson (1966: 161) called the forgotten but simple truth that people often acquire money not in order to hold it but in order to use it. Moreover, in the GT Keynes assumes an exogenous money supply.⁹ Remarks such as 'the quantity of money as determined by the action of the central bank' (Keynes 1936: 247) or 'the quantity of money created by the monetary authority' (*ibid.* 205, see also *ibid.*: 84, 167, 174, 230, 267) can be found throughout the text. This was explicitly noted by Schumpeter, who argues that, in the GT, Keynes assumes that 'the quantity of means of payment [is] externally given, i.e. [is] freely malleable by governments and central banks' (Schumpeter 1954: 1176), whereas, in his earlier writings dating from the 1920s, 'he actually only accepted the equation of exchange' (*ibid.*: 1102), that is, 'a formal relation [between the money supply, its velocity, the price level and the volume of transactions] without any causal connotation' (*ibid.*: 1096).

Another central feature of the GT is that financial markets receive star billing. Keynes gives two reasons for this. First, in chapters 13 through to 15 he argues that the cost of borrowed funds is an important determinant of investment. Second, in chapters 12 and 22 we find the argument that financial markets will inevitably be affected by waves of shareholder optimism or pessimism which will influence entrepreneurs' calculations of the marginal efficiency of capital and may, ultimately, even dictate their investment strategy.

Furthermore, as will be seen below, Keynes's analysis of the determination of short- and long-term rates of interest and their effect on investment decisions differs drastically from Schumpeter's. Even before 1936, Keynes was already convinced that the short-term rate of interest was of little significance as a determinant of investment. Thus, in his correspondence with Hawtrey in 1935, Keynes pointed to the minor importance of short-term interest charges as a share of total cost, arguing that therefore they were a matter of little concern for decision-making in business. Even though the argument put forward is different, he confirmed this point of view in the GT:

The short-term rate of interest is easily controlled by the monetary authority, both because it is not difficult to produce a conviction that its policy will not greatly change in the very near future, and also because the possible loss is small compared with the running yield (unless it is approaching vanishing point). (Keynes 1936: 202–3)

Therefore, what matters is the long-term rate of interest, which is not always easily controlled by the monetary authorities. The most obvious and sudden variations in the long-term rate are not caused by changes in the money supply, but are instead linked to changes in the liquidity preference function. Schumpeter's approach contrasts strongly with this view of the workings of financial markets. Above all, Schumpeter is not at all convinced that financial markets have a decisive role to play in the provision of credit for economic activity. His view is based on two main arguments. First, Schumpeter perceives of the 'money market' as the interaction of two distinct spheres: the 'sphere of hoards and reserves' and the 'sphere of capital' or 'income yielding assets' (Schumpeter 1917/1918 [1956]: 176), where the latter includes the stock market. However, this distinction is of secondary importance to Schumpeter who holds that both markets are essentially interdependent.¹⁰ He argues, in particular, that the workings of financial markets are subordinate to those of 'the sphere of hoards and reserves' and, therefore, to the choices of the banking system. In Schumpeter's view, the usual dichotomy between short-term loans and long-term assets is, hence, inadequate. Instead, he maintains that capitalist development inherently tends to create the conditions for a 'perfect negotiability of all instruments of credit, whatever their legal form may be' (Schumpeter 1939: 613). Therefore, bonds and shares differ from short-term instruments only 'technically and by degree' (*ibid.*: 614) because financial speculation implies a withdrawal of existing balances or relies on credit creation. Credit and finance, banks and financial markets, and hence short- and long-term rates of interest, are intrinsically linked to one another, with long rates really representing a 'trend value' of short rates.

In this framework, the role of long-term rates is hugely more important than that of short-term rates, the main reason being that entrepreneurs' real profits do not so much depend on the rate of interest paid on bonds but on interest paid to the banking system. In Schumpeter's view, income is divided into wages, bank interest and profits. Thus, interest payments made to banks involve a transfer of real wealth from the industrial to the financial sector. Whenever interest is paid to banks, real output is divided into real wages, industrial profits and financial profits. As Graziani (1989: 27) points out, 'a financial capital is thus gradually built up by banks, along with an industrial capital built up by firms'. This reinforces an essential point made by Schumpeter, to wit, the fact that interest paid to the banking system is a 'tax' on profits and consequently a brake on development. Finally, in the Schumpeterian framework, banks are the

main financial institutions, which is why they are at the centre of much of Schumpeter's focus and interest.

The role of banks

While Schumpeter was writing his 1910 article 'On the nature of economic crises', followed in 1912 by his *Theory of Economic Development*, Keynes was preoccupied with the unsatisfactory state of monetary theory in Britain, which, in his judgement, was reduced to a 'matter of oral tradition' (Keynes 1983: 375). Anglo-Saxon thought on the theory of bank credit had indeed fallen somewhat behind developments in continental Europe. The view of banks as creators of money, inherited from MacLeod (1855), had lost ground in academic circles, though retaining some popularity in banking circles.¹¹ MacLeod's theory of bank credit had been violently attacked by Cannan, who had instead proposed his famous 'cloak-room theory of banking activity' (Cannan 1921), which held that no single bank, nor the banking system as a whole, could ever lend more money than the deposits it had collected. Cannan's view, according to which banks collect savings and then use them in order to finance investment, had become the official doctrine which Keynes had to confront, and would ultimately discard, in his *Treatise*.

Not surprisingly, then, Keynes's main goal in the TM is to show that credit granted by banks is not limited by savings, or deposits, already in existence (that is, banks can 'create' deposits). Nonetheless, Keynes still felt it necessary to specify the constraints under which banks operate and which they have to respect. It is for this reason that he brings to our attention several cases.¹² First, there is the case of 'pure credit' granted by a single bank: the creation of deposits by the bank determines the means of payment deposited with the banking system, not vice versa. Moreover, the single bank experiences no limits to this creation of deposits. Second, in the case where there are several banks, the creation of finance by banks is governed by the average behaviour of the banking system. Finally, in a 'mixed-money' system, banks as a whole are constrained by reserve requirements which depend on the monetary policy of the issuing bank.

One problem with this approach is that it fails to specify the analytical determinants of banks' behaviour and of the setting of interest rates. In the theoretical part of the TM, Keynes appears to reduce banks' behaviour to the monetary policy pursued by the issuing bank.¹³ Variations in the bank interest rate are governed by changes either in legal reserves or in the discount rate.¹⁴ In so doing, Keynes makes the interest rate – and, thus, the determinants of banks' behaviour – exogenous.

Schumpeter's approach is free of such inadequacies. Like Keynes, he shows that banks are bound by norms of, and limits to, credit supply. Twenty years before the publication of the TM, Schumpeter concludes that these limits are determined by the average behaviour of banks as a whole. However, contrary to Keynes, he downplays the role of the issuing bank, assuming instead that

we have a banking system grouped around a central issuing bank, but that there are no other legal barriers and rules for the gestation of banking business ... This represents the leading case the treatment of which is easily applicable to other cases.

(Schumpeter 1912 [1934]: 112–13)

Other than in the TM, on this assumption it is impossible to resort to reserve requirements as the main determinant of the credit supply.

Consequently, Schumpeter needs to specify the endogenous determinants of the credit supply curve and of the interest rate. His starting point is a closer examination of each bank's supply behaviour. According to Schumpeter, each bank is faced with the risk of financial loss since it can only succeed in meeting financial requests if its customers settle their debts. In order to monitor this risk, each bank has to evaluate the economic projects or activities to be financed against the limits to supply set by the average behaviour of banks as a whole. Risk management, then, implies that there are two determinants of bank behaviour in Schumpeter's framework: the quality and the total amount of commitments. Each bank faces two types of risk: the total risk of bankruptcy related to the financing of innovative as opposed to imitative activities, and the relative risk of bankruptcy for those banks adopting a more accommodating credit policy than the average bank.¹⁵

Schumpeter is thus in a position to define the rules required for securing banking activity. The crucial point is 'neither the formal character of the business to be transacted ... nor the security that makes sound banking, but knowledge and understanding of, and proper attention to, the purpose which the balances applied for are to serve' (Schumpeter 1939: 641). According to Schumpeter, these rules consist of 'judging the chances of success of each purpose and, as a means to this end, the kind of man the borrower is, watching him as he proceeds' (*ibid.*). This, then, is the basis on which banks determine the amount and the composition of a loan as well as the rate of interest at which it is granted. Hence, the supply of credit presupposes an entrepreneurial demand for balances. The credit requested will be granted if the bank thinks it proper to meet this demand at terms compatible with the potential debtor's economic targets which are, in turn, a function of the latter's profit expectations.

We can thus conclude that the Schumpeterian credit market is characterised by a negative relationship between the demand for credit and the interest rate, on the one hand, and by a positive relationship between the supply of credit and the interest rate, on the other. The shape of the credit demand curve is determined by the fact that the rate of interest is a 'tax' on profits. The relationship between the rate of interest and the credit supply is positive because of the greater risk accepted by banks, who extend their credit facilities to those potential entrepreneurs who have been out-selected at lower levels of the rate of interest, and because of the likely depreciation of capital through inflation. The equilibrium level of the interest rate is established on the basis of these two

curves (Schumpeter 1912 [1934]: 191–8). That is, the interest rate fixed by each bank must be equal to the rate of risk assigned to the ‘marginal’ debtor (*ibid.*: 195–6). Likewise, at the aggregate level, the equilibrium level of interest must equalise the profit rate expected by the ‘marginal’ entrepreneur or imitator whose demand for finance has been met with the rate of interest at which the ‘marginal’ bank has actually granted the last credit.¹⁶

However, as we shall see, the complexity of the Schumpeterian analysis makes it somewhat difficult to pin down the determinants of credit supply, credit demand and the interest rate with more precision. Schumpeter’s own view on the matter is aptly summarised in the following passage:

[T]here is always, no matter how great the amount of credit in circulation, some demand for credit which remains unsatisfied even though it is able to pay the current rate of interest. The productive demand for any commodity, e.g. wool, is limited, at constant quantity of money, by the falling probability of processing continually increasing quantities; by contrast, demand for credit is self-propagating, in that the consequences of its expansion and increasing satisfaction go on creating the economic conditions for even more credit demand. The more bank money is issued, the more credit is necessary for the purchase of one and the same quantity of means of production, and the more, also, can economically be invested in their acquisition.

... The demand for credit makes possible not only itself, but also a corresponding supply; and every supply makes possible a corresponding demand, so that supply and demand, in this case do not confront each other as independent forces. To this extent, therefore, the banks determine not only to whom they will grant credit but also how much credit as a whole they wish to grant and what demand to call forth.

(Schumpeter 1917/1918 [1956]: 207)

On the one hand, the above passage contains important hints about the roles played respectively by entrepreneurs and bankers in the process of determining the volume of credit.¹⁷ It demonstrates that the volume of credit is a function of the interaction between both agents. Firms take the initiative, but banks have the power to select from among these initiatives, based on their expectations as to the likelihood of borrowed funds being repaid: ‘We know already by what forces this supply is regulated: firstly, with regard to possible failures by entrepreneurs and, secondly, with regard to the possible depreciation of the credit means of payment’ (*ibid.*: 195).

On the other hand, however, this passage also highlights the limitations of Schumpeter’s analysis of the workings of the money market. In the first place, even when examining the ways in which the credit market operates from within his own framework, Schumpeter fails to offer exact conclusions, the main reason being that credit supply and credit demand are mutually interdependent. Schumpeter’s reasoning suggests that the higher the demand for credit, the

more important its supply. However, an increase in credit will be inflationary, consequently raising the entrepreneurs’ demand for the quantity of credit money required to finance the same quantity of means of production, implying an increase in the demand for credit. Therefore, an ‘uncertain value’ adheres to the concepts of credit demand and supply due to the permanent instability involved. In other words, equilibrium levels of credit and of the interest rate cannot be accurately determined. In the second place, Schumpeter’s description of the money market is not very useful for an analysis of the process of credit creation. Cyclical shifts of the demand for finance affect not only actual but also potential credit levels (i.e. the maximum credit banks can create in a given institutional context). Moreover, even in a monetary system where banking operations are apparently constrained by reserve requirements, credit demand does not meet with any technical supply limits. As pointed out in the above passage, the reason is credit rationing (that is, the fact that the credit volume actually supplied by banks is always lower than the potential volume so that the former is in elastic supply).¹⁸ Furthermore, economic development will push potential credit in the same direction (for instance, banks are likely to reduce their reserve ratio and the cash-deposit ratio falls in periods of prosperity).¹⁹ In brief, in this model, actual credit supply shifts with demand and does not face a definite ‘ceiling’ of potential credit because the latter moves procyclically.

It follows that, in the Schumpeterian model, even though banks obviously perform an important task in the accumulation process because ‘purchasing power is the vehicle of an essential process’ (Schumpeter 1912 [1934]: 97), and because without credit there will be no innovations and no cycles, banks do not determine economic fluctuations. On the one hand, at the onset of an upswing interest is zero and cannot be reduced any further. On the other hand, when active innovation is going on, a lowering of the interest rate is of little analytical relevance because of the shifts in entrepreneurial demand (Schumpeter 1939: 634–8). In Schumpeter’s words, this means that ‘the analytical schema presented in this book evidently does not belong to the family of monetary theories of business cycles’ (*ibid.*: 142). The actual upper ceiling of the upswing is not set by credit supply, which expands in prosperity. Rather, limits to credit supply are set by the prospect of the success of innovations since interest depends on profits, and the risk taken is not the entrepreneur’s but the capitalist’s (the banker’s) (Schumpeter 1912 [1934]: 75–6, 1939: 104).

Schumpeterian bankers then appear to be both Stiglitz’s and Weiss’s ‘social accountants’, replacing the auction market ruled by the law of supply and demand, and the ‘ephors’ of market economies who assess innovative projects, but do not ‘think them up’.^{20,21}

Concluding remarks

By taking account of the relationship between finance and economic activity, both Keynes and Schumpeter are able to develop a true analysis of economic instability which assigns a central role to financial factors. However, the nature

of economic instability clearly differs between the two authors. To use a distinction suggested by Vercelli (1985), one could say that the type of instability investigated by Schumpeter is 'physiological', in the sense that it makes the survival and the development of the capitalist system possible, whereas the type of instability Keynes is concerned with is 'pathological', in the sense that it impedes the performance of an individualistic economic order.

This assertion may offer the key to a better understanding of the actual development of financial structures from commodity money to sophisticated credit instruments in market economies. More specifically, we suggest that financial innovations have been introduced whenever the need was felt to increase the structural flexibility of the economic system.²² Unfortunately, the development of financial structures seems to have contributed not only to more physiological instability but also to more pathological problems, resulting at times in financial crises, inflation, unemployment and generalised economic crises.²³ Neither Keynes nor Schumpeter paid sufficient attention to this basic ambiguity of financial tools and institutions and their evolution over time. A synthesis of the two approaches would perhaps be the most promising route to a more balanced and articulate view of the role of money in economic fluctuations.

Moreover, such a synthesis might be of use for the clarification of an important empirical issue, namely, the nature of the evolution of the role of financial institutions in capitalist economies from the time of Schumpeter and Keynes to the present. As is well known, financial capitalists no longer act as the 'éphors' of the economy, providing the necessary finance to ensure the growth of capital stock. Today's narrowly focused 'managers of money' are preoccupied little with the development of capital assets and much less with the going concerns of economic and technological progress. Indeed, the great crash of 1929–33 marked the end of this stage of 'finance capitalism' in which investment bankers dominated financial markets. Today, with the advent of 'money managerial capitalism' (Minsky 1993: 108), financial structures seem much closer to Keynes's characterisation of the financial arrangements of advanced capitalism as a 'casino'.

However, this evolution of financial structures does not render Schumpeter's approach obsolete. By enriching the analysis with a broader view of the economy as a set of evolving institutions, Schumpeter implicitly completes Keynes's theory of monetary production. Indeed, nowhere is market-driven institutional evolution (innovation) more apparent than in the financial sphere. As Schumpeter himself argued, financial institutions are also entrepreneurial organisations striving to innovate in order to generate capital gains (Schumpeter 1947 [1951]: 222). Hence, the rapid changes in the use of monetary and financing tools that have characterised the past forty-five years of successful capitalism would have been easily understood by Schumpeter. Thus, the framework he built remains a valid theoretical tool for explaining the evolution of today's financially sophisticated economies.

Notes

- 1 In the published text of *The General Theory*, Keynes uses the terms 'barter economy' and 'monetary economy'.
- 2 Arena 1985; de Boyer 1985.
- 3 See, for instance, Schumpeter 1917/1918 [1956].
- 4 Schumpeter 1917/1918 [1956]: 173, 174 and 177; Schumpeter 1939: 546.
- 5 Schumpeter 1917/1918 [1956]: 179.
- 6 On this point, see Graziani 1978: 91 and Messori 1985: 49.
- 7 Roberton 1966 accused Keynes of having neglected the process of the creation of liquidity in *The General Theory*.
- 8 Keynes 1937a: 208. This may be attributed the fact that Keynes was intent on modifying the approach adopted in *The General Theory* as little as possible. As will be seen in the next section, the stock market there occupies the main position, while the banking system seems to be entirely absent.
- 9 Mainly to facilitate the analysis, see Robinson (1971: 81–2).
- 10 A footnote to *The Theory of Economic Development* dealing with this problem lends support to this interpretation. Schumpeter argues there that 'at the most one may with Spiethoff distinguish the capital market as the market for long-term purchasing power from the money market as the market for loans. But purchasing power is the commodity in each' (Schumpeter 1912 [1934]: 124 fn. 1). For a more detailed account, see Atena and Festré 1996.
- 11 See Graziani 1989.
- 12 For a more detailed account, see Messori 1986: 131–3.
- 13 See, for instance, Keynes 1930: ch. 17.
- 14 *Ibid.*: ch. 13, section 2.
- 15 Schumpeter 1912 [1934]: 75 fn. and 137; 1939: 104.
- 16 See Messori 1986: 139.
- 17 For a more detailed account, see Atena and Festré 1996.
- 18 See also Schumpeter 1939: 126 and 640–1.
- 19 Schumpeter 1912 [1934]: 112–15; 1939: 121–3; 1917/1918 [1956]: 206–8. This point has been stressed by Bellofiore 1985, in particular.
- 20 Stiglitz and Weiss 1988.
- 21 Schumpeter 1912 [1934]: 74. The 'éphor' was a magistrate of Sparta who contained and controlled the kings. In Schumpeter's framework it is the banking system of a capitalist economy which controls the finance of economic activities and only those activities which are financed enter the realm of the possible.
- 22 As suggested by Schumpeter himself, see 1939: 122.
- 23 In this we follow the 'Minskian' interpretation of *The General Theory* (Minsky 1975).

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2. Intermédiation financière et innovation

2.1. Innovations bancaires et financement de l'innovation (2) :

Festré, A. et Nasica, E. (2009) “Schumpeter on money, banking and finance: an institutionalist perspective”, *European Journal of the History of Economic Thought*, 16, 2, p. 325-356.

Schumpeter on money, banking and finance: an institutionalist perspective

Agnès Festré and Eric Nasica

1. Introduction

In this paper, we provide an institutional interpretation of Schumpeter's analysis of money, banking and finance. This interpretation is founded on an overall investigation into Schumpeter's writings addressing those issues from different perspectives.

In Section 2, we discuss the widespread evolutionist interpretation of Schumpeter and rather assert an institutionalist perspective. In support of our interpretation, we highlight the specific role played by economic sociology in Schumpeter's methodological approach. Economic sociology, indeed, provides the foundations of a theory of institutions and institutional change, which is often undermined by the usual evolutionary interpretation. We believe, however, that taking this dimension seriously into account may have implications for our understanding of economic and institutional change in Schumpeter.

Section 3 illustrates this general statement by focusing on Schumpeter's analysis of money, banking and finance, and their respective roles in the process of economic development. Starting from the angle of the three pedagogical stages of Schumpeter's analysis of economic development – the circular flow, the steady-state and the development cases – we show how institutional change is progressively introduced into those respective cases

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and emphasize the leading role of the banking system in the overall evolution of the financial system. Two functions of the banking system will be specifically pointed out. On the one hand, the banking system, through its function of credit creation, is seen as the 'ephor' of the capitalist system, as an institutional setting pre-existing to it and rendering its expansion possible. On the other hand, the banking system faces inner tensions due to transformations taking place within the economic system and must adapt to those changes. In this perspective, the banking system may be conceived as a vector of innovation in the field of banking and corporate finance, which, similarly to the real sector, is ruled by the law of creative destruction.

2. Schumpeter's vision of economic development: an institutionalist perspective

Schumpeter's work has been often taken as reference for most evolutionary economists (see, for instance, the emblematic book of Nelson and Winter 1982). In the following, however, we will argue that Schumpeter's hesitation to use the evolution metaphor is not incidental but gives us some indication of what he meant by 'economic' evolution. For us, it is clear that Schumpeter's vision of economic development, even if it may lend itself to some today evolutionary explanations of economic change, cannot be understood without taking the complementary and necessary role of institutional changes seriously.

2.1. Schumpeter and the evolution metaphor

In Schumpeter's writings, we find many arguments against the use of the evolution metaphor. At his epoch, this metaphor was invading many fields of social sciences and Schumpeter was very keen to warn the economists against the biological analogy that the term 'evolution' could imply.¹ As early as in *Das Wesen*, Schumpeter refers to Marshall's attempt at making use of such analogies, noting that this did not produce the result one could reasonably have anticipated but rather created 'the danger of confusion' (Schumpeter 1908: 538).

In a 1917/1918 paper entitled 'Money and the Social Product', Schumpeter also makes little secret of his hostility against his contemporary Austrian masters, stating that their 'causal-genetic' explanations provide

¹ This position comes out most clearly in the first German edition of his *Theorie der wirtschaftlichen Entwicklung* (1911/12), which has recently been republished by Duncker & Humblot in Berlin (Schumpeter 1911/1912).

striking examples of the danger of 'evolutionary' reasoning: '[T]he historical beginnings of a phenomenon by no means always show it in its simplest and purest form, so that an attempt to get at the essential nature of the problem by generic treatment may be easily misleading' (Schumpeter 1936 [1917/1918]: 157).

Later, in a recently discovered article from 1932 entitled 'Development',² Schumpeter also makes it clear in a Max Weberian manner that he wanted to protect himself against an unscientific connotation, this time, of the term *Entwicklung* (development), with value judgments of progress:

... [T]wo [...] associations [...] are responsible for the scientific discredit of the term 'development' [...]. These two associations can be characterized by the terms faith in progress and evolutionism. (Schumpeter 2005 [1932]: 119)

Referring to the Darwinian or Mendelian types of theory of descent, he notes in the same article that:

fit always fails when it comes to the inaccessibility and indeterminacy of novelty and of the leap, even more so when such a theory of descent acknowledges the leap and names it e.g. sport or mutation. It always runs into logical limits, or in other words, the fact that our logic is a logic of the adaptation process which can only deny or dismiss development. (Schumpeter 2005 [1932]: 118)

In sum, for Schumpeter, social science, in general – and economic theory, in particular – must remain value-free. In passing, this feature constitutes a strong point of convergence between Schumpeter and Max Weber.³ Moreover, a theory of development has to face the problem of novelty seriously, which requires a logic that goes beyond the mere logic of adaptation displayed by Darwinian or Mendelian types of evolutionary theory.

In his *Theory of Economic Development*, Schumpeter indeed rejects the idea that the whole of mankind would show some kind of uniform nonlinear development⁴, as assumed by the German Historical School personified by Roscher as well as the evolutionary thought centred in Darwin, but also psychologist explanations that consist of seeing more in motives and acts of volition than a reflex of the social process (Schumpeter 1934: 57). He adds, thus reinforcing his claim for value-free economic theory, that we

² Schumpeter's article on 'Development' was written by the author as a contribution to the *Festschrift* for Emil Leclercq in 1932. It was translated by M. Becker and T. Knudsen in the *Journal of Economic Literature* in 2005 (43 (1): 108–11; introduction of this volume jointly written by M. Becker, H. Ebinger, U. Hertk and T. Knudsen).

³ See, for instance, Powell (1996).

must get away from evolutionary ideas that are surrounded by 'the reproach of unscientific and extra-mysticism' as well as 'of dilettantism' (Schumpeter 1934: 58).

From what precedes, it is clear that Schumpeter is careful about the use of the evolutionary metaphor to depict the process of economic change.

More precisely, it is not so much the terms 'evolution' or even 'development' that Schumpeter rejects, but rather the tendency in the history of ideas to associate these terms with value judgements.⁴ His dithering in time concerning the use of the English terms of 'evolution' or 'development' shows his caution and the difficulty he finds to describe properly what he has in mind. Not incidentally, in a letter to Stewart S. Morgan of 18 May 1934, two months after he wrote the preface to the *Theory of Economic Development*, Schumpeter refers to his book as the *Theory of Economic Evolution* (see Hedke and Swedberg 2000: 267).⁵ Besides, in his subsequent *Business Cycles*, and more precisely in Chapter IV ('The Contours of Economic Evolution'), Schumpeter takes up the term 'evolution' as a key ingredient.

Besides, Schumpeter raises an additional argument against evolutionary explanations of his time in the field of natural sciences: the fact that they are unable to deal in a satisfactory manner with the problem of novelty.⁶

⁴ See Schumpeter (1933 [1954]: 85–98).

⁵ We are grateful to the referee for this indication.

⁶ This issue is addressed by Becker *et al.* (2006). They first note that Schumpeter's opinion on Darwin's evolutionary theory is not entirely clear, because it depends on an interpretation of the few remarks he made on the subject in his writings (Becker *et al.* 2006: 356). In the above quoted passage from *Development* (Schumpeter 2005 [1932]: 118), Schumpeter acknowledges the value of both Darwin's and Mendel's theories as explanations of incremental change, but, however, dismiss both theories as explanations of novelty and discontinuity. To put the matter in a nutshell, Schumpeter saw clearly that 'mutation', as that term is normally used in Darwinian evolutionary theories, is less an explanation than a label for the inexplicable' (Becker *et al.* 2006: 357). Secondly, they rightly point out one of the major challenges of Schumpeter's theoretical endeavour: to explain novelty as arising endogenously in a routine-based system. Among the various routes that Schumpeter identified in order to explain novelty (character traits of entrepreneurs, new combinations generated by production functions, interaction effects between different spheres of the social realm and inspiration from theories of evolution), no one proved to be entirely satisfactory. Related to the explanation based on new combinations, Becker *et al.* note that Schumpeter's interest in Mendel and Mendel's discoverer de Vries (as assessed by an interview with Wolfgang Stöber, 4 August 2001, at his home in Ann Arbor, MI) might indicate that he hoped for the identification of some regularity underlying replications, such as the Mendelian combinations of reproduction 'in order to provide a more precise inheritance mechanism than the word combination' (Becker *et al.* 2006: 357).

Now, regarding economic evolution, Schumpeter makes clear that this phenomenon involves the element of novelty or change as a crucial factor. In his own terms, 'evolution is a disturbance of existing structures [...] more like a series of explosions than a gentle process, through incessant transformation' (Schumpeter 1939, vol. I: 102). Since development is defined as a change from one equilibrium (Schumpeter 1934, 1939) or 'norm' (Schumpeter 2005 [1932]) to another in such a way that the process of change or transition involves discontinuity, its analysis requires, according to Schumpeter, a different logic from the one conveyed by the logic of adaptation or incremental change. Furthermore, as Schumpeter puts it, 'development is a problem, not simply of the facts but of our mental apparatus' (Schumpeter 2005 [1932]: 117).

To sum up and at first sight Schumpeter's conception of economic evolution, can hardly be reconciled with Darwinism, even though no Darwinism copyright can be imposed on the word 'evolution' (Hodgson and Knudsen 2006: 2). In some sense, some of Schumpeter's objections to Darwinism are still topical. For instance, the idea that human intentionality is inconsistent with the 'blind' process of Darwinism is not so far from Schumpeter's insistence on the fact that innovation is the result of the activity of 'New Men' (Schumpeter 1939, vol. I: 96) and not the result of mere adaptation from already existing production structures, following some kind of stochastic process.⁷

The aforementioned remarks concerning Schumpeter's attitude towards evolutionism do not, however, entirely preclude an evolutionary type of interpretation of Schumpeter's analysis of economic change. Given the great variety of evolutionary explanations of economic change and the lack of clarity of the present 'evolutionary economics' project, we will not explain in detail why and how those explanations could be reconciled with Schumpeter's original message. To put the matter in a nutshell, we agree with Hodgson and Knudsen that any evolutionary economic explanation involves some Darwinian principles, such as the principles of selection, variation and inheritance as basic ontological features. However, this does not mean that a generalized Darwinism is enough to explain the processes of social evolution. In sum, it provides more a 'meta-theoretical framework than a complete theory' (Hodgson and Knudsen 2006: 17). From this very restricted viewpoint, Schumpeter's analysis may be considered

7. In this respect, Winter's argument is not that far from Schumpeter's, in so far as he also rejects, in a Peircean way, the use of biological analogies in economics. He, however, is more optimistic about the possibility of replacing 'the idea that mutations are inexplicable or random events', with 'ideas that associate mutations, for the most part, with intentional, motivated change.' (Becker et al. 2006: 359).

'evolutionary'. However, we argue that this interpretation is, to say the least, incomplete, or even misleading, if we take into account Schumpeter's methodological specificity, and in particular, the importance he attaches to economic sociology.⁸

2.2. Schumpeter's conception of economic sociology: the role of institutional factors

As is well known, Schumpeter's method is clearly defined in Chapter 2 of *History of Economic Analysis* (1983 [1954]), where he distinguishes the three 'techniques' – history, statistics and (economic) theory – that together constitute 'economic analysis'. In addition to these three techniques, there is economic sociology that constitutes a fully-fledged component of his methodology. The arguments in support of Schumpeter's claim for the introduction of a supplementary technique in the toolbox of economists may be summarized as follows.

The reasons why economic sociology should constitute a fully-fledged field of economic analysis and be dealt with separately from economic history on economic theory are outlined by Schumpeter. On the one hand, he argues that the institution of property and freedom of contract or the introduction of any kind of government regulation are not only a concern of economic history but they constitute social facts that shape the society and thus make economic history a kind of generality, a type or a model. From this perspective, economic sociology can be described, in accordance with Schmoller's definition as a 'theory of generalizing history'. In a paper he dedicated to Schmoller, Schumpeter notes that

economic theory usually contains statements about 'social institutions', such as 'property', 'inheritance', and 'the family', and that these institutions are 'partly economic' and 'partly non economic in nature'. Social institutions therefore cannot be analysed with conventional economic theory; pure economic theory is only applicable to topics such as value, price, and money. Something else is needed – a 'theory of economic institutions, basically within economic theory'. And this something else is economic sociology. (Schumpeter 1926, quoted by Swedberg 1991: 46)

As Shionoya puts it nicely: economic sociology is therefore conceived by Schumpeter as a 'bridge between history and theory' or as a compromise between the generality meant by theory and the individuality meant by history' (Shionoya 1997: 200). This methodological feature, however, needs

8. For an assessment of the importance of economic sociology in Schumpeter's work, see Shionoya (1997) and Swedberg (1989, 1991).

further clarification in order to give full support to our institutionalist interpretation. In particular, economic sociology is not conceived by Schumpeter as a comprehensive method for analysing the process of sociocultural development, but rather consists of an approximation in so far as it summarizes the set of interactions that occurs at different levels of social life in order to focus on the institutional factors that are closely linked with economic activity. In other terms, Schumpeter explicitly restricts the scope of economic sociology to the study of institutions (Swedberg 1989).

On the other hand, Schumpeter emphasizes the fact that economic sociology provides a theory of economic behaviour conceived as embedded and interacting with the institutional setting of the whole society and not assumed as a given datum inherited from history. The following quotation taken from Schumpeter's *History of Economic Analysis* reinforces the argument by locating the demarcation line between theory and economic sociology precisely at the level of the assumptions concerning behaviour:

... economic analysis deals with the questions how people behave at any time and what the economic effects are they produce by so behaving; economic sociology deals with the question how they came to behave as they do. If we *define human behaviour widely enough*, so that it includes *not only* actions and motives and propensities but also the social institutions that are relevant to economic behaviour such as government, property inheritance, contract, and so on, that phrase really tells us what we need. (Schumpeter 1983 [1954]: 17–8; emphasis added)

Therefore, economic sociology is valuable and deserves special focus because it permits one to deal with the institutional background underlying economic behaviour. Moreover, it allows one to endogenize economic behaviour, which is usually taken as an exogenous factor by economic analysis. Such a procedure also permits one to derive heterogeneous norms of behaviour, in contrast to the uniform and universal norm of behaviour; that is, the hedonistic (and static) norm of behaviour taken as granted by Walrasian economic analysis.⁹

⁹ This argument can also be extended in order to deal with Schumpeter's conception of rationality. Taking into account economic sociology indeed permits a better understanding of Schumpeter's multi-level methodological perspective (see the disjunction 'rationality of the observer' versus 'rationality of the observed' in Schumpeter 1940) concerning the problem of rationality of economics. More generally, the introduction of economic sociology into Schumpeter's methodological framework permits to extend the range of application of rational models as compared with pure economic theory (see Festé and Garrouste 2006).

Finally, and more generally, economic sociology can be interpreted as one bridge between statics and dynamics, or as means to unify Schumpeter's analytical framework, by qualifying the usual argument of the logical inconsistency between the routine-based static circular flow and the case of development, supposedly arising endogenously from the circular flow.¹⁰ If economic sociology or, in other words, the analysis of the role of institutions and institutional change, can be considered as secondary for economists whose interest is focused on the working of stationary economic states, it becomes however a central issue for dealing with economic dynamics, as Schumpeter defines it in his *Theory of Economic Development* – that is, 'such changes in economic life as are not forced upon it from without but arise by its own initiative, from within.' (Schumpeter 1934: 63). Under those circumstances, economic sociology cannot be considered as non-economical, and thus must also to be distinguished from simple sociology. Moreover, since Schumpeter excludes from the definition of economic development such changes in data or in economic conditions, to which the economy continuously adapts (Schumpeter 1934: 63), economic sociology provides the tool for dealing with the social structure of an economic system. More precisely, for Schumpeter, economic sociology or social institutions are more than a complement to economic analysis. They rather constitute a logical priority to it. In other terms, for Schumpeter, it is not possible to deal with economic change without considering complementary and necessary previous institutional change. This is rather well expressed in the following passage:

Because of the fundamental dependence of the *economic aspect* of things on everything else, it is not possible to explain economic change by previous *economic* conditions alone. For the economic state of a people does not emerge simply from the preceding economic conditions, but only from the preceding total situation. (Schumpeter 1934: 58; original emphasis)

In sum, economic sociology deals with the institutional background underlying economic behaviour, but also with how this background is likely to change; that is, institutional change.

¹⁰ We have in mind here, for instance, the role of leadership and the character traits of the entrepreneur in Schumpeter's first German edition of the *Theory of Economic Development*. For a more detailed discussion of Schumpeter's shifts of emphasis, from the second edition onward, from the individual entrepreneur conceived as a leader interacting with many various sectors of social life (economics, politics, art, etc.) to the de-personified entrepreneurial function, see Becker and Knudsen (2002).

In an article entitled ‘American Institutions and Economic Progress’,¹¹ Schumpeter clarifies his conception of institutions and institutional change. He emphasizes that:

by ‘institutions’ we mean in this course all the patterns of behaviour into which individuals must fit under penalty of encountering organized resistance, and not only legal institutions (such as property or the contract) and the agencies for their production or enforcement. (Schumpeter 1950a, cited in Swedberg 1991: 438)

This definition is perfectly consistent with the subject-matter of economic sociology, which consists, as we have emphasized, in relating institutions to economic behaviour. A few lines later, Schumpeter adds that ‘institutional patterns [...] shape the economic process and [that] the analysis of the sequence of events of this process cannot be adequately explained either by economics or by political science’ (Schumpeter 1950a, cited in Swedberg 1991: 440) but requires a specific analysis of institutional change. In the same article, Schumpeter sketches out a picture of what this analysis could be by mentioning several factors of institutional change.

A *first factor* of institutional change is related to routine activity, which induces in itself a slow process of institutional change which it is very important to understand’ (Schumpeter 1950a, cited in Swedberg 1991: 439). The usual interpretation of Schumpeter’s conception of routines often opposes routines to innovation within the productive sphere, but undermines the fact that Schumpeter also makes clear that routines are part of the underlying institutional setting:

which compel individuals and groups to behave in certain ways whatever they may wish to do – not indeed by destroying their freedom of choice but by shaping the choosing mentalities and by narrowing the list of possibilities from which to choose. (Schumpeter 1950b: 129–30)

From this perspective, economic change is also concerned with how

routines change.

This quotation stresses the fact that routines are embedded within the society as a whole and illustrates the importance of how institutional change is important in order to deal with economic change. In the remaining of the paper, we will show how banking and financial institutions are likely to establish routines in the everyday banking practices and how

economic and institutional change may alter those routines and their associated anchored behaviours, so as to permit economic development.

A *second factor*, which Schumpeter refers as the ‘personal element’ of institutional change, is brought about by the responses of social groups of individuals to the impact of factors external to the given institutional pattern of a given society. This factor clearly relates to the phenomenon of leadership, which is at the core of Schumpeter’s theory of social classes,¹² but also refers to a specific non-rotinized kind of behaviour. In the following, we will emphasize the role of the personal equation as a factor of change by arguing: (1) that creative destruction occurs not only in the production sphere, as well-known, but also within the financial sphere; and (2) that this process is triggered by individuals such as bankers or groups of individuals such as partnerships between financiers and manufacturers, who display a different norm of behaviour than the one associated with previously established financial practices.

A *third factor* constitutes what Schumpeter refers as the ‘element of chance’ of institutional change; that is, the possibility that ‘situations may arise in business or in politics the temporal coincidence of which, though some extent fortuitous, may produce consequences that could not have been predicted from any study of either development taken separately’ (Schumpeter 1950a, cited in Swedberg 1991: 441).¹³ This factor may be interpreted as follows: for Schumpeter, the capitalist economy is a turbulent system, constantly in motion, but to think more precisely about what factors are unique and which are repeated, or what is random and what is

¹² As suggested by Shionoya, the structure of Schumpeter’s theory of social classes can be summarized as follows: ‘It starts from the general theory of leadership, it defines various social areas as the fields in which *social functions* are fulfilled, it arranges the complex of social areas in terms of *social values* or *social leadership* (the aptitude of fulfilling the social functions) to derive a social hierarchy (social classes), and it summarizes in the word *Zielgeist* the spiritual and cultural expressions that correspond to the hierarchical social classes thus derived’ (Shionoya 1997: 250). Schumpeter’s conception on social classes is found in his 1927 article on *Social classes* where he makes clear that individuals’ behaviour are not to be considered as strictly individual but also as the result of social stratification. This feature is symptomatic of Schumpeter’s methodological approach, which consists of a mix of methodological individualism and holism. In passing, Schumpeter breaks off in this regard with most of his Austrian contemporaries. For more details on Schumpeter’s conception of social classes and how it is compatible with methodological individualism, see Arena and Festé (2006: 54–5) and Festé and Garrouste (2006).

¹³ Schumpeter mentions a fourth factor of institutional change, which is ‘brought about by the responses of politicians, bureaucrats and journalists to the impact of factors external [such as wars or crises] to the given institutional pattern of a given society’.

determinate, requires close attention to institutional and historical detail. However, Schumpeter did not believe the task of explaining change in the economy should be turned over to the economic historians or the economic sociologist; the goal of economic theory should be to account for change. This third factor therefore accounts for the indeterminateness that is irreducible in any theoretical endeavour to analyse economic change. This factor may, for instance, refer to financial or monetary international crises, the consequence of which could alter the working of financial institutions in a radical and irreversible way.

With these three factors we can now draw some provisional properties of institutional change for Schumpeter. First, institutional change is conceived as an endogenous process. This feature is often overlooked by the usual interpretation of Schumpeter's analysis, which claims that Schumpeter is focused on the emergent properties of change, while neglecting the process of change itself.¹⁴ Our interpretation is, however, based on the role of economic sociology (i.e. on the institutional background underlying economic behaviour). As can be briefly summarized, this institutional background contains several analytical ingredients such as social stratification (involving both an interclass and intraclass dynamics in relation to some necessary social functions) or the phenomenon of leadership (also involving an individual and a social dimension). To put the matter in a nutshell, the institutional setting of the society is crucial for understanding economic change given that it moulds the behaviour of individuals and *vice versa* since repeated behaviours become anchored into the institutional setting to such an extent that they constitute routines that strengthen the institutional background.

Second, institutional change is a process involving the interaction of distinct groups of men such as families or social classes that are defined according to the social function they have to perform in a given society. The existence of such groups, which have some degree of autonomy *vis-à-vis* individuals and interact with each other in many instances of social life, may give rise to social values or collective beliefs that mould the public opinion and shape the behaviours of individuals. This feature is at the basis of the phenomenon of leadership.

Third, institutional change is a process that involves gradual, sequential, and incremental transformations due to the relative autonomy and inertia of collective beliefs or to leadership that may involve self-enforcement mechanisms (success bringing success...). Moreover, patterns of individual behaviours adapt only slowly and gradually to the changing

environment because 'routinized' or automatic behaviour implies some resistance to change.

Fourth, institutional change is also characterized by a process of 'destructive creation' and, therefore, of radical change.¹⁵ Within this process, the 'personal element' plays a crucial role since it permits, under some favourable circumstances, to break off with established routines and brings in some novelty into the system, sometimes under the impulse of major crises or conflicts of interests. On the other hand, social groups are likely to disappear if they prove not able to perform their social functions under the renewed institutional setting.

Finally, the evolution of society is ultimately for its most part driven by economic forces because of the fundamental dependence of the economic aspect of things on everything else' (Schumpeter 1934: 58). However, this process is not deterministic since economic transformations such as new combinations, for instance, are retained by the social structure, the underlying mechanism being the interaction among agents, and social agents nested within social sectors. Social stratification then reflects on the behaviour of individuals so that there appear dynamic mechanisms such as self-enforcement but also hysteresis or inertia effects that imply that, in most of the cases, the evolution of institutions and social structures lags behind the process of economic change.¹⁶

This way of looking at institutional change is not far from North's idea that crises are important as a matter that strengthens new ideas and weakens the position of the *status quo* tenants (North 1994). It also bears a relation to Hodgson's conception of institutions as both subjective ideas in the heads of individuals and objective structures faced by them: 'agents and structures, though distinct, are connected through a circle of mutual interactions and interdependence' (Hodgson 1998: 181).

Let us now investigate how this overall framework of institutional change may be dealt with in the specific case of Schumpeter's analysis of money, banking and finance.

3. Banking institutions and economic development

The great diffusion of Schumpeter's contribution on innovation casts his banking and credit analysis into the shadows. This section aims, however, at

¹⁴ From an analytical perspective, the dichotomy between radical and incremental changes refers to the opposition between punctuated equilibrium versus gradualism (see Eldridge and Gould 1972).

¹⁵ For more details, see Feslre and Garrouste (2006).

¹⁶ See, for instance, Peroux's (1935) *Introduction to French translation of Schumpeter's Theory of Economic Development*.

showing that, in Schumpeter's theory, each stage of capitalist development is shaped by the institutional structure, especially banking institutions, and that this structure is always evolving in response to profit-seeking activity under the constantly renewed financial institutional setting.

3.1. The banker, as the 'ephor' of the capitalist system

Before entering into a precise analysis of the role of monetary and financial institutions in Schumpeter's description of the process of economic development, a few introductory remarks may be fruitful. First, we want to emphasize that Schumpeter's contribution in the monetary field cannot be understood in isolation from the other parts of his vision of economic development.

In particular, four aspects of Schumpeter's monetary analysis are worth reminding of:

First, it should be stressed that, building on the Quesnay-Walras concept of 'circular flow', Schumpeter conceives economic life as a system of flows of monetary expenditure directed toward objects sold against such expenditure' (Marget 1951 [1991]: 180).

Second, given that monetary analysis is defined by Schumpeter as 'a theory of the economic process in terms of expenditure flows', money, is, in short, 'the means whereby a link is established in time between the successive discretely realized events of the economic process' (Marget 1951 [1991]: 181).

Third, money in itself 'has no organ of locomotion' but flows 'in response to decisions made by *economic units*', such as a consumer, a business firm, a government or a financial institution. With respect to decisions made by government and financial institutions, one should note that they determine 'whether there shall be additions to, or subtractions from, the total stock of money-spending power; and what particular elements in the community shall receive or be deprived of money-spending power as a result of these decisions' (Marget 1951: 181-2).

Fourth, this representation of the 'circular flow' of economic life rests 'upon specific assumptions so as to the nature of the institutional arrangements which condition the functioning of the economic process' (Marget 1951: 184). In other words, for Schumpeter, '[i]t is the responsibility of monetary analysis in particular to see to it that the nature and functioning of *monetary* [and financial] institutions [...] be studied from the standpoint of their effect upon the magnitude and direction of money flows' (Marget 1951: 184).

It is in particular this last point that will be dealt within this section. We will show, using the tools of analysis of Schumpeter provided by the

distinction between three successive cases – the 'circular flow', the 'steady-growth case' and the 'development case' – how monetary and financial institutions gradually and indirectly shape individuals' behaviour as well as their position within social stratification, and consequently provide necessary conditions for economic (as well as institutional) change to occur.

To begin, let us consider the case of the circular flow.

At this stage, no specific monetary or financial institution is apparently involved. But, in the background of this theoretical scheme there exists an 'institutional framework derived from economic history' (Schumpeter 1983 [1954]: 16); namely, the fact that money in itself is a 'social institution' or a social accounting and clearing system (Schumpeter 1936 [1917/1918]: 150; Schumpeter 1970: 206).¹⁷ This provides a good example of what Schumpeter has in mind when in *History of Economic Analysis* he advocates for the addition of a fourth technique of economic analysis (i.e. economic sociology) to the ones of history statistics and 'theory', defining it as 'a sort of generalized or typified or stylized economic history' or as the discipline that deals with the question of how social institutions come to operate as they do (Schumpeter 1983 [1954]: 20-1).

The function of money at this stage is, however, in principle 'of a mere technical nature' with no effect on the distribution of income and the production structures; money is essentially a device for carrying on business transactions, a mere satellite of commodities, a servant of the processes in the world of goods (Schumpeter 1936 [1917/1918]: 151). In other terms, within the setting of the circular flow, money is only considered as the mere counterpart of real exchanges.

Schumpeter thus conceived of the circular flow as a case of simple reproduction, referring explicitly to Marx, or the fictitious basic skeleton of the process of development (Schumpeter 1939, vol. I) whereby there is no savings, no interest and no growth. The time interval considered is equal to the period of production, during which the social product, the sum of goods and services for consumption, is produced and consumed. All means of production last one period. Both types of goods result from the 'productive services' of labour and 'nature' (Schumpeter 1970: 113). Money is therefore viewed, in the spirit of Bentzen's 'claim theory' or 'entrance ticket theory', as 'a claim ticket and a receipt voucher' of already existing goods and services (Schumpeter 1936 [1917/1918]: 154-55 and 160).

¹⁷ For more details, see Dangel-Hagnauer (2002), in Arena and Dangel-Hagnauer (2002).

Let us now consider the case of steady growth. This stage is introduced by Schumpeter in order to deal with the appearance of savings into the economic process. It is worth quoting at length how Schumpeter defines this state:

We will envisage a society, stationary in every respect, except in that it displays a positive rate of saving. Production functions are invariant and external disturbances are absent. There is a positive rate of interest. If, however, the system is adapted to the actual rate of savings [...] this disturbance will be currently absorbed; for, as long as saving goes on at all, each instalment will depress the rate of interest to the extent required to create its own investment opportunity [...] The result would, in fact, be a steady growth of the system's industrial outfit by the steady addition to it of new units of plants and machinery, which, however, must be of the same types as those which are already in use [...], in order to exclude a new and different element which would otherwise intrude. (Schumpeter 1939, vol. I: 79–80)

The kind of savings Schumpeter refers to in this state is business saving, which is done with a specific investment purpose in mind. In other terms, there are no other motives for the act of savings than the motive of investing in the already existing technology; that is, replacement for used physical capital, or addition to the existing capital stock. Consequently, most sources of savings that are not regarded as claims to already existing income are absent from this 'stationary state'. For instance, cash holdings or reserves¹⁹ are absent from this state. This also means that Schumpeter's definition of saving²⁰ excludes all considerations related to the Keynesian notion of liquidity.²¹

Even though unusual, it is not surprising that Schumpeter includes the case of steady growth under 'statics'. He simply regards it as an extension of the pure model of the 'circular flow', except that it displays a positive rate of saving. One may possibly consider that Schumpeter's ultimate purpose in introducing this intermediary case into the analysis is to create an organic link between the circular flow and the case of 'economic development'.

¹⁸ See Festié (2002b), in Arenà and Dangel-Hagnauer (2002).

¹⁹ Cash holdings do not, in fact, belong to the 'business sphere' but to the sphere of hoard and reserves²² that, together with the 'sphere of capital', constitutes the 'money market', as already mentioned. See also Arenà and Festié (1996: 167–77).

²⁰ For a comparison between Keynes and Schumpeter's conception of savings, see Nasica (2002).

Associated with the appearance of savings is the emergence of the phenomenon of interest. Given Schumpeter's conception of saving,²³ interest can only be conceived as a purely 'monetary phenomenon' (Schumpeter 1939, vol. I: 128). Moreover, as the rate of interest is derived from the positive rate of profit associated with the operation of innovative productive activities, it is also a short-term phenomenon (see Arenà and Festié 1996: 175).

The steady-state case now authorizes the emergence of banks or other financial intermediaries, such as private capitalists for instance, which lend money or capital to producers in order for them to invest in capital goods and sustain a steady growth in the total industrial outfit. In this case, a strict equality between investment flows and savings in term of monetary flows is guaranteed and no structural change within the distribution of income or within the production system is allowed.

Banks thus play a passive role, allowing credit that can only consist of already existing idle stocks of money that are claims to already existing income. In other terms, they do not disturb the normal operation of the existing production structures and the normal circulation of national income. This kind of credit corresponds to what Schumpeter refers as 'normal credit'; that is, credit that 'creates claims to the social dividend, which represent and maybe be thought of as certifying services rendered and previous delivery of existing goods' (Schumpeter 1934: 101). It is to be distinguished from the 'abnormal credit', which will appear in the development case.

Let us now switch to the case of development. This case provides the core of Schumpeter's contribution in his *Theory of Economic Development* as well as in *Business Cycles*. Now, the figures of the entrepreneur and the banker are consubstantial with the process of development. In the scheme of economic development, credit consists of the 'abnormal' kind of credit; that is, credit that 'creates claims to the social product, which, [...] in the absence of past productive services [can] only be described as certificates of future services or of goods yet to be produced' (Schumpeter 1934: 101).

²¹ Schumpeter defines savings as the earmarking, by an household, of an element of its current receipts – as distinguished from "capital gains" – for the acquisition of titles to income or for the payment of debt' (Schumpeter 1939, vol. I: 75).

²² Schumpeter defines interest as 'the price paid by borrowers for a social permit to acquire commodities and services without having previously fulfilled the condition which in the institutional pattern of capitalism is normally set on the issue of such a social permit, i.e., without having previously contributed other commodities and services to the social stream' (Schumpeter 1939, vol. I: 125).

This implies that banks cannot be described as passive intermediaries as in the case of steady growth since they now play a key role in the distribution of economic resources. As Schumpeter puts it, the banker 'has either replaced private capitalists or become their agent; he has himself become the capitalist par excellence. He stands between those who wish to form new combinations and the possessors of productive means' (Schumpeter 1934: 74).

On one side, banks interfere with real propagation mechanisms by allowing the transfer of productive resources to new entrepreneurs. These reallocation effects can interfere with price competition and alter the outcome of the process of adaptation in the course of which some existent firms turn out to have become unprofitable and are eliminated, while others, seizing new profit opportunities and being backed up by banks, manage to escape bankruptcy. This feature is of utmost importance. In particular, it reveals the complementary nature of institutional and economic change; namely, the fact that institutions are the expression of the dominant position of leaders in society. In this way, the development of credit shows the leadership of entrepreneurs in the capitalist society, to such an extent that Schumpeter refers to credit as a special social permit that is given by the society to the entrepreneurs in order for them to have purchasing power at their disposal, without having to go through the usual path of labour (Schumpeter 1934: 107).

On the other side, banks interact with entrepreneurs in determining the volume of credit. While it is the entrepreneurs who initiate the process, banks decide which of these initiatives to finance based on their expectations regarding the profitability of innovative projects and the entrepreneurs' ability to repay their loans. We know already by what forces this supply is regulated: first with regard to possible failures by entrepreneurs, and secondly, with regard to the possible depreciation of the credit means of payment (Schumpeter 1934: 195). In another passage, Schumpeter explicitly argues that:

the banker must not only know what the transaction in which he is asked to finance and how it is likely to turn out, but he must also know the customer, his business, and even his private habits, and get, by frequently talking things over him, a clear picture of the situation. (Schumpeter 1939, vol. I: 116–17)

On closer examination,²³ it is possible to define the equilibrium level of the interest rate at a given point in time by deriving a supply and a demand

curve for credit.²⁴ However, this description of the workings of the money market is not very satisfactory.

In the first place, banks select entrepreneurs not only by setting the rate of interest but also by evaluating innovations as well as the entrepreneurs themselves and the subsequent use they make of a loan.

Secondly, the changes in the demand for finance occurring throughout the cycle affect not only actual but also potential credit (i.e. the maximum credit banks can create in a given institutional context). Moreover, the question of technical limits to credit supply, such as may arise in a monetary system when banking operations are constrained by reserve requirements and when there is a preference for cash on the part of the public, is of little relevance to Schumpeter, given that banks can ration credit and manage cash/deposit ratios in a procyclical manner, reducing them in prosperity and raising them in a depression (Schumpeter 1934: 112–15; 1939: 121–3; 1956 [1917/1918]: 206–8). In short, the actual supply of credit shifts with the demand and does not face a definite ceiling of potential credit supply since the latter moves procyclically.

More importantly, the influence they exert on the financial side of the economy is not limited to credit creation and control. More specifically, in Schumpeter's analysis banks are seen to have both a permanent and an asymmetric impact on the money market that includes both the 'sphere of hoards and reserves' and the 'sphere of capital'. The common feature of these two spheres, and therefore the distinctive feature of the money market, is that they permit stock markets to work. The money market is the place where 'cash reserves' – that is, 'idle non-circulating money', and 'income yielding assets' – are mutually exchanged (Schumpeter 1936 [1917/1918]: 176). The first sphere of the money market is the 'sphere of hoards and reserves'. The second corresponds to 'capital' or 'income-yielding assets' and includes the real estate and mortgage markets as well as the stock market. In this framework then, the role of banks is clearly not limited to the control of credit. Schumpeter, in fact, asserts that:

The most cursory glance at money market processes shows that the banks regulate both stock market speculation and the pulse-beat of industrial and commercial life, now restraining, now stimulating them. (Schumpeter 1956 [1917/1918]: 176)

This implies that banks exert a very strong influence on economic life.²⁵ This power derives from two factors.

²³ The rationale for this analytical development. See Schumpeter (1934: 191–8).

²⁴ See Bellafiore (1991: 378), Messori (2004) and Festri (2002a).

²⁵ In a passage of his *History of Economics Analysis*, Schumpeter reasserts this point: 'Credit operations' of whatever shape or kind do affect the working of the

First, Schumpeter assumes that both spheres of the money market are interrelated. Therefore, the markets for short-term loans and long-term assets do not work separately but interact within a single money market in which purchasing power is exchanged. This derives from Schumpeter's conception of interest according to which 'interest is a [monetary] value phenomenon and an element in price' (Schumpeter 1934: 173) flowing from profit (1934: 175). Given this definition, there is no rationale for distinguishing 'between interest on loans' and 'original interest on capital' (Schumpeter 1934: 177). In *Business Cycles*, Schumpeter explains that 'the capitalist process develops, along the money market, [...] perfect negotiability of all instrument of credit, whatever their legal form may be' (Schumpeter 1939, vol. II: 613). In this perspective, there are no differences in principle between bonds and credit and between short term and long term interest rates. As Schumpeter indicates:

Bonds, for instance, thus become a vehicle of the shifting of balances, which only technically and by degree differs from short-term instruments [...] there exists no such thing as the long-term rate and that it we nevertheless wish to use the concept, the thing we ought to mean is some kind of trend value of short rates. (Schumpeter 1939, vol. II: 614)

In other terms, the sphere of capital is hierarchically submitted to the sphere of hoards and reserves.

Second, the 'sphere of hoards and reserves' depends heavily on banks since the latter can manipulate the volume of available liquidity through the lending of credit. By creating means of payment through organizing credit, banks effectively regulate the activity of this sphere. Moreover, the interdependence of both spheres within the money market allows banks to extend their influence to the sphere of income-yielding assets. On the one hand, banks create *ex nihilo* credit means of payment, thereby strongly contributing to the emergence of interest. This, in turn, affects the whole

economy in that the existence of interest now constitutes an additional motive to save on the part of consumers. In other terms, interest emerges through the activity of banks, through lending and borrowing and diffuses within the whole money market.²⁶

Lending and borrowing can become part of the normal routine of industry and commerce, and interest can economically and socially acquire the importance that it actually has, only if the control of present purchasing power means more future purchasing power *in the tomorrow*. (Schumpeter 1934: 189)

Therefore, banks neither are purely neutral intermediaries nor are the effects of credit creation transitory since they give rise to a secondary wave of the creation of new sources of purchasing power that can be mobilized to finance further productive activity. However, the influence of bankers cannot be conceived as an irreversible process. As bankers are closely linked to the leadership of the entrepreneurs, which Schumpeter considers transitory²⁸ (Schumpeter 1934: 90), their influence is necessarily subject to gradual or even radical change.

To sum up, Schumpeter views the bankers as the ephors²⁷ of the capitalist economy that control and select what can be financed and what is actually financed only is within the realms of possibility. In Schumpeter's framework, this strategic function of finance is the prerogative of banking institutions and it is therefore not surprising that Schumpeter put so much emphasis on the role of banks or of the banker in business or economic activity. However, little attention was paid to a second fundamental aspect of Schumpeter's contribution on finance: the fact that the banking system as a whole is subjected to innovations.

26 There are at least two arguments mentioned by Schumpeter to account for the transitory nature of the leadership of entrepreneurs. A first one refers to the character traits of entrepreneurs. Schumpeter indeed notes that entrepreneurs do not have any 'attitude, or cultural tradition' (Schumpeter 1934: 90) and do not have the 'prestige of middle-age war-like lords'. A second reason lies in the fact that the position of the entrepreneurs might be threatened as soon as the necessary social function they have to achieve (i.e. introducing innovation for its most part) loses momentum. In this respect, it seems that innovation is inevitably associated to some resistance to change from the social environment in which the entrepreneur attempts to promote some change so that innovation is *de facto* transitory.

27 An ephor was an elected magistrate of Sparta who exercised supervisory power over the kings. The term refers to an overseer, guardian or ruler.

3.2. The banker as an entrepreneur and innovator

The leading role of entrepreneurs in implementing productive or organizational innovations is one of the most widespread features of Schumpeter's contribution. In this perspective, entrepreneurial business is implicitly considered as playing the lead in the financial negotiations that they carry on with financial institutions such as banks.

In a capitalist environment, however, bankers perform an entrepreneurial function, which is by no means less important than the one of business entrepreneurs for economic development. Clearly, financial institutions and practices appear and disappear. Thus, Schumpeterian creation and destruction occur also in the field of finance, as well as innovation, whether it takes the form of product, process or organizational innovation or whether it consists in incremental or radical change. Moreover, new types of financing media may emerge, and thereby trigger further process and product innovation. Although not often stressed by commentators, this feature of bankers was emphasized by Schumpeter. He indeed noted that:

Financial institutions and practices enter our circle of problems in three ways: they are 'auxiliary and conditioning'; banking may be the object of entrepreneurial activity, that is to say, the introduction of new banking practices may constitute enterprise; and bankers (or other financers') may use the means at their command in order to embark upon commercial and industrial enterprise themselves (for example, John Law). (Schumpeter 1947 [1989]: 153)

This quotation shows that Schumpeter perfectly understood that financial institutions are also entrepreneurial organizations striving to innovate in order to generate capital gains. This implies that financial systems evolve not only in response to demands of business leaders and individual investors, but also as a result of the innovative activity of profit-seeking entrepreneurial financial firms.

To put it in a nutshell, in Schumpeter's theory of economic development, new combinations, which are the outcome of negotiations among entrepreneurial businessmen and financiers, lead to process and product innovations but also to new financing relations and financial institutions.²⁸ When Schumpeter was writing his *Theory of Economic Development* (i.e. in the early years of the twentieth century), the institutional background of capitalism was undergoing a process of ongoing change, inducing profit-seeking bankers to accommodate their practices to these successive changes. Each new stage of development reached during this period was

backed up by specific financial tools as well as appropriate financial institutions.

The two main functions of the Schumpeterian banker – as an 'ephor' and as an 'innovator' – examined above, perfectly reflect the specific industrial and financial environment of this historical period of capitalism. First, it may be useful to recall what is *not* the Schumpeterian banker: he or she is not the banker of 'commercial capitalism'.²⁹

Commercial or 'merchant' capitalism springs from European feudal society and has its source in America with the establishment of British colonies in the 1660s. At that time, only trade was financed thanks to the banking system and emerging financial markets. Commercial capitalism is an outgrowth of merchants placing their goods on ships and caravans. Trade at a distance, and therefore payments at distance, requires expertise on behalf of bankers in long-distance merchant practices and in the techniques of international commercial finance. Banking practices of commercial capitalism (i.e. merchant banking) involves both the vouching for the legitimacy of distant trade partners and the financing of goods in transit. The financing of expensive and long-lived capital assets falls outside the domain of banks and organized financial markets. Proprietorships, partnerships, and governments provide the funds for the capital assets of such an economy (Minsky 1993).

The Schumpeterian great waves of innovation, which marked the railroad industry for instance, ended the period of commercial capitalism because the positions to be financed were too great to be handled in the usual way. Innovation in finance was a prerequisite – for the banking structures of merchant capitalism were ill-suited to finance the capital development of the economy. Obviously, Schumpeter's view of the banker as the 'ephor' of the capitalist system – providing finance for innovative, new combinations of resources – does not spring from 'commercial capitalism' but from another specific stage of capitalist development; namely, industrial capitalism that lasted from 1813 to 1890. Industrial capitalism was characterized by the emergence of financial organizations that could mobilize the resources required for factory manufacturing, capital-intensive transportation, mills and mines, and so on.

In Great Britain and the United States, commercial banks were not the main channel used by corporations for financing their expensive

²⁸ See also Minsky (1990, 1993).

²⁹ We use the terminology of Whalen (2001), who identifies five stages of capitalism for US economic history: merchant capitalism (1607–1813), industrial capitalism (1813–1890), banker capitalism (1890–1933), managerial capitalism (1933–1982), and money-manager capitalism (1982–present).

investment is that made the industrial revolution possible.³⁰ While trade was still financed through commercial credit, capital accumulation of these economies mainly depended upon financial markets. The main middlemen of these financing markets were *investment bankers*. This was the era of the houses of Rothschild and Morgan. These bankers acted as brokers when facilitating trade in existing issues and as dealers when underwriting new issues. These new lines of business sprang from the need to trade positions in the liabilities of business organizations and to provide external finance for capital asset ownership:

Stock exchange speculation, especially, and the speculative holding of newly issued stock were in all countries largely financed by banks, which, therefore, always served the purpose of financing long-time investments, at least in this indirect way, even if in no other. (Schumpeter 1939, vol. I, 348)

Those investment bankers who proved to have been able to provide finance for innovative combinations of resources then became the mainstay of economic power, the 'ephor' of the 'exchange' economy. But industrial capitalism was also a period marked by numerous rounds of cutthroat price competition. By threatening the financial health of industrial firms, this competition jeopardized the ability of corporations to fulfil their payment commitments.

Responsible bankers, concerned about the quality of the instruments they sold, '*began to abhor competitive markets*' (Minsky 1993, 109). Morgan, for example, is reported as having said 'I like a little competition; but I like combination better' (quoted by Heilbroner and Singer 1994, 206).

By responding to and accommodating cut-throat competition, investment bankers paved the way for the development of 'banker capitalism' that spread through the United States in the 1880s and 1890s. It is also during this period that the second feature of the Schumpeterian banker (i.e. its entrepreneurial and innovative function) is the most obvious.

In the United States, the emergence of banker capitalism was characterized by investment bankers seeking to protect the cash flows of the firms they financed, which lead them to turn their attention towards the financing of industrial combinations (cartels, trusts, and mergers) a trend not at all impeded by the Sherman Anti-Trust Act. Quite the contrary, a merger wave took place right in its aftermath. For instance, between 1892

³⁰ The banks of this period often combined investment and commercial functions.

and 1902, JP Morgan was instrumental in promoting mergers that created General Electric, American Telephone and Telegraph, International Harvester, and United States Steel (Heilbroner and Singer 1994: 206): 'By 1904, one or two giant firms – usually put together by merger – controlled at least half the output in seventy-eight different countries' (Heilbroner and Singer 1994: 208). At the industry level, investment bankers acquired a controlling position in the economy not only by promoting mergers but also by securing large ownership shares on the boards of directors of newly combined corporations.

Such a phenomenon had already been observed in Germany several years before and noticed by Schumpeter (1939; chapter VII), who praised German industrial credit banks (*Kreditbanken*) for their *entrepreneurial* attitude and for having, thereby, fostered the rise of large industries.

In Germany, during the initial stage of industrialization (1850–1870), few large private banks were financing most of the newly established industrial firms. These banks did not develop as a consequence of industrialization but pre-existed to it. They were enjoying considerable market power in an oligopolistic banking market that was protected by regulatory barriers to entry. They actively promoted investment in industrial technology and engaged in coordination of industrial investments. And these banks acted not only as lenders but also as shareholders, thus pioneering universal banking. *Kreditbanken* played an active role in industrial development combining commercial and investment banking activities and nurturing close relations with industry (Da Rin 1996). Between 1851 and 1870, 259 firms were incorporated – up from 102 in the previous 25 years. Incorporation was typically managed with the help of an industrial credit bank. *Kreditbanken* acted as universal banks, providing loans and securities issue for their clients but also retaining equity positions in those firms.³¹

The personal nature of their business relationships allowed them to gather and circulate information effectively and, thereby, to have a strong influence on investment decisions. As Tilly (1966: 181) argued:

the contribution of German bankers to the mobilization of capital operated not only on the supply side but on the demand side as well; by organizing and alling themselves so closely with industrial enterprises, banks strengthened and in part represented the demand for investment funds.³²

³¹ Rieser (1911: 339–40) described in detail the participations taken by *Kreditbanken* in railways and heavy industries in the 1850s.

³² The great crash of 1929–1933 marked the end of the era in which investment bankers dominated financial markets. In the United States, the role of bankers as the ephors of the decentralized market economy was reduced when

It is very likely that Schumpeter's vision of the banker as an innovator has been inspired by the American and German periods of 'banker capitalism'. These periods indeed perfectly reflect Schumpeter's idea, already underlined above, that 'banking may be the object of entrepreneurial activity' not only because 'the introduction of new banking practices may constitute enterprise' but also because 'bankers may use the means at their command in order to embark upon commercial and industrial enterprise themselves' (Schumpeter 1947: 153).

This vision should, however, be contrasted with the one of Hilferding (1910), who took part, together with Schumpeter, in Böhm-Bawerk's seminars in Vienna. Hilferding endorsed a vision of finance, using the term capital finance, which encompasses both banking and industrial capital. He therefore developed an analysis that undermined the tension existing between industrial and finance capital, maintaining that they are doomed to melt into one single block. According to Hilferding, banks are more powerful in the relationship between finance and industry because: first, money capital stands at distance from the production sphere and hence it achieves some kind of relative autonomy; and second, since banks are able to diversify their assets, the failure of one transaction will not cause their bankruptcy, whereas the industrialists' survival can be threatened by the failure of one single transaction. Therefore, Hilferding concluded that there is a univocal tendency for banking capital to dominate industry. This analysis has been criticized on several grounds (cf. Harris 1988). In particular, Sweezy (1942) argues that industrial capital dominance was the main force in the expansion of capitalism. Industrial capital has acquired its own independence from banking capital by higher rates of internal accumulation. This has allowed industrial capital to reinvest profits in its industries without the need for further ending by the banks. According to Sweezy, Hilferding missed out a very important phase in the development of monopoly capitalism. Although the banks have the power to influence the formation of corporations and mergers, they cannot do so infinitely. In all likelihood, a middle position can be established using the insights of those two extremes. First, the power relationship between industrial and banking capital requires some

government took over the responsibility for the adequacy of profits, of aggregate demand. The flow of profits that followed from the deficits of government meant that the internal cash flows of firms could finance their investments. Management of established firms that had some market power that protected them from competition could be independent of their investment bankers: there was no need to use market intermediaries to finance investment. Firms rather than bankers were the masters of the private economy. (For a more complete analysis, see Whalen 2001 and Minsky 1993.)

kind of balance in order for the accumulation process to proceed. If banking capital has absolute power in this relationship, then it will accrue the whole of the surplus and the accumulation process will stop. On the other hand, if industrial capital plays the lead in appropriating the surplus, the owners of capital will be no longer be willing to lend out money capital. From this perspective, financial innovations can be seen as many tools of adaptations to the tension existing between industrial and banking capital. Moreover, this tension is not constant but it is likely to change during the course of the cycle and the course of change in the capitalist economy so that is should not be analysed in a static context.

Streissler also provides an interesting historical perspective regarding those issues, noting that, in the last two decades before World War One, Austrian bankers did not in fact finance the starting of new enterprises but rather gave old enterprises a new start through the incorporation of existing enterprises and the introduction, in progressive stages, of the common stock thus created on the stock exchange (Streissler 1981: 75). This interpretation gives strong support to the idea that bankers were innovators, not in the field of production but rather in the field of organization. By reorganizing the existing industries and by standing on the demand side of credit, bankers have played an important role in the upsurge of economic growth but it was mainly due to economies of scale of incorporation and the easier access to credit which it made possible (Streissler 1981: 75). Moreover, large banks were mainly financing circulating capital and not investment in new capital goods. But the enormous increase in normal short-term credit and mortgage credit opened new opportunities for financing part of the necessary building for other financial intermediaries: increased finance of a completely traditional type, finance of the non-innovative side of the enterprise, may have set free capital for the innovative investment proper [...] [b]ut it was no conscious effort on behalf of the banks to further innovation' (Streissler 1981: 77). This situation was reinforced by the context of the depressive 1880s, characterized by both dwindling opportunities of government finance and a glutted credit market with declining rates of interest. Although mainly exerting a rather conservative influence, as shown by their reluctance towards competition and their tendency to impede it through the formation of cartels and their policy of caution, large Austrian banks were in the urgent need to find new investment outlets.

What emerges in Schumpeter's analysis of the role of monetary, banking

and financial institutions is the strong emphasis he puts on the process of transformation that those institutions are undergoing. This interpretation is

confirmed by Schumpeter's stance on the problem of emergence of institutions. In particular, in an article dedicated to the fiscal State he wrote in 1918, Schumpeter indicates that:

Above all, there is the possibility, provided by the events described by fiscal theory, of perceiving the laws of social being and the forces which constrain the destinies of people and also the way according to which *concrete* situations, especially specific forms of organizations, can emerge and disappear. (Schumpeter 1918: n. 6, cited in Swedberg 1991: 133)

It is also perfectly in line with what Schumpeter refers as 'patrimonialization' of innovation and business practices. What Schumpeter means by 'patrimonialization' is the process by which some social activities or some social classes tend to disappear because they do not correspond anymore to necessary social functions as they did before (Schumpeter 1951 [1927]: 191–9). One of the key features of this process relates to individual economic behaviour, since Schumpeter emphasizes that the process of patrimonialization goes hand in hand with a process of growing rationalization. This characteristics is well illustrated by Schumpeter's discussion on the role of routines. If he often opposes routines to innovation within the productive sphere, he also makes clear that routines are part of the underlying institutional setting. From this perspective, economic change is also concerned with how routines change. This is why, according to Schumpeter, some social functions such as the entrepreneurial function associated with leadership and innovative behaviour are likely to smooth down or even to disappear, as innovation diffuses within society. The process of 'routinization of innovation' that Schumpeter refers to when referring to 'Trustified Capitalism' in *Capitalism, Socialism and Democracy*, clearly illustrates this point:

This social function is already losing importance and is bound to lose it at an accelerating rate in the future even if the economic process itself of which entrepreneurship was the prime mover went on unabated. For [...] it is much easier now than it has been in the past to do things that lie outside familiar routine – innovation itself being reduced to routine. (Schumpeter 1950b: 132)

This quotation stresses the fact that routines are embedded within society as a whole and illustrates how institutional change is important in order to deal with economic change.

To conclude, our revisiting of Schumpeter gives strong support to an institutionalist interpretation of his work. Moreover, it permits, according

to us, to revive the modern theory of institutions by providing a basis for dealing with institutional change or the dynamics of institutions.

4. Concluding remarks

In this paper, we have shown that Schumpeter's vision of the process of economic development and its associated financing problems is far more complex than it is usually assumed in the literature. We have stressed, in particular, the primary role of institutional change within the process of economic development. This feature is particularly relevant for analysing the relation between the entrepreneur and the banker. We have indeed emphasized that this dyad is submitted to a process of co-evolution through an adaptive process of the financing structures of both the banking system and the firm. In this process, some new institutional arrangements emerge as historical examples of incorporation and capitalization illustrate as well as new financial institutions such as investment banks for instance.

From a more theoretical point of view, we have stressed how the emergence of savings and of interest in the steady-state case induces some institutional change within the financial system of the economy, as the development of the two spheres – the sphere of hoards and reserves and the sphere of capital – that constitute the money market exemplifies. What results from our analysis is that Schumpeter's analysis of economic change cannot be dealt with separately from both his conception of institutional change and his methodological approach. This feature does not preclude an evolutionary interpretation of Schumpeter's works but, if we want to use the term 'evolutionary', we have to stress the specificity of Schumpeter's conception of economic evolution, which involves institutional change as a logical priority. Moreover, since, according to Schumpeter, institutional change occurs both at the individual and collective levels, a 'mechanical' process of selection is irrelevant for explaining both institutional and economic change. We exemplified this Schumpeterian analytical perspective, showing that, even if the entrepreneur and the banker are crucial for the existence of economic development, their emergence is, however, rooted in some underlying institutions.

Acknowledgements

The authors thank the International Center for Economic Research (Turin) for its financial support. They acknowledge remarks by Pascal

Bridel, Harald Hagemann and the two anonymous referees on earlier versions of this paper. The usual caveat applies.

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Abstract

In this paper we provide an institutional interpretation of Schumpeter's analysis of money, banking and finance. We justify this interpretation by considering first Schumpeter's overall methodological perspective, in particular the role played by economic sociology in his approach, and second by showing that the way Schumpeter describes the successive steps

2. Intermédiation financière et innovation

2.2. Innovations bancaires, procyclicité des taux d'intérêt et instabilité financière :

Nasica, E. (2010), “Rational and innovative behaviours at the core of financial crises: banking in Minsky’s theory”, dans D. Papadimitriou et L.R. Wray (éds.), *The Elgar Companion to Hyman P. Minsky*. Northampton: Edward Elgar, p. 160-191.

5 Rational and innovative behaviors at the core of financial crises: banking in Minsky's theory

Eric Nasica

Introduction

The 2007 subprime mortgage crisis underlined the central role played by banks in generating a financial crisis. While this crisis surprised most economists and practitioners, a rereading of Hyman P. Minsky's writings on banking would have probably allowed anticipating a great part of the current dramatic events on money, credit and financial markets.

As is well known, starting in the middle of the 1950s, and for the next 40 years, Hyman P. Minsky developed an original business cycle theory based on a financial conception of economic fluctuations, and more specifically, on the 'Financial Instability Hypothesis (FIH)' (Minsky 1975, 1982 and 1986). This theory is mainly based on the succession of two phases during the business cycle: first, a process of transition toward greater financial fragility of the economy which builds up in the expansionary phase; second, the transition from a financially fragile situation to a situation of recession and then of large amplitude economic crisis.

The aim of this chapter is to specify the nature and the role played by the Minskyan banker in each of the phases of the business cycle. More precisely, we show that financial instability in the Minsky sense is a consequence of specific behaviors adopted by banks along the business cycle and neglected by other banking theories.

The chapter is organized as follows. First, the decision-making environment and the induced rationality of the Minskyan banker are highlighted. We show how the specific banks' rationality explains the process of pro-cyclical financial fragility characterizing the FIH. Second, the behavior of the Minskyan banker in the money market is studied. We show how entrepreneurial and innovative behaviors of commercial banks create an institutional instability and weaken monetary policy tools. These behaviors also explain the pro-cyclical rise in the money market rate. Finally, the behavior of the Minskyan banker in the credit market is analyzed. We focus on how banks' reactions to changes in the financial structure of economic agents (both firms and banks) help to explain the pro-cyclicality of the market credit interest rate and thus the

transition from a financially fragile situation to a situation of financial crisis.

Banks' behavior under uncertainty and pro-cyclical financial fragility

In a general way, Minsky considers that simple observation of financially sophisticated economies shows that problems of imperfect and asymmetric information are essential and are empirically meaningful. In these economies agents (in particular entrepreneurs and bankers) specialize in the activities in which they have a specific informational advantage. The exception is then not asymmetry but rather symmetry of information. When asymmetric information prevails, lenders have access to complete information as to the projects that they finance only inasmuch as investors reveal it voluntarily. Thus, Minsky insists that in a world where 'each participant . . . has private information as well as its own market power' bankers never see a *pro forma* they do not like, since there is an incentive for borrowers to exaggerate the quality of their investment projects (Minsky 1989, p. 177). This observation suggests that there are points of similarity between Minsky's analysis of banking and the approach in terms of credit rationing under asymmetric information developed by new-Keynesian economists. By the way, Minsky himself suggested that 'a convergence between the new and the post-Keynesian economics can be expected, and the result is likely to be fruitful' (Ferri and Minsky 1989, p. 123).

There is no denying that both Minsky's banks and new-Keynesian lenders are 'rational skeptics' with regard to the information provided by borrowers. As expressed by Minsky, 'it is the duty of the "banker" . . . to be skeptic – to reveal the shaky or heroic assumptions and also the unwarranted inferences' (Minsky 1992, p. 23). In the two approaches skepticism leads to the emergence of a set of institutional arrangements whose purpose is to protect the interests of lenders: collateral (or net worth), restrictive covenants, interest rate increases and premiums on external finance that increase its price in proportion to the opportunity cost of self-finance (Minsky 1986, pp. 187–93). In this perspective asymmetric information cannot merely be considered as a minor imperfection of otherwise smoothly performing systems or as an arbitrary or ad hoc assumption. On the contrary, asymmetric information seems to be an inherent characteristic of market economies. Moreover, like in new-Keynesian models, the Minskyan banker limits the availability of finance once it has reached a certain level, thereby creating a form of rationing. As Minsky argues, 'although some risks faced by lenders are expressed in observable increases in interest rates, as leverage increases and the confidence in future cash flows decreases, this observed rise in interest rates is not the full picture of

the rise in financing costs' (Minsky 1986, p. 123). Some agents will then be subject to quantitative constraints insofar as there will be no interest rate that will make banks more willing to grant them more loans.

However, the contributions made by new-Keynesian economists cannot entirely account for the way Minsky describes the behavior of agents, in particular their financial behavior. This is due to the differences in the decision-making environments within which the two approaches are embedded. Even if Minsky does consider problems that arise between agents in situations of asymmetric information, he also emphasizes that these problems occur in a world of fundamental uncertainty, one that has little to do with an environment of probabilistic risk used in new-Keynesian works. Indeed, the approach Minsky develops clearly fits in with Keynesian fundamentalism, as it considers that the concepts of expectations, uncertainty and ignorance are at the heart of Keynes's contribution to economic theory. That is why, in contrast to the new-Keynesians who extensively develop models that depart as little as possible from the premises of neoclassical theory, Minsky unambiguously rejects the axioms considered as fundamental features of new classical economics.

The first axiom he rejects is the one depicting an economic world oblivious of history and 'crucial decisions' (Shackle 1955). Instead Minsky's world is one of complex decision-making where fundamental uncertainty, in the sense of Keynes, dominates and where decisions, once taken, can exhibit over time a strong dose of indeterminacy. It is such an environment of strong uncertainty that must be considered, Minsky believes, in order to provide a relevant description of the way agents behave in the credit market: 'because both bankers and their borrowers are aware of time, they recognize that their current decisions are made in the face of uncertainty' (Minsky 1986, p. 118). This has obviously little to do with the exogenous uncertainty, the probabilistic risk favored by the new-Keynesians. Indeed like Knight for whom 'Uncertainty must be taken in a sense radically distinct from the familiar notion of Risk' (Knight 1921, p. 19), Minsky insists that 'the risks bankers carry are not objective probability phenomena; instead they are uncertainty relations that are subjectively valued' (Minsky 1986, p. 239).

Naturally the overruling character of strong uncertainty induces Minsky to reject a second axiom accepted by new-Keynesian economists, namely that the rationality of economic agents can be depicted by the standard hypothesis of rational expectations. In Minsky's model, considering strong uncertainty leads neither to Lucas's conclusion that we are in the presence of 'economic reasoning of no value', nor to radical indeterminacy of behavior. In line with the works developed by post-Keynesian authors in this area, Minsky's economic agent is driven by 'rational

'spirits' of a different nature.¹ This form of rationality finds strong theoretical underpinnings in Keynes's writings on probabilities (Keynes 1973a) and in the rationality of a conventional kind (Keynes 1973b). It is precisely this form of rationality that characterizes Minsky's analysis of the behavior of banks. Like Kregel for whom 'since expectations are partly formed on the basis of the operation of the economy and partly on the imagination of agents, they are composed both of endogenous and exogenous elements' (Kregel 1995, p. 218), Minsky describes the behavior of banks as based on 'objective' endogenous variables and on aspects determined in a conventional or 'subjective' fashion. As Minsky explains, 'an increase in debtors who find it difficult or impossible to fulfill their commitments on debts will induce bankers to be skeptical of new proposals for debt financing, even as nonfulfillment of debt contracts by business decreases available bankers' funds' (Minsky 1986, p. 118). To this objective factor influencing the formation of banks' expectations, there is an added subjective component. It implies that realized outcomes (for example, the quantity of loans that has been repaid) can induce banks to modify their decisions as to the amount of credit to be granted, independently of how these outcomes fit in with their expectations. This means in particular that, even if results merely confirm the 'banks' expectations, it is likely that, encouraged by increased confidence in their forecasting methods, they will make more loans. Accordingly, the longer the period during which the debt to equity ratio of the economy remains at a certain level without provoking a financial crisis, the more banks are likely to raise their estimates of the maximum level of indebtedness (in proportion to the value of assets both they and potential borrowers hold) to which it is prudent to agree.

This process of pro-cyclical fragility also affects banks' balance sheets. Indeed, competition among banks leads them to increase their indebtedness in proportion to the amount of their equity, reserves and safe assets (such as government securities). How banks undergo the process of balance sheet fragility is explained in Chapter 10 of *Stabilizing an Unstable Economy*, which Minsky devotes to banking (Minsky 1986, p. 223–53). He shows very simply that the profit-seeking behavior of banks leads them to reduce deliberately their equity-to-assets ratio when their activity is expanding. That is because even a small reduction in this ratio is likely to lead to large increases in the rate of profit as well as to a rapid increase in the size of the banks' total assets. Expansion thus encourages them to engage in financial operations involving high leverage.² Conversely, when the economy is slowing down, banks will seek to increase their equity-to-assets ratio in order to protect their shareholders against possible losses resulting from the default of borrowers. Thus, as a result of competition,

the equity-to-assets ratio of commercial banks is subject to change during the business cycle, inasmuch as its evolution tends to be countercyclical. Some authors claim to have detected a weakness or at least a certain looseness in this part of Minsky's theory. The question they raise is whether an increase in debt to equity ratios and thus in financial fragility is likely to occur. According to some commentators Minsky's model is inconsistent insofar as, while and even though agents might consider a depression or a financial crisis to be in the offing, the way they compose their portfolios actually tends to increase the likelihood of the crisis. In particular, for Friedman and Laibson, 'some element of myopia is a crucial ingredient here as well' (Friedman and Laibson 1989, p. 169). A similar point of view is voiced by Tobin who, commenting on Minsky's approach, writes 'rational expectations adherents will doubtless object that the alleged cycle would vanish as soon as borrowers and lenders understood it' (Tobin 1989, p. 106).

This argument hardly stands up because one variable remains unknown by banks and other economic agents, namely the exact moment at which the financial crisis will actually break out. Now this variable is a crucial one, inasmuch as today's market economies are characterized by an 'asymmetric reward structure' (Dymski and Pollin 1992). This means that for the individual financial or non-financial firm it is in no way profitable to engage in 'hedge' finance during an economic boom. In fact, a firm that would not make use of all available leverage would run the risk of seeing its market value drop (since, among other reasons, it would distribute fewer dividends than other, more indebted, firms). Moreover, in the long run, it would not be able to remain competitive. As a result, when prosperity wanes, aggressive managers will already have been rewarded, while hedge managers, if they have not been eliminated, will have made lower profits. In addition, during a crisis many aggressive managers default, so that the responsibility of financial distress falls on no one in particular, in sharp contrast to the situation prevailing during the boom where exaggeratedly cautious agents find themselves in an isolated position. The same idea was expressed by Keynes many years ago, in Chapter 12 of the *General Theory*:

'worldly wisdom teaches that it is better for reputation to fail conventionally than to succeed unconventionally' (Keynes 1973b, p. 158).

This discussion clearly establishes that Minsky's banker is neither irrational nor myopic. Simply, he or she must form expectations and make decisions in an uncertain decision-making environment characterized by an asymmetrical reward structure. As a result, financial fragility builds up endogenously in the expansionary phase because it is then individually rational for banks to make more loans (and for firms to issue more debt).³ Notwithstanding the opinion of Friedman and Laibson, Minsky's idea

that 'even as agents note the unfavourable objective circumstances, their significance for today is discounted' (Minsky 1989, p. 181) is not 'based upon 'behavioral underpinnings [that] have remained vague' (Friedman and Laibson 1989, p. 161). Minsky's banker is fully rational. He or she is, however, subject to a particular form of rationality.

Innovative bankers and the money market

We have just shown that banks' behavior under uncertainty generates the process of pro-cyclical financial fragility characterizing the first phase of the FIH. Let us see now how banks' behavior also explains the second phase of Minsky's theory of the business cycle, namely the transition from a financially fragile situation to a situation of financial and economic instability. The main determinant of this transition is an increase in interest rates in both money and credit markets that is likely to lead to present-value reversals when the weight of speculative and Ponzi finance is great. Increases in the interest rate also lead to less investment and thus to reductions in the aggregate flow of profits. A situation of this kind can lead to a liquidity run: firms that cannot meet their payment commitments either from their proceeds or through borrowings must sell off part of their assets (Minsky 1986, pp. 216–17 and 1988, pp. 22–8). Such sales cause asset prices to collapse, which might turn a recession into an economic depression. In the following argument, we highlight how entrepreneurial and innovative behaviors of commercial banks explain the pro-cyclical rise in the money market rate. This part of Minsky's theory is inspired by several theoretical influences recalled below.

A 'Tobin–Schumpeter' view of banking

A key feature of Minsky's analysis is the fact that the behavior of banks is guided essentially by the permanent quest for profit opportunities. This view lessens to a great extent the distinction between banks, other financial institutions and non-financial agents. Indeed,

the line between commercial banks, whose liabilities include checking deposits, other depository thrift institutions, miscellaneous managers of money (like insurance companies, pension funds and various investment trusts), and investment bankers is more reflective of the legal environment and institutional history than of the economic function of these financial institutions. (Minsky 1986, p. 223)

For similar reasons the distinction between financial institutions and non-financial agents does not seem crucial to him: 'banks and bankers are not passive managers of money to lend or to invest; they are in business to maximize profits. They actively solicit borrowing customers,

undertake financing commitments, build connections with business and other bankers, and seek funds' (Minsky 1986, pp. 229–30).

Interestingly, this aspect of Minsky's theory is reminiscent of the approach developed in Tobin's article 'Commercial banks as creators of money' (1963), in which Tobin contrasts the 'old view' on banking with the 'new view'. Like Minsky, Tobin and the supporters of the new view make no clear distinction between banks and other financial institutions, or between what Gurley and Shaw call the 'monetary system' – comprising the commercial banks and the Fed – and the 'other financial intermediaries' (Gurley and Shaw 1956, pp. 260–61). All these financial agents are 'financial intermediaries' whose main and characteristic function is to 'satisfy simultaneously the portfolio preferences of . . . borrowers [and] lenders' (Tobin 1963, p. 274). Another important resemblance between banks and other financial institutions is related to the Marshallian behavior adopted by all financial intermediaries. As with 'nonfinancial industries', their supply will go on increasing as long as 'the marginal returns on lending and investing . . . will not exceed the marginal cost to banks of attracting and holding additional deposits' (Tobin 1963, p. 277, 281).

Thus, in the absence of reserve requirements, 'expansion of credit and deposits by the commercial banking system would be limited by the availability of assets at yields sufficient to compensate banks for the costs of attracting and holding the corresponding deposits' (Tobin 1963, p. 279).

Accordingly, it is the regulatory restrictions (reserve requirements and interest rate ceilings) imposed only upon banks rather than the monetary nature of their liabilities that underpin the relation between reserves and deposits, as determined by the customary money multiplier. However, as noted by Tobin, even in presence of such regulatory constraints, the simple money multiplier does not necessarily apply to all increases of reserves: the level of deposits and of bank assets is in fact also influenced by 'depositor preferences' as well as by the 'lending and investing opportunities' offered to banks (Tobin 1963, pp. 279–81).

Thus, Minsky's analysis of banking, by attenuating the distinction between commercial banks and other financial intermediaries, and between money and other financial assets, but also by underscoring the entrepreneurial behavior of banks, is akin to the one developed by the new view. However, the two approaches also display differences. Even though Tobin argues that changes in depositors' preferences can affect the lending capacity of banks, he does not seem to fully size up the role played by banks' active management of assets and liabilities as a way of, first, untightening the regulatory quantitative constraints to which they are subjected and, second, simply carrying out their profit-seeking activity. On the contrary, Minsky insists that banks are entrepreneurial firms whose innovations

allow greater profits: new financial instruments, new financial procedures and new financial institutions are in particular created by innovative bankers who receive monopoly rents that disappear as innovations diffuse (Minsky 1990, 1993). This view is akin to Schumpeter's analysis of banking. According to the Austrian author, in a capitalist environment, bankers perform an entrepreneurial function, which is by no means less important than the one of business entrepreneurs for economic development. Clearly financial institutions and practices appear and disappear. Thus, Schumpeterian creation and destruction occur also in the field of finance, as well as innovation, whether it takes the form of product, process or organizational innovation or whether it consists in incremental or radical change. Moreover, new types of financing media may emerge and thereby trigger further process and product innovation. Though not often stressed by commentators, this feature of bankers was emphasized by Schumpeter. He indeed noted that

financial institutions and practices enter our circle of problems in three ways: they are 'auxiliary and conditioning'; banking may be the object of entrepreneurial activity, that is to say, the introduction of new banking practices may constitute enterprise; and bankers (or other 'financiers') may use the means at their command in order to embark upon commercial and industrial enterprise themselves (for example John Law). (Schumpeter 1947 [1989], p. 153).

Like Schumpeter, Minsky perfectly understood that financial institutions are also entrepreneurial organizations striving to innovate in order to generate capital gains. This implies that financial systems evolve not only in response to demands of business firms and individual investors but also as a result of the innovative activity of profit-seeking entrepreneurial financial firms. As will be seen below, the innovative and entrepreneurial behavior of commercial banks is at the core of Minsky's explanation of endogenous macroeconomic instability.

Money policy and banking innovation

The elements central to Minsky's analysis of banking were defined some fifty years ago, in his very first article, 'Central banking and money market changes' (1957). This article offers a clear picture of Minsky's complex analysis of endogenous money supply. It also highlights the entrepreneurial and innovative behavior of commercial banks, with the effects such behavior has on the determination of the money market interest rate.

In the article, Minsky analyzes the case where the central bank is implementing a restrictive monetary policy (Minsky 1957, pp. 182–4). Monetary authorities apply a policy of this kind when they fear that economic expansion might generate inflation, a policy that causes an increase in the

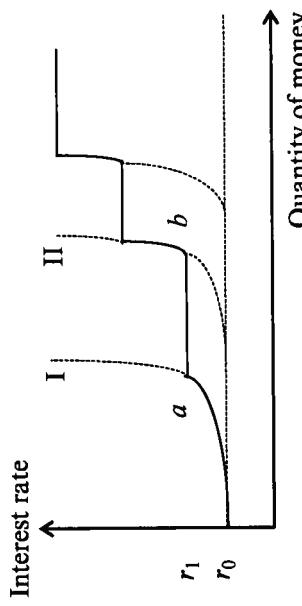


Figure 5.1 Banking innovation and the money market rate

interest rate, owing to 'a vigorous demand for financing relative to the available supply' (Minsky 1957, p. 172). Two possibilities are considered. The first consists in reasoning within a stable institutional environment, one where 'a tight money policy will be effective and the interest rate will rise to whatever extent is necessary in order to restrict the demand for financing to the essentially inelastic supply ... This can be represented as a positively sloped curve between velocity and the interest rate' (Minsky 1957, p. 182). Institutional stability is not, however, Minsky's main focus. At the beginning of the 1950s changes began affecting the money market, as the markets for Federal funds and for repurchase agreements emerged and expanded. For Minsky these evolutions simply reflected the existence of a form of institutional instability governed by the profit-seeking and innovative behavior of commercial banks.

The process described in the 1957 article unfolds as follows. Rising interest rates act as a signal which private market operators interpret as new profit opportunities. Higher interest rates imply that greater opportunity costs affect the excess reserves held by commercial banks. Their incentive is therefore to lend these reserves to the Federal funds market. Besides, the Federal funds rate is always lower than the discount rate, Minsky observes (Minsky 1957, p. 174). This is a circumstance banks short of reserves will take advantage of, as will non-bank financial institutions, such as government bond houses, induced to make borrowings by issuing repurchase agreements that non-financial firms acquire. This is made all the easier because high interest rates will lead such firms to move away from non-interest-bearing demand deposits and seek more profitable ways of investing their money.⁴ Thus the increase in interest rates creates an environment propitious to the emergence and the development of financial innovations.

An important outcome of such innovations is that they increase the velocity of money and thereby the quantity of money supplied to potential borrowers. Two main factors explain the relationship that develops between the rise in velocity and the increase in the quantity of money. In the first place, greater reliance by banks on the market for Federal funds allows a larger volume of demand deposits for a given amount of central bank money: 'a given volume of reserves now supports more deposits' (Minsky 1957, p. 181). In the second place, the innovative process described earlier implies that the assets held by commercial banks undergo two important changes: (1) the proportion invested in short-term government securities, such as Treasury bills, diminishes as higher rates persuade non-financial firms to increase their holdings of such assets; and (2) lending to government bond houses also declines as these agents now collect a large amount of funds from non-financial firms through issues of

repurchase agreements. As a result, for a determined volume of demand deposits, a larger amount of bank loans is granted to firms (Minsky 1957, p. 182). Why Minsky identifies these various changes, affecting the balance sheets of banks and brought about by the innovative process, with an increase in bank reserves thus becomes clear, as well as why both velocity and the quantity of money increase when economic activity expands (Minsky 1957, p. 182).

These changes that concern the money market thus create institutional instability, which gives rise to rightwards shifts in the interest rate–velocity curve. An upward-stepped money supply curve obtains, similar to the one represented in Figure 5.1. The increasing portions of the curve depict the effect of a restrictive monetary policy on the interest rate when the institutional environment remains stable. However, such increases do not last indefinitely, as an increase in the interest rate (for instance, from r_0 to r_1) creates profit opportunities, money market innovations and thus institutional instability, as described by the curve shift from I to II. A plateau, $a\rightarrow b$, appears, which characterizes the period during which institutional innovation is spreading.

During this period the impact on the interest rate of a restrictive monetary policy is completely counteracted, while the velocity of circulation and the supply of money appear to be infinitely elastic. As stressed by Minsky, in such a context the effectiveness of monetary policy based on the surveillance of monetary aggregates weakens. As a result, in order to fight inflation, the central bank has no other choice than to act directly on the liquidity of commercial banks. It will therefore try to diminish reserves to an extent that is great enough to compensate for the increase in velocity. This reaction to the profit-seeking and innovating behavior of commercial banks will have the effect of pushing up interest rates even more, thus recreating the conditions for the whole process to recur. Hence

the succession, over time, of the increasing and horizontal portions of the curves represented in the figure.

Moreover, the institutional innovative process also exerts a negative influence on the liquidity of the economy. In other words, the innovative process described earlier is likely to lead to a situation where the economy becomes less liquid although the quantity of money is rising. As Minsky writes, ‘the reverse side of the coin to the increase in velocity is that every institutional innovation which results in both new ways to finance business and new substitutes for cash assets decreases the liquidity of the economy’ (Minsky 1957, p. 184). This evolution is mainly due to the particular form of rationality that Minsky’s banks exhibit when decisions are taken within an environment of Keynesian uncertainty.

As noted earlier, such rationality rests upon objective bases, but also on more conventional or subjective grounds. This means that, even if actual outcomes only confirm banks’ expectations, it is likely that, on account of their increased confidence in the way they are forming their expectations, banks will augment their lending and contribute to making the economy less liquid. Reduced liquidity of the economy is in fact caused by the deterioration of the financial structure of borrowers and lenders, as manifested in the rise in the debt-to-net-worth ratio (Minsky 1957, p. 185). Moreover profit-seeking by both financial and non-financial agents implies decreased liquidity of holdings. On the one hand, it leads to the substitution in commercial banks’ portfolios of private debt for government securities. It reflects, on the other hand, the replacement of deposits in firms’ portfolios by government debt and, at a later stage, of government debt by repurchase agreements issued by government security houses.

It is interesting to stress here the particular features of the money supply curve. They afford a good understanding of the complexity of Minsky’s reasoning and of its originality within post-Keynesian theory. In the latter, especially in the ‘horizontalist’ view (Moore 1988), the quantity of money is to a large extent determined by the demand for credit by entrepreneurs and is thus influenced by the level of effective demand. In other words it is the animal spirits of entrepreneurs that play the key role in the dynamics of money: any increase in the demand for money will increase the equilibrium amount of money, without any effect on the interest rate. The money supply is endogenous and adapts both completely and passively to the demand for money. On the contrary, interest rates are determined exogenously by the central bank. In short, one can qualify post-Keynesian horizontalism as an approach in which the money supply is endogenous and the interest rate exogenous.

There is thus a substantial divergence between Minsky and post-Keynesian horizontalists in the interpretation of the relationship between

the central bank and the commercial banks. For Minsky the way commercial banks react to profit opportunities and to the policy conducted by the central bank prevents the latter from setting the interest rate at the level it deems desirable. The evolution of this rate depends strongly on the succession of phases of institutional stability and instability induced by the active and innovative behavior of the commercial banks. The horizontalist conception of the money supply is thus rejected in Minsky’s interpretation, which makes room for an interest rate that is not entirely exogenous even though the money supply is endogenous. In addition, the money market interest rate behaves pro-cyclically: its increase simply reflects the dynamic process that takes place under the influence of the innovations of commercial banks confronting the restrictive reactions of the central bank when the economy expands.

Agents’ financial structure and the credit market

Minskyan bankers’ behavior explains not only the pro-cyclical rise in the money but also in the credit market rate. We underline below how banks’ reactions to changes in the financial structure of economic agents explain the pro-cyclicity of the market credit interest rate and thus the transition from a financially fragile situation to a situation of financial crisis.

Banks’ liquidity preference

With the effects of institutional innovation presented above the economy becomes subject to a greater risk of illiquidity, which in turn leads to greater liquidity preference. As stated by Minsky, ‘economic units . . . desire more liquidity. A tendency to use savings to liquidate debt and hence to increase the ratio of net worth to debt will arise’ (Minsky 1957, p. 186). To understand the impact of increased liquidity preference, it is necessary to observe that it is not equivalent to a larger demand for money. Reliance here on the distinction established by Wray (1992) is very helpful. According to Wray an increase in liquidity preference (the desire to exchange illiquid assets for more liquid ones) is actually the opposite of demanding more money, that is, demanding more funds because spending is expected to augment. Applied to Minsky’s analysis of banking, this means that an increase in liquidity preference should be understood as not having the same effect on the interest rate as a greater demand for money. In fact, as seen previously, not only are banks eager (because of profit opportunities), they are also able (thanks to liability management) to respond to borrowers’ larger demand for money. To the contrary, it is unlikely that banks will as easily agree to raise their supply of money in a context of enhanced liquidity preference. For Minsky, as for other post-Keynesian authors, such an increase in liquidity preference is associated with a reduction in anticipated profits,

an environment that does not encourage commercial banks to develop their assets or to augment their supply of finance.⁵ In fact, a situation of 'generalized liquidity preference' arises, since it concerns not only households and firms, but also banks. Although it might be assumed that borrowers would share the same expectations as banks and, as a result, would reduce their demand for money, Minsky reminds us that there is in fact an 'inelastic demand for finance', due in particular to the existence of investment projects displaying very long gestation periods and thereby requiring the roll-over of debt for the repayment of principal.⁶

The confrontation between a supply of money that is inclined to diminish under the influence of the preference by banks for greater liquidity and a demand for money that tends to become more inelastic during the ascending phase of the business cycle reinforces the pro-cyclicality of the interest rate.

Borrower's and lender's risk

Independent of any variation in liquidity preference, a second aspect, the indebtedness of the economy, also plays a fundamental role in the determination of the interest rate. In fact, as argued by Minsky as early as in 1957, the increase of the debt ratio is likely to exert an upward pressure on the financial conditions granted to borrowing agents (Minsky 1957, p. 185). To understand this, account must be taken of the way the financial structures of both borrowers and lenders evolve.

In Minsky's analysis, the evolution of the borrower's financial structure affects the lender's as well as the borrower's risk. When he refers to the lender's risk, Minsky clearly alludes to Keynes's definition in Chapter 11 of *The General Theory*.⁷ However, whereas Keynes relates the lender's risk to the decision to invest and to the comparative uncertainty of long-run expectations, Minsky also considers different types of financial structure. Indeed, notwithstanding the amount that can be self-financed, investment of whatever level involves issuing debt. The greater the size of its investments, the higher the risk that a business will default, which is reflected in the financial conditions applied by banks. To that effect 'some risks faced by lenders are expressed in observable increases in interest rates, as leverage increases and the confidence in cash-flows decreases' (Minsky 1986, p. 193). Other effects of the increase in the lender's risk are that it can give rise to loans of shorter maturity, or loans of smaller amounts, or to restrictions in dividend payouts.

While the lender's risk can be clearly observed in loan contracts, Minsky notes that the relationship between financial structure and financial conditions also takes a more subjective appearance, in the form of the borrower's risk. Here again the author acknowledges his indebtedness

to Keynes.⁸ Yet, reference to the principle of increasing risk first brought to light by Kalecki (1937) is even clearer.⁹ Indeed, in Minsky's approach the borrower's risk is the manifestation that, beyond the amount that can be self-financed, investment implies financial costs that are inescapable, whereas the cash flows generated by production are unquestionably uncertain. Therefore 'the borrower's risk will increase as the weight of external or liquidity diminishing financing increases' (Minsky 1986, p. 191). Then, because a bank loan is to a large extent granted on the basis of the debtor's expected profits, the bank's risk increases in line with the borrower's risk. It is therefore likely that an increase of the borrower's risk will lead, as with a greater lender's risk, to a rise in the interest rate charged on bank loans.

The relationship between the liability structure of borrowers and the financial conditions imposed upon them is an essential aspect of Minsky's explanation of interest rate determination. It is also one that is well known, as it underpins his financial theory of investment. Nonetheless, a second aspect of his analysis, one that is not quite so familiar, deserves to be examined. It concerns the effect on the interest rate of changes affecting the balance sheet structure of banks.

As mentioned before, competition among banks leads them to deteriorate their balance-sheets pro-cyclically. This has two implications. First, banks that have become financially more fragile because of high leverage may be confronted with steadily increasing refinancing costs, owing to the 'collegiate surveillance' exerted by banks and other institutions operating in the money market (Minsky 1986, p. 240). As is likely, banks that face growing borrowing costs in the money market will be inclined to pass them on to the rates they charge, thereby endogenously contributing to the higher interest rates on bank loans.

Second, increased leverage of banks is also at the heart of a second kind of upwards pressure exerted on bank loans. The reason, already noted by Minsky in 1957, is that 'the chances of insolvency and illiquidity [of commercial banks] increase simultaneously', which persuades them to demand higher interest rates in order to compensate for the increasing risk associated with the greater size of their assets (Minsky 1957, p. 185). Minsky thus proposes an enlarged view of the lender's risk since, in the present case, it no longer refers only to the borrower's financial structure, but also to the bank's.

Again, Minsky manifests his differences with other post-Keynesian theorists. Indeed, in the horizontalist approach commercial banks are extraordinarily passive, both in the money market where the interest rate is fixed exogenously by the central bank and in the market for loans where they respond automatically to 'borrowers' demands. In this approach

commercial banks do not exert any significant influence on prices and quantities in the markets where they operate. In contrast, Minsky's commercial banks recover a more active role in the determination of prices and quantities both in the money market and, as has just been seen, in the loans market. In Minsky's view of banking, the endogeneity of the money supply is no longer synonymous with the passivity of commercial banks.

Conclusion

In this chapter we analyzed Minsky's theory of banking. This theory is somewhat an extension of the approach proposed by the new-Keynesians since Minsky believes that asymmetric information does exert some influence on the behavior of agents, in particular of those operating in capital markets. However the existence of this kind of imperfection cannot be considered as a necessary condition for there to be credit rationing or, more generally, constraints of some sort in the financial markets. The essential reason for this, as we have seen, is that, in Minsky's theory, financial arrangements are set up within a decision-making environment where asymmetric information and Keynesian uncertainty in fact coexist. Keynesian uncertainty, which has nothing to do with the probabilistic risk retained by the new-Keynesians, induces banks to adopt, independently of any effect of asymmetric information, a whole range of behaviors that go far beyond the rationing of the demand for loans in the credit market. Indeed, when Keynesian uncertainty prevails, the adoption of behaviors that are based upon a particular form of rationality, where conventions and animal spirits play an important role, implies that bankers, like other economic agents, do not act as do the robot-like decision-makers of the rational expectations theory. Other behaviors and other variables are to be considered: the level reached by the agents' indebtedness, the ratios of indebtedness that are judged acceptable, changes in the 'state of confidence', the liquidity preference of banks and the related appearance of financial and endogenous instability.

By focusing his analysis on active and innovative commercial banks, Minsky stands also clearly apart from the horizontalists whose positions are still widely shared by many post-Keynesian theorists of the endogenous money supply. This can be explained by the fact that numerous theoretical influences have inspired Minsky's analysis of banking. His ability to integrate the contributions of authors as different as Keynes, Schumpeter or Kalecki within a single consistent setting has allowed him to investigate certain aspects that are often lacking in even recent Keynesian analyses of banking: financial innovation, fundamental uncertainty, increasing risk, the financial structure and the liquidity preference of banks.

Finally, the pivotal role played by Minsky's analysis of banking within

his theory of economic instability was highlighted. Taking banks and their behavior into account has enabled Minsky to lay down the foundations for an original approach of economic fluctuations. Organized around the study of the dynamics of financial relationships, his approach shows that the rational profit-seeking and innovative behavior of banks produces both financial fragility and financial instability. The behavior of banks, an aspect that is often neglected by commentators of Minsky's approach, thus appears to be one of the most important ingredients of the FIH. It is central to understand the complex financial relations that can trigger the kind of dramatic episode of financial crisis experienced in 2007 in 'financially sophisticated economies'. More generally, it deserves to be taken into account in all of its complexity by theorists interested in the relation between banking and economic instability.

Notes

1. See, in particular, Kregel (1987) and Davidson (1982–83). The phrase 'rational spirits' has been coined by Kregel (1987).

2. 'The impact of increased leverage on bank profits is impressive: if a bank that makes 0.75 per cent on assets decreases the ratio of capital to assets to 5 per cent from 6 per cent, the profit rate on book value will be 15.0 per cent rather than 12.5 per cent. If such an increase in leverage takes place over several years, the profit rate will rise each year. With a constant dividend on book value ratio, this implies that the growth rate mandated by retained earnings will rise from 7.5 to 10 per cent.' (Minsky 1986, p. 237).

3. Minsky proposed characterizing financial fragility by separating firms into three categories. He distinguished between 'hedge', 'speculative' and 'Ponzi' finance. Hedge finance is a situation where, in each period, debt repayments are smaller than expected profits. Firms that resort to speculative finance generate proceeds that allow for the payment of short-term interest charges, but which are sometimes lower than the corresponding total debt repayment costs (principal and interest). For businesses engaged in Ponzi finance, even repayment of interest is impossible without reliance on additional debt. The larger the proportion of agents engaged in speculative and Ponzi finance, the more fragile is the economy because it loses its shock-absorbing ability.

4. As Minsky explains, non-financial firms became the main source of finance for government bond houses in the middle of 1956.

5. See for instance, Minsky (1975, p. 76, 123).

6. Minsky (1986, p. 195). Consequently, the demand for money will be less elastic inasmuch as the economy exhibits greater financial fragility.

7. '[T]he lender's risk ... may be due either to moral hazard, i.e. voluntary default or other means of escape, possibly lawful, from the fulfilment of the obligation, or to the possible insufficiency of the margin of security, i.e. involuntary default due to the disappointment of expectation' (Keynes 1973b, p. 144).

8. 'The entrepreneur's or borrower's risk ... arises out of doubts in his own mind as to the probability of his actually earning the prospective yield for which he hopes' (Keynes 1973b, p. 144).

9. According to this principle, the marginal risk of investing in fixed capital goods increases with the size of their acquisition. Kalecki gives two reasons for this increase. First, the more he invests, the greater the risk of failure to which the entrepreneur's wealth is exposed. The second reason relates to the illiquidity risk that arises when increasing quantities of capital are invested in industrial facilities that cannot be readily reconverted into liquidity without generating capital losses.

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6 What would Minsky do?

Marshall Auerback, Paul McCulley and Robert W. Parentau

Hy Minsky's framework has a very simple core thesis. Stability is destabilizing, because market participants, or economic agents, behaving as human beings do in the face of fundamental uncertainty, will tend to extrapolate stability well into the future. And, if stability is extrapolated into the future, then there will be a tendency for economic agents to assume ever more risky debt structures. In this sense, the world of financial and economic decision making is inherently momentum-driven – human beings are inherently reflexive. Intellectually, we know we are supposed to buy low and sell high. Emotionally, we can't bring ourselves to do that. Rather, we tend to do the exact opposite, which imparts an intense procyclical character to capitalism. Perhaps even worse, it imparts procyclicality to regulatory structures.

While in the financial press, reference to the ‘Minsky Moment’ – the dramatic point when a financial crisis erupts – has become increasingly popular, it is important to understand that Minsky described financial fragility as an inherent process that builds over time, and not just a random event.

For the past several years, we have traversed an economic expansion fueled by debt and accompanied by leveraged speculation of unprecedented proportions. While some central banks expressed concern, we have witnessed the development of a parallel, largely unregulated financial system dominated by hedge funds, private equity funds, and investment banks employing derivatives and structured finance vehicles. The concern was rooted in the knowledge that throughout history, when debt financed speculation runs amok, bad things can happen. As early as 2004, PIMCO's Bill Gross warned:

We are hooked on debt; we are a finance-based economy. And so? Why not just keep on going. So far so good the New Agers would claim. What's wrong with 400% of GDP or 500% of GDP? What's wrong with dropping it from helicopters if we have to as good Ben Bernanke has suggested? Well, let me tell you what's wrong. Debt levels and debt ratios have limits. When and if interest rates do go up, the servicing costs of an accelerating debt economy eventually bite the hand of its master. My point is that at some point on this seemingly never ending ascent of debt/

2. Intermédiation financière et innovation

2.3. Evolution des modes de financement et nouvelles formes d'intermédiation : l'exemple du private equity :

Dufour, D. et Nasica, E. (2007) “Incertitude, rationalité et confiance dans les choix d’investissement : une analyse de la relation entre marchés financiers et capital-risque”, *Revue d’Economie Industrielle*, n° 120, 4^{ème} trim, p. 103-124.

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INCERTITUDE, RATIONALITÉ
ET CONFIANCE
DANS LES CHOIX D'INVESTISSEMENT :
UNE ANALYSE DE LA RELATION
ENTRE MARCHÉS FINANCIERS
ET CAPITAL-RISQUE ⁽¹⁾

Mots-clés: Capital-risque, venture capital, rationalité limitée, heuristique de disponibilité, confiance.

Key words:

INTRODUCTION

La littérature consacrée aux déterminants du capital-risque insiste sur la relation positive existant entre le montant des fonds investis dans cette activité et la situation prévalant sur les marchés financiers. Ceci n'est pas surprenant dans la mesure où des anticipations d'introductions en bourse favorables, synonymes de plus-values importantes pour les capital-risqueurs, sont des incitations essentielles pour le marché du capital-risque. Cependant, au cours des dernières années, la relation entre marchés financiers et activité de capital-risque apparaît beaucoup moins claire : les comportements récents d'investissement des capital-risqueurs semblent s'être sensiblement et durablement

(1) Les auteurs remercient les rapporteurs anonymes de leurs remarques et suggestions.

déconnectés de l'évolution des marchés financiers. Nous avons choisi d'expliquer ce phénomène en fondant notre analyse sur un élément essentiel mais généralement négligé dans la littérature : la forme spécifique de rationalité adoptée par les capital-risqueurs dans leurs choix d'investissement.

Dans la première partie de l'article (section 1), nous présentons les arguments théoriques et empiriques qui fondent l'existence d'une relation entre la situation prévalant sur les marchés financiers et les investissements en capital-risque.

Dans un second temps (section 2), nous rappelons les particularités de l'environnement décisionnel dans lequel évoluent les intervenants sur le marché du capital-risque. C'est cet environnement décisionnel spécifique qui conditionne le choix des outils analytiques appropriés à l'étude de la rationalité des sociétés de capital-risque.

Nous présentons ensuite (section 3) un modèle, inspiré des approches en termes de rationalité limitée, formalisant les comportements d'investissement des sociétés de capital-risque. Ce modèle met en évidence les raisons pour lesquelles une société de capital-risque peut, en adoptant certaines règles de décisions rationnelles en situation d'incertitude, modifier sensiblement le volume et la forme de ses investissements au cours du temps. Plus précisément, ce modèle caractérise les comportements des capital-risqueurs par deux traits distinctifs : le premier est une *sur-réaction* de la part des intervenants sur le marché du capital-risque qui les conduit à diminuer brutalement et sensiblement la pondération du facteur marchés financiers dans leur processus de décision d'investissement ; le deuxième est une *rigidification* des comportements des capital-risqueurs conduisant ces derniers à répéter de période en période le même type de comportement en matière d'investissement, induisant par là même une déconnexion entre les choix d'investissement et l'évolution des performances du marché financier.

Enfin, nous analysons de manière statistique les caractéristiques de la relation entre l'évolution des marchés financiers et l'investissement en capital-risque sur la période récente (1999-2006) en nous basant sur le cas de la France. Les résultats statistiques obtenus sont ensuite interprétés à la lumière du modèle théorique que nous proposons (section 4).

I. — LA RELATION ENTRE MARCHÉS FINANCIERS ET CAPITAL-RISQUE

Le capital-risque est l'une des composantes du capital-investissement. Il est possible, au sens large, de considérer toute activité d'apport de fonds propres à des sociétés non cotées comme des opérations de capital-investissement. Le capital-investissement regroupe trois grandes rubriques : le capital-risque, le capital-développement et le capital-reprise/transmission d'entreprise. Le capital-développement et le capital-reprise/transmission d'entreprise concernent le

financement de firmes ayant déjà plusieurs années d'existence : elles ont dépassé la phase de démarrage et se situent en phase de croissance, voire de maturité (2).

Le capital-risque au sens strict, sur lequel est centré cet article, est réservé aux opérations d'investissement dans des entreprises en création ou dans de jeunes entreprises technologiques. Ce type de financement fait intervenir trois métiers bien distincts. Le premier est le *seed capital* ou capital d'amorçage : c'est le financement très en amont du démarrage de l'entreprise. L'objectif de cette levée de fonds est de prouver la faisabilité de l'idée ou du projet. La finalité de cette étape est de permettre l'élaboration du plan de développement ou plan d'affaires (*business plan*) pour convaincre des investisseurs de financer le lancement d'un nouveau projet. Le second métier du capital-risque est le capital-création. C'est le financement du démarrage proprement dit (*start up*) de l'entreprise. Il concerne le « premier tour de table » et les premières années de vie de l'entreprise. La troisième et dernière activité formant le capital-risque est le financement de la phase de post-création ou phase de première croissance (*early stage*). Elle concerne les deux ou trois premières années de démarrage de l'entreprise. Elle va jusqu'au stade du lancement industriel et commercial du projet.

Pour mieux comprendre l'influence des marchés financiers sur l'activité de capital-risque, il est primordial d'expliciter ce que Gompers et Lerner (2001) appellent le « cycle du capital-investissement ». Ce cycle comprend une succession de trois grandes phases. Il débute par une levée de fonds du capital-risqueur auprès d'agents économiques désireux d'investir dans des entreprises non cotées. Une deuxième phase correspond à l'investissement dans l'entreprise proprement dit. L'apport de fonds propres s'accompagne de la mise en place par le capital-risqueur de procédures de contrôle (3) visant à limiter le

- (2) Au cours de son développement, l'entreprise a besoin de capitaux propres pour financer sa croissance ou pour franchir une nouvelle étape (renforcement de la politique commerciale, réajustement au niveau de la production, lancement d'un nouveau produit, pénétration de marchés étrangers). Le capital-développement répond à ce type de besoins. Le capital-reprise/transmission d'entreprise caractérise le financement d'opérations d'acquisitions d'entreprises. Les capital-investisseurs interviennent en effet fréquemment dans le cadre de financement de LBO (Leverage Buy Out). Ce type d'opération concerne quasi-exclusivement les entreprises « matures » car les LBO se caractérisent par des coefficients d'endettement importants et nécessitent donc, pour être réalisées, des flux de trésorerie les moins volatiles possibles.
- (3) Ces processus sont mis en place aussi bien avant (due diligence, syndication des investissements...) qu'après l'entrée dans le capital de l'entreprise. Les mécanismes de contrôle post-contractuels (attribution de bons de souscription d'actions au dirigeant, mise en place d'un financement par étapes...) visent à créer un cadre incitatif pour les dirigeants de manière à ce que leurs décisions de gestion soient conformes aux objectifs des actionnaires minoritaires que sont les capital-risqueurs.

risque de son portefeuille ainsi que les conflits d'intérêt susceptibles de naître dans le cadre de la relation d'agence l'unissant aux dirigeants de l'entreprise financée. Les opérations de sortie constituent la dernière phase du cycle du capital-investissement. Le capital-risqueur dispose de différents modes de sortie : la cession de ses parts aux dirigeants ou aux cadres de l'entreprise, à un industriel ou à un autre financier, la liquidation de l'entreprise (en cas d'échec), et enfin l'introduction en bourse. Les éventuelles plus-values réalisées par le capital-risqueur lors de cette phase permettent, d'une part, de rémunérer les fonds investis dans l'organisme de capital-risque et, d'autre part, de réinvestir dans de futures participations. Un nouveau cycle de capital-investissement peut alors redémarrer.

La phase de sortie est donc cruciale puisqu'elle permet de mesurer le montant de valeur créée durant la période de présence du capital-risqueur dans le capital de l'entreprise et d'évaluer la pertinence des processus de sélection et de contrôle qu'il a mis en place.

Notre analyse est centrée sur l'une des possibilités de sortie mentionnée ci-dessus : les marchés financiers. Les raisons de ce choix sont multiples. Tout d'abord, de nombreuses études économétriques mettent en évidence une influence importante des marchés financiers sur l'investissement en capital-risque. Ces études utilisent différents facteurs pour illustrer le rôle des marchés financiers. Ainsi, pour Black et Gilson (1988), Gompers et Lerner (1998) et Jeng et Wells (2000), les IPO (*initial public offerings*), qui reflètent le rendement potentiel du capital-risque, apparaissent comme l'un des déterminants essentiels des investissements. Black et Gilson en concluent que le développement du marché du capital-investissement est indissociable de l'existence de marchés financiers développés et profonds capables d'absorber les introductions en bourse des entreprises. D'autres études montrent que la liquidité du marché, représentée notamment par la capitalisation boursière (Schertler, 2003) a un impact positif sur le développement des investissements en capital-risque. Enfin, plus récemment, Gompers *et alii* (2005) ont souligné, dans une étude portant sur les États-Unis, que l'activité de capital-risque était très sensible aux signaux, tels que le Q de Tobin, émis par les marchés financiers.

Une autre raison importante nous incitant à privilégier les introductions en bourse est que ce mode de sortie est le plus rémunérateur pour le capital-risqueur. Une étude de Venture Economics (1988) montre ainsi que la sortie sous forme d'IPO est cinq fois plus rentable que la sortie *via* la cession des parts à une autre entreprise (4). Les travaux plus récents de Gompers (1995) pour les

(4) Selon cette étude, l'investissement en capital-risque dans une firme ultérieurement introduite en bourse a un rendement moyen de 195 % sur une période de 4,2 ans contre 40 % pour une firme ultérieurement cédée.

États-Unis et de Schwienbacher (2004) pour l'Europe, confirment les meilleures performances de la sortie en bourse par rapport à la sortie industrielle. Par conséquent, le fait pour un capital-risqueur de mener à bien des IPO lui permet de signaler son expérience au marché et, partant, de réduire les coûts de transaction de sa relation avec les dirigeants. Dans le même ordre d'idées, le fait de réaliser des introductions en bourse réussies améliore la réputation du capital-risqueur et lui permet de lever des fonds auprès des investisseurs à des conditions plus favorables.

Enfin, la sortie sous forme d'IPO permet aux capital-risqueurs de mieux gérer les éventuels risques de conflit d'intérêt avec les dirigeants (Black et Gilson, 1988). En effet, lors de l'introduction en bourse, les dirigeants-fondateurs gardent souvent une influence importante dans l'entreprise. À l'inverse, lorsque le capital-risqueur sort du capital via une sortie industrielle ou en cédant ses parts à un autre fonds d'investissement, l'indépendance des dirigeants n'est plus assurée. La perspective de restitution du contrôle va réduire les comportements opportunistes et inciter les dirigeants à mener à bien le projet de développement, la création de valeur et, *in fine*, l'introduction en bourse.

Les arguments théoriques et empiriques rappelés ci-dessus mettent donc clairement en évidence le fait que les investissements en capital-risque dépendent fortement de la situation prévalant sur les marchés financiers.

II. — CAPITAL-RISQUE, INCERTITUDE RADICALE ET RATIONALITÉ LIMITÉE

Les firmes recourant au capital-risque possèdent des caractéristiques spécifiques qui rendent leur activité particulièrement incertaine.

En premier lieu, elles sont fréquemment positionnées sur des marchés en fort développement, émergents, voire à créer au moment où l'entreprise est financée. En second lieu, leurs produits se situent généralement soit dans la phase de conception soit dans la phase de lancement (5). Troisièmement, l'activité des start-up technologiques est fondée sur la mise en œuvre et la gestion d'actifs immatériels (savoir-faire, développement technologique) qui jouent un rôle primordial dans l'essor de la firme mais sont difficilement quantifiables et négociables. Or, ces actifs immatériels, à la différence d'actifs physiques, peuvent difficilement servir de « collatéraux » au sens de garanties tangibles qui

(5) Selon la terminologie employée dans l'approche du cycle de vie du produit. Les phases de conception et de lancement se caractérisent par des résultats durablement négatifs ainsi que par des taux d'échec des projets très élevés (de l'ordre de 70 % pour la première, de 30 à 50 % pour la seconde). Au total, seuls 15 à 20 % des projets initiaux des start-up dépassent le stade de la phase de lancement (Adam et farber, 1994).

jouent en général le rôle de réducteurs d'incertitude et d'asymétrie d'information dans les relations de financement (6).

L'environnement décisionnel des capital-risqueurs n'est donc pas simplement risqué mais incertain (7). Ce constat a des implications importantes sur le choix des outils analytiques appropriés à l'étude de la relation capital-risqueur/start-up technologique. L'une des voies explorées au cours des dernières années consiste à analyser cette relation par le biais des outils de la théorie des options réelles. L'intérêt d'une telle démarche est indéniable.

En premier lieu, les options réelles sont considérées comme un outil d'analyse permettant de pallier certaines insuffisances des méthodes traditionnelles d'évaluation des projets d'investissement (Dixit et Pindyck, 1994, Trigeorgis, 1996). Ces dernières (comme l'approche DCF, *discounted cash-flows*), basées sur l'actualisation, impliquent un biais lorsqu'elles sont appliquées dans l'environnement décisionnel particulièrement incertain entourant les start-up technologiques. En effet, plus le risque est élevé, plus le taux d'actualisation augmente et plus la valeur actuelle de l'entreprise sera faible. Dans ce contexte, les projets (et les entreprises) à très forts risques sont pénalisés alors que l'on sent intuitivement qu'il n'est pas tenu compte de la valeur stratégique des opportunités de croissance associées à ces projets. Une autre faiblesse des méthodes d'évaluation traditionnelles est que seules les possibilités présentes du décideur sont prises en compte. Cela conduit à adopter une vision « statique » de la décision d'investissement qui ignore d'éventuelles interventions des dirigeants à des dates ultérieures en réaction à l'évolution de l'environnement et à l'acquisition d'informations nouvelles.

La théorie des options réelles (8) s'est précisément développée pour tenir compte à la fois de l'irréversibilité (9), de la flexibilité et du caractère dynamique des projets d'investissement.

- (6) Ajoutons que, bien souvent, le seul élément « concret » qu'une start-up puisse présenter à un apporteur de capitaux externes est le plan de développement (*business plan*). Quelle que soit la qualité apportée à l'élaboration de ce document, il reste fondé quasi-exclusivement sur des projections incertaines et ne réunit donc pas les critères traditionnellement utilisés par les pourvoyeurs de fonds (solidité du bilan et rentabilité présente et passée, carnet de commandes, parts de marché...) pour filtrer les demandes de financement.
- (7) Pour reprendre la distinction utilisée par Lavoie (1992, p. 43), il y a *risque* lorsque chaque action mène à un ensemble de résultats possibles spécifiques dont la valeur est connue, chaque résultat étant associé à une probabilité spécifique ; il y a *incertitude* lorsque la probabilité d'un résultat est inconnue, ou lorsque la valeur d'un résultat est inconnue, ou lorsque certains des résultats d'une action sont inconnus, ou encore lorsque l'éventail des choix possibles est inconnu.
- (8) Myers (1977), Kester (1984), Dixit et Pindyck (1994), Trigeorgis (1996), Amram et Kulatilaka (1999).
- (9) Les investissements en actifs réels et intangibles sont en partie irrécupérables (*sunk costs*) quand ils sont spécifiques à un type d'industrie ou à une firme (R&D, marketing par exemple).

En effet, un projet d'investissement contient un certain nombre d'options. Il s'agit notamment d'« options d'abandon » lorsque l'entreprise a la possibilité de ne pas poursuivre indéfiniment un projet qui s'avérerait non rentable. Il s'agit également d'« options de croissance ». Celles-ci reposent sur l'idée qu'en investissant dans une technologie nouvelle, l'entreprise acquiert principalement l'option d'investir dans une série de projets futurs. Ainsi, pour une start-up technologique, les investissements réalisés pendant la phase de démarrage (par exemple en R&D) engendrent des opportunités de croissance qui représentent l'essentiel de la valeur de l'entreprise. Enfin, un projet contient l'option de pouvoir attendre ou échelonner les investissements et, le cas échéant, reporter la décision. On l'appelle l'« option de flexibilité ». Sa valeur est d'autant plus élevée que la nature irréversible du projet est marquée.

Une autre caractéristique intéressante de l'approche par les options réelles est qu'elle permet de rendre compte de certaines pratiques utilisées par les capital-risqueurs. En effet, afin de réduire les risques inhérents aux financements des projets innovants, les organismes de capital-risque procèdent à un financement « par étapes » (*stage financing*) consistant à fractionner l'investissement et à intervenir en fonction de l'évolution de l'environnement et de la réalisation des différents objectifs intermédiaires (*milestones*) fixés à la fois par le capital-risqueur et le dirigeant. Comme le note Dubocage (2003), ces investissements successifs ont le statut d'« options d'apprentissage » : ils donnent des informations à l'investisseur sur la rentabilité du projet et réduisent l'incertitude (10).

Malgré les atouts indéniables de l'approche par les options réelles, cette méthode est très peu utilisée par les capital-risqueurs (Desbrières et Broye, 2000) en raison de son degré de complexité technique (lié notamment à la difficulté à déterminer la valeur de certains paramètres comme le prix du sous-jacent). D'un point de vue théorique, cette méthode se heurte également à un problème de contradiction interne (Dubocage, 2003 ; Dubocage et Rivaud-Danset, 2006). En effet, en se fixant comme objectif de proposer une règle de décision fondée sur un résultat chiffré, elle a recours à des méthodes (actualisation des cash-flows futurs (11), référence à des marchés financiers efficients, etc.) finalement très proches de celles de l'analyse financière traditionnelle. Or, ces méthodes sont difficilement applicables dans le cadre de l'environnement d'incertitude radicale caractérisant la relation entre capital-risqueurs et start-up technologiques.

- (10) L'importance du financement par étapes en tant que mécanisme de contrôle de l'entreprise et de facteur de succès pour l'investissement en capital-risque a été démontrée empiriquement par différents auteurs, notamment par Sahlman (1990).
- (11) On utilise notamment le concept de VANA (valeur actuelle nette augmentée) qui est la somme de la valeur actuelle nette du projet et des options réelles qui lui sont attachées.

Cette remarque nous conduit à analyser les comportements des investisseurs en capital-risque avec les outils analytiques fournis par les approches en termes de rationalité « limitée » ou « procédurale » plutôt que par les approches plus traditionnelles fondées sur la rationalité « substantielle » (selon la terminologie de Simon, 1976).

Dans l'hypothèse de rationalité substantielle, largement utilisée dans la théorie néo-classique de la décision, l'ensemble des états de la nature, c'est-à-dire l'ensemble des actions et de leurs conséquences possibles, est prédéterminé et connu par l'individu au moment de la prise de décision. Celui-ci est également supposé doté de capacités cognitives et calculatoires illimitées, ce qui lui permet d'associer des probabilités objectives ou subjectives (Savage, 1954) à l'occurrence de chacun de ces événements possibles, de calculer l'utilité espérée qu'il retirerait de chacune des conséquences possibles de ses actions et de choisir la décision qui lui apporterait le plus de satisfaction possible.

L'approche en termes de rationalité procédurale s'applique en revanche à un environnement décisionnel radicalement différent. L'hypothèse selon laquelle les individus connaissent parfaitement la liste des événements futurs potentiels est considérée comme irréaliste et ce, pour deux raisons.

La première est la faiblesse des capacités cognitives de l'individu qui limite son accès à l'information et l'empêche de disposer d'une connaissance exhaustive de l'ensemble des événements possibles (Stigler, 1961, Williamson, 1994). La seconde est que la liste des états de la nature possibles n'est pas considérée comme une donnée préalable à la prise de décision. À l'instar de Shackle (1955, p. 6), pour qui les agents économiques prennent des décisions « cruciales » et ne peuvent donc « *chasser de leur esprit la possibilité que le simple fait d'exécuter une expérience peut définitivement détruire les circonstances dans lesquelles elle a été accomplie* », le raisonnement en termes de rationalité procédurale tient compte du fait que les décisions successives des individus produisent des irréversibilités qui modifient l'éventail des événements possibles (Simon, 1976). Il est alors difficile d'associer des probabilités, fussent-elles subjectives, à des événements futurs qui peuvent être inconnus car non encore existants au moment de la prise de décision : la maximisation d'une utilité espérée et la détermination d'une solution « optimale » deviennent alors impossibles.

Dans cet environnement d'incertitude radicale et de capacités cognitives limitées dans lequel les capital-risqueurs doivent prendre leurs décisions, c'est un autre mode de prise de décision que le traditionnel comportement d'optimisation qui prévaut. Il est fondé sur la mise en place et l'utilisation de procédures conscientes – on parle de règles de comportement (*rules of thumb*) – ou inconscientes – on les qualifie d'habitudes (Hodgson, 1988) qui permettent aux agents économiques de prendre des décisions rapidement sans avoir à tenir compte de la totalité de l'information disponible.

Loin d'être des défaillances du marché, ces procédures sont rationnelles parce qu'« *elles sont des modes de comportement que la firme (ou l'individu) élabore afin de prendre des décisions dans un environnement complexe d'incertitude et d'information imparfaite* » (Cyert et Simon, 1983, p. 105). Les exemples concrets de leur utilisation foisonnent dans le domaine économique et financier: période d'amortissement pour la décision d'investissement, taux normal d'utilisation de la capacité, ratios « normaux » d'endettement, de liquidité et de fonds propres, etc.

Les modèles de rationalité limitée ont suivi différentes voies afin de formaliser les décisions des agents économiques en information imparfaite (12). Parmi ces travaux, le modèle de fiabilité développé par Heiner (1983) nous semble particulièrement adapté à l'analyse des décisions d'investissement des sociétés de capital-risque.

L'argumentation de Heiner est la suivante : il existe un écart entre les capacités cognitives d'un agent et la complexité de l'environnement auquel il est confronté [*competence-difficulty (« C-D ») gap*]. Cet écart découle des changements imprévus qui affectent l'environnement ainsi que des capacités limitées des agents à réagir de manière appropriée à ces changements. C'est cet écart qui introduit l'incertitude dans l'analyse des choix.

Or, selon Heiner, c'est précisément cette incertitude, sous la forme du *C-D gap*, qui est à l'origine des régularités et donc de la prévisibilité des comportements économiques. Un agent économique, dans un environnement décisionnel de simple risque probabilisable et agissant conformément à l'hypothèse d'anticipations rationnelles (Muth, 1961) aurait un comportement extrêmement irrégulier car, étant totalement flexible dans ses choix, il réagirait immédiatement à toute perturbation de l'environnement afin de se replacer dans l'état optimal. En revanche, chez Heiner, la rigidité – et donc la prévisibilité – des comportements viennent de la nécessité de comparer le risque d'erreur lié au choix d'une nouvelle action avec le coût d'opportunité de la conservation de l'ancienne ligne de conduite.

En d'autres termes, plus le degré d'incertitude est élevé, plus le risque de prendre la mauvaise décision (c'est-à-dire de décider de changer les procédures de choix en vigueur et encourir des pertes subséquentes, ou décider de ne pas changer ces procédures alors qu'une modification aurait engendré des gains) est élevé. Si les agents avaient une connaissance parfaite de leur environnement, ils seraient toujours capables de déterminer si le moment est propice pour modifier leur comportement. Cependant, en situation d'incertitude et de connaissance incomplète, les agents économiques reçoivent des signaux

(12) Par exemple, Laville (1998) distingue six familles de modèles de rationalité limitée : les modèles de satisfaction, de coûts, de fiabilité, d'automate, d'apprentissage et d'évolution.

qu'ils interprètent difficilement. Il n'est, par conséquent, intéressant de modifier son comportement habituel que si cette modification engendre des gains espérés substantiels ; c'est-à-dire lorsque les gains associés au changement de comportement (ou les gains nets comparés à la situation consistant à ne pas modifier son comportement) et leur probabilité sont élevés.

Ce raisonnement a une implication importante : un agent doit ignorer les actions qui ne s'avèrent appropriées que dans des situations rares ou « anormales ». Inversement, le répertoire d'un agent doit se limiter aux actions qui sont adaptées à des situations relativement probables ou récurrentes. Ainsi, ce répertoire exclut-il des actions qui sont optimales dans certaines situations, et ce même si la probabilité de réalisation de ces situations est positive.

Le modèle que nous développons ci-dessous afin d'expliquer les comportements d'investissement des capital-riueurs reprend, en les prolongeant, les grandes lignes de l'approche de Heiner (13).

III. — LE MODÈLE

3.1. Notations et conditions de fiabilité

Considérons une société de capital-risque (SCR dans la suite) initialement limitée dans son répertoire d'actions possibles en matière d'investissement dans les start-up technologiques. Supposons, pour simplifier, qu'il y a initialement une seule action possible dans le répertoire : « Investir dans les phases de développement et de reprise-transmission des start-up technologiques ».

La question que l'on se pose est la suivante : dans quelles conditions la SCR acceptera-t-elle d'élargir son répertoire d'actions possibles et donc d'investir dans une phase antérieure de l'activité des start-up technologiques, c'est-à-dire dans la phase de démarrage ?

Le modèle utilisé pour répondre à cette interrogation utilise les notations suivantes :

K l'action : « Investir dans la phase de démarrage de start-up technologiques » ;

R : ensemble des circonstances dans lesquelles choisir l'action K est approprié ;

(13) Pour une application voisine, sur le marché bancaire, voir P. Neal (1996).

W : ensemble des circonstances dans lesquelles choisir l'action K est inapproprié ;

Π = probabilité que les circonstances soient favorables pour investir dans la phase de démarrage de start-up technologiques ;

$1 - \Pi$ = probabilité que les circonstances soient défavorables pour investir dans la phase de démarrage de start-up technologiques

g = gain anticipé de la SCR dans les circonstances favorables

l = perte anticipée de la SCR dans les circonstances défavorables

$r = P(K/R)$ = probabilité d'investir dans la phase de démarrage alors que les circonstances sont favorables à ce choix

$w = P(K/W)$ = probabilité d'investir dans la phase de démarrage alors que les circonstances sont défavorables à ce choix

La SCR choisit d'élargir son répertoire d'action à l'action K, c'est-à-dire d'investir dans la phase de démarrage de start-up technologique si et seulement si :

Gain espéré de cet investissement > perte espérée de cet investissement

$$\Leftrightarrow \Pi r g > (1 - \Pi) w l \quad (1)$$

soit

$$(r/w) > (l/g)[(1 - \Pi)/\Pi] \quad (2)$$

ou, de manière condensée,

$$\rho > T \quad (2')$$

Cette inégalité représente la *condition de fiabilité* associée à l'investissement dans une phase de démarrage. Cette condition traduit le fait que le capital-risqueur introduit une nouvelle action (« investir dans la phase de démarrage de start-up technologiques ») dans son répertoire d'actions possibles quand le gain espéré, si l'environnement est favorable au choix de cette action, est supérieur à la perte envisagée lorsque l'environnement est défavorable, avec :

$\rho = (r/w)$ (probabilité de faire le bon choix/probabilité de faire le mauvais choix) représente le *ratio de fiabilité* associé à la décision d'investissement c'est-à-dire la *confiance* qu'accorde la SCR à son choix d'investissement dans une phase de démarrage d'une start-up technologique.

$T = (l/g)/(1 - \Pi)/\Pi$ représentant le *seuil minimum ou limite de tolérance* que le ratio de fiabilité doit atteindre afin que la SCR décide d'élargir son répertoire d'action à l'investissement dans la phase de démarrage d'une start-up technologique.

Dans cette perspective, si $\rho > T$ la SCR aura un comportement « flexible » ou « accommodant » vis-à-vis des demandes de financement des start-up en phase de démarrage. En revanche, si $\rho < T$ elle aura un comportement « rigide » consistant à n'investir que dans des firmes technologiques matures sous forme de capital-développement et de capital-reprise/transmission.

3.2. Dynamique du modèle

Nous allons maintenant examiner les facteurs qui influencent chacun des côtés de l'inégalité représentant la condition de fiabilité afin de comprendre les raisons pour lesquelles une SCR peut évoluer d'un comportement « rigide » à un comportement « flexible » face aux demandes de financement des start-up technologiques.

Le côté droit de l'inégalité dépend de la probabilité $(1 - \Pi)$, c'est-à-dire de la probabilité que les circonstances soient défavorables pour investir dans la phase de démarrage de start-up technologiques.

Pour mieux comprendre la nature particulière de cette probabilité, il faut d'abord soigneusement la distinguer de la probabilité de perte sur un portefeuille d'investissement telle qu'elle est traditionnellement mesurée par les capital-risqueurs. Lorsqu'on raisonne sur un portefeuille de capital-risque donné, il est possible d'estimer avec un niveau de confiance et de précision acceptables le risque de perte ainsi que les corrélations entre les investissements de ce portefeuille afin de constituer des provisions adéquates pour absorber les pertes espérées. Il y a d'ailleurs une forte incitation à effectuer convenablement ce type d'évaluation: une sous-estimation du risque entraînant de fortes pertes potentielles pour le capital-risqueur, tandis qu'une surestimation du risque (et un sous-investissement) se traduira par des pertes de parts de marché tout aussi néfastes.

En revanche, l'état de la connaissance relatif à la détermination de la probabilité $(1 - \Pi)$ est beaucoup moins complet. Les capital-risqueurs savent seulement qu'il existe une faible probabilité que se produise un choc défavorable aux conséquences potentiellement catastrophiques pour le marché du capital-risque dans son ensemble. Néanmoins, ils ne disposent ni d'une connaissance probabiliste *a priori* de $(1 - \Pi)$ ni de suffisamment de données pour estimer cette probabilité sur la base de séries statistiques passées. Ce niveau d'ignorance s'apparente davantage à de l'incertitude au sens de Keynes (1937) ou de Knight (1921) qu'à un simple risque probabilisable.

On peut alors difficilement supposer que, en ce qui concerne l'estimation de $(1 - \Pi)$, les probabilités subjectives des investisseurs en capital-risque convergeront vers les probabilités objectives. Ce constat est encore renforcé par le fait que, puisqu'un choc défavorable de grande ampleur (un type krach boursier ou tout autre phénomène de grande ampleur susceptible de remettre en cause la stabilité du système dans son ensemble) se produit rarement, il peut être négligé, sans dommage pour les décideurs, pendant de très longues périodes. Dans ces conditions, le fait pour un capital-risqueur de sous-estimer le niveau effectif de $(1 - \Pi)$ dans l'évaluation du risque de son portefeuille au cours de périodes « normales » (*i.e.* hors périodes de crises) d'activité économique ne relève pas d'un comportement irrationnel. Une société de capital-risque qui essayerait d'intégrer dans le calcul de son taux de rentabilité exigé une prime de risque appropriée à l'existence d'événements peu fréquents mais générateurs de fortes pertes potentielles adopterait un comportement relativement « rigide » vis-à-vis du financement des firmes technologiques en création. Elle se priverait ainsi, contrairement à des investisseurs plus « flexibles », de parts de marché et de gains potentiels importants durant la phase de « boom » de l'investissement. De plus, en cas de crise importante sur le secteur concerné (en l'occurrence, les start-up technologiques en phase de démarrage), *un grand nombre* de sociétés de capital-risque « flexibles » sont touchées, de sorte que la responsabilité de l'échec n'incombe à aucune d'entre elles en particulier. Cela contraste fortement avec la situation prévalant durant le boom d'investissement où les capital-risqueurs « exagérément rigides » enregistrent *de manière isolée* des résultats inférieurs aux autres investisseurs. On se trouve ainsi dans une situation de « structure de récompense asymétrique » où les comportements « flexibles » sont récompensés davantage et sanctionnés dans une moindre mesure que les comportements « rigides » (14).

La nature de la probabilité $(1 - \Pi)$ se prête donc difficilement à un traitement analytique fondé sur les outils traditionnels de la théorie de la décision (15). En revanche, certains travaux relevant de la psychologie cognitive ont étudié en profondeur les méthodes simplifiées (heuristiques) mises en place par les individus pour estimer les probabilités, telles qu' $(1 - \Pi)$, d'événements peu fréquents et singuliers n'obéissant pas à une loi de probabilité connue.

L'une de ces heuristiques est l'*« heuristique de disponibilité » (availability heuristics)* (Kahneman et Tversky, 1982). Elle est employée lorsque les agents estiment la probabilité d'occurrence de certains événements à partir de la

(14) Cette idée était déjà présente chez Keynes pour qui: « *la sagesse universelle enseigne qu'il vaut mieux pour sa réputation échouer avec les conventions que réussir contre elles* » (1979, pp. 170).

(15) Pour reprendre la position de Lucas lorsqu'il écrit: « *En situation d'incertitude, le raisonnement économique ne sera d'aucune valeur* » (Lucas, 1981, p. 224).

mémorisation qu'ils ont d'événements similaires. Dans ce contexte, la probabilité subjective de réalisation d'un événement est d'autant plus forte que sa fréquence passée est élevée ou que sa dernière date de réalisation est proche de la période courante. L'exemple qui illustre le mieux ce phénomène est celui du comportement d'un conducteur qui vient d'assister à un accident de la route. La réponse immédiate du conducteur est de conduire beaucoup plus prudemment. Il se comporte ainsi comme si la probabilité d'avoir un accident avait soudainement augmenté. Mais, progressivement, à mesure que le temps s'écoule, l'image de l'accident s'estompe dans la mémoire et la prudence du conducteur diminue.

Dans le cadre de notre modèle, l'accident de la route va prendre la forme d'une défaillance brutale et aiguë d'un indicateur de performance du marché financier. Une telle défaillance s'assimile à un choc défavorable pris en compte dans la formation des probabilités subjectives par les capital-risqueurs. Le raisonnement en termes d'heuristique de disponibilité, que nous supposons utilisé par les sociétés de capital-risque, implique alors que ces dernières « surréagissent » de telle manière que la probabilité subjective de réalisation d'un environnement défavorable $(1 - \Pi)$ atteigne un niveau élevé, éventuellement supérieur à la probabilité $(1 - \Pi)_E$ effective (mais inconnue *a priori* par les agents).

Quelles sont les conséquences de cette modification des anticipations des SCR sur la condition de fiabilité du modèle ?

Tout d'abord, la hausse de la probabilité $(1 - \Pi)$ engendre une hausse de la limite de tolérance T . Si cette hausse est suffisamment importante, la condition de fiabilité s'écrit :

$$\rho < T$$

Il s'ensuit un *rétrécissement* du répertoire d'actions de la SCR : l'action K n'est pas retenue par la SCR et ce comportement va perdurer tant que l'inégalité précédente ne s'inverse pas. Économiquement, un tel raisonnement doit conduire à l'apparition de comportements « rigides » en matière de financement des phases de création des start-up technologiques : il est hautement probable que ces sociétés subissent un *fort rationnement* de la part des SCR pendant une *période relativement longue*.

En ce qui concerne le côté gauche de l'inégalité, à savoir le ratio de fiabilité ρ , il mesure, pour la SCR, la probabilité d'avoir raison par rapport à la probabilité de se tromper. En d'autres termes, ce ratio représente le degré de *confiance* que la SCR accorde à ces prévisions relatives à l'investissement dans les start-up technologiques.

On peut penser que la dynamique de cette variable est positivement corrélée à l'évolution des indicateurs de performance du marché financier. Par conséquent, dans notre modèle, une amélioration de ces indicateurs conduit, toutes

chooses égales par ailleurs, à accroître le niveau de ρ , à rendre les comportements d'investissement des capital-risqueurs plus flexibles et donc à éléver le volume de capital-risque.

Il faut néanmoins noter que cet effet favorable de l'amélioration des marchés financiers sur le capital-risque ne sera observable que s'il est suffisamment important pour que l'inégalité représentant la condition de fiabilité soit de la forme $\rho > T$.

IV. — ANALYSE STATISTIQUE DE LA RELATION ENTRE MARCHÉS FINANCIERS ET CAPITAL-RISQUE À TRAVERS L'EXEMPLE FRANÇAIS

L'objectif de cette partie est double. Il s'agit tout d'abord de mettre en évidence les éventuelles corrélations existant entre l'évolution des marchés financiers et le montant des investissements sur le marché du capital-risque français. Nous interprétons ensuite les résultats statistiques obtenus à la lumière du modèle théorique que nous venons de présenter.

4.1. L'analyse statistique

L'analyse statistique du capital-risque français soulève plusieurs difficultés. La principale concerne le montant des fonds levés ainsi que des sorties. Il est impossible de disposer de statistiques globales à vocation d'exhaustivité, les formes d'intervention en capital-risque sont trop variées pour le permettre. Il faut donc se contenter des statistiques compilées par des organismes privés ou publics par sondage auprès des organismes professionnels du capital-risque. Les statistiques que nous présentons ont donc plus pour objet de donner une représentation des tendances à l'œuvre que de décrire de manière complète la réalité du capital-risque en France depuis 1999.

Afin d'analyser statistiquement la relation entre l'évolution des marchés financiers et l'investissement en capital-risque, nous utilisons des données relatives à l'indice ITCAC et aux levées de fonds dans le secteur internet. Ce secteur a, entre 1999 et 2001, reçu une part importante des levées de fonds de la période (16). Ce constat a été fait sur la même période outre-Atlantique (Lerner 2002).

L'ITCAC est un indice du marché boursier de Paris destiné à décrire l'évolution du cours de sociétés technologiques. En décembre 2006, il comprenait 76 valeurs dont plusieurs étaient cotées sur le nouveau marché quand celui-ci

(16) Pour l'année 2000, cette proportion est de l'ordre de 25 % (AFIC 2005).

existait encore. Cet indice est disponible depuis le 1^{er} janvier 1999. Nous avons retenu l'ITCAC dans la mesure où il s'agit d'un indice étroitement lié au financement des valeurs technologiques. Par conséquent, un renversement de tendance de ce type de marché voué au financement des entreprises technologiques ne peut que freiner le financement par capital-risque. Nous avons préféré l'ITCAC à l'indice du Nouveau Marché dans la mesure où figuraient sur ce dernier marché des entreprises que l'on ne pouvait pas rattacher aux entreprises technologiques. Ajoutons que l'ITCAC est encore aujourd'hui disponible ce qui n'est pas le cas de l'Indice du Nouveau Marché.

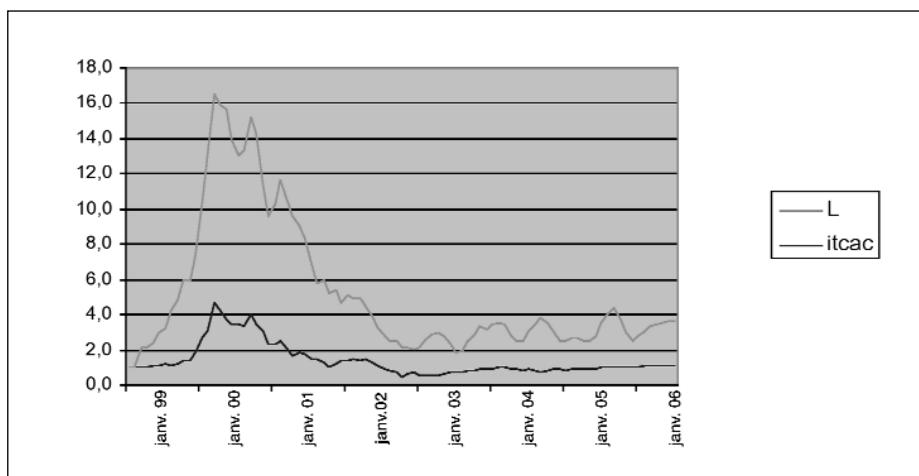
La période étudiée est comprise entre le 1^{er} janvier 1999 et le 30 septembre 2006, soit 93 observations mensuelles.

Afin de pouvoir mettre les deux statistiques à la même échelle, nous avons représenté l'indice ITCAC divisé par 1000 et les levées de fonds internet mesurées en millions d'euros. Les levées de fonds qui sont disponibles sur le *Journaldunet*, ont été désaisonnalisées par utilisation des moyennes mobiles. Au démarrage de la période, les deux statistiques sont voisines.

Pour ce qui concerne l'ITCAC, le graphique appelle les commentaires suivants :

- les levées de fonds ont connu sur la période une instabilité plus élevée que l'ITCAC,
- sur la période 1999-2002, les évolutions des deux statistiques semblent obéir à la même dynamique avec une amplitude plus marquée pour les levées de fonds,

Graphique - Évolution de l'ITCAC et des levées de fonds internet



Source : Journaldunet.org

— à partir de janvier 2003, nous assistons à une tendance à la progression de l'ITCAC alors même que les levées de fonds sont caractérisées par une forte irrégularité.

La relation entre l'évolution des marchés financiers et l'investissement en capital-risque est testée par une régression linéaire de la forme :

$$L_t = a_0 + a_1 ITCAC_t + \varepsilon_t$$

La variable expliquée, notée L_t , est le montant d'investissement en capital-risque au sein des entreprises du secteur internet le mois t . $ITCAC_t$ est la valeur de l'ITCAC pour ce même mois.

Nous avons tout d'abord testé la régression sur la période 1999-2006.

Tableau 1 - Régression sur la période 1999-2006

	Constante	ITCAC	DW
a	-0,63	3,15	0,586
t	-3,55	29,4	
Probabilité	0,000	0,000	

Les résultats de la régression (tableau 1) font apparaître une autocorrélation des résidus statistiquement significative. Les résultats sont donnés dans le tableau 2.

Tableau 2 - Régression AR sur la période 1999-2006

	Constante	ITCAC	AR(1)	DW
a	1,57	1,65	0,93	1,646
t	1,60	7,416	25,46	R ²
Probabilité	0,113	0,000	0,000	0,924

Il apparaît donc bien sur l'ensemble de la période une relation statistiquement significative entre les levées de fonds et l'indice ITCAC. Nous avons testé différents rangs d'auto-corrélation, seule l'auto-corrélation de rang 1 est statistiquement significative.

Nous avons ensuite testé la stabilité de cette relation en décomposant la période globale en deux sous-périodes : 1999-2002 et 2003-2006. Nous donnons les résultats de ces corrélations dans les tableaux 3 et 4 ci-dessous.

Tableau 3 - Régression AR sur la période 1999-2002

	Constante	ITCAC	AR(1)	DW
a	2,55	1,72	0,91	1,89
t	2,08	6,24	16,27	R ²
Probabilité	0,048	0,000	0,000	0,945

Les résultats obtenus pour la période 1999-2002 (tableau 3) sont voisins de ceux observés sur la période entière. Là encore, seule l'auto-corrélation de rang 1 est statistiquement significative.

L'examen des résultats de la régression sur la période 2003-2006 (tableau 4) fait apparaître des résultats profondément différents.

Tableau 4 - Régression AR sur la période 2003-2006

	Constante	ITCAC	AR(1)	AR(2)	DW
a	1,91	0,18	1,29	-0,79	2,03
t	4,85	0,43	11,92	-7,42	R _—
Probabilité	0,000	0,670	0,000	0,000	0,793

Si la relation entre les levées de fonds et l'ITCAC est significative avant 2003, elle cesse de l'être à partir de janvier 2003. En d'autres termes, les levées de fonds restent insensibles à la progression de l'indice à compter de cette date. Les levées de fonds sont fortement auto-correlées avec des auto-corrélations de rangs 1 et 2 statistiquement significatives et de sens contraire.

4.2. L'interprétation des résultats à la lumière du modèle

En rapprochant les résultats de l'analyse statistique à ceux de notre modèle théorique, il est possible de mettre en évidence une rupture dans les comportements d'investissement des capital-risqueurs au cours des dernières années.

Tout d'abord, au cours de la période 1999-2002, l'ITCAC est une variable explicative fortement significative traduisant une influence très sensible du marché financier des valeurs technologiques sur l'investissement en capital-risque. Les raisons à l'adoption de ce comportement sont néanmoins différentes selon la sous-période considérée. En effet, entre 1999 et 2000, c'est-à-dire avant le e-krach, la corrélation positive entre marché financier et investissement s'explique par une hausse de la confiance ρ due à l'amélioration de l'indice ITCAC. De son côté, le seuil minimum du ratio de fiabilité, T, est faible car les capital-risqueurs, en l'absence de chocs défavorables récents, estiment que la probabilité de réalisation d'un événement défavorable sur le

marché du capital-risque est peu élevée. La condition de fiabilité de notre modèle est donc telle que $\rho > T$. La situation est alors particulièrement favorable à l'essor de l'activité de financement des start-up technologiques en phase de démarrage en raison du comportement « accommodant » des capital-risqueurs à leur égard. En revanche, au cours de la deuxième sous-période, entre 2000 et 2002, immédiatement après le e-krach, les effets de l'adoption d'une heuristique de disponibilité par les capital-risqueurs se font pleinement ressentir : ils entraînent une augmentation brutale et aiguë du seuil minimum T en raison de la « sur-réaction » à la hausse affectant la probabilité $(1-\Pi)$. Comme, de son côté, la confiance ρ des capital-risqueurs diminue fortement en raison de l'effondrement de l'ITCAC, il s'ensuit logiquement un retournement de la condition de fiabilité du modèle qui devient telle que $\rho << T$. Cela se traduit concrètement par une réallocation des portefeuilles des sociétés de capital-risque au détriment des investissements dans les start-up en phase de démarrage qui subissent ainsi un fort rationnement.

À partir de 2003, l'ITCAC n'est plus une variable explicative significative : malgré l'évolution à nouveau favorable de cet indice observée depuis janvier 2003, l'investissement en capital-risque au sens strict ne redémarre pas et l'essentiel des fonds continue à être orienté vers les entreprises plus matures, essentiellement sous forme de capital-reprise/transmission. En d'autres termes, le comportement d'investissement des sociétés de capital-risque semble s'être déconnecté de l'évolution du marché financier des valeurs technologiques. Notre modèle fournit une explication à cette rupture dans les comportements : malgré les évolutions récentes favorables de l'ITCAC qui ont contribué à améliorer la confiance ρ depuis le début de l'année 2003, le souvenir du e-krach reste encore présent dans les esprits des investisseurs. D'après le modèle, l'effet-mémoire associé à l'heuristique de disponibilité utilisée par les capital-risqueurs maintient leur estimation de la probabilité $(1-\Pi)$ – et donc le seuil minimum du ratio de fiabilité, T – à un niveau élevé. Dans ces conditions, en dépit de la hausse récente de ρ , la condition de fiabilité ne s'est pas retournée et demeure telle que $\rho < T$. On se trouve ainsi dans une situation où l'offre des capital-risqueurs est peu flexible vis-à-vis des demandes de financement des start-up en phase de démarrage et où l'évolution du marché financier ne joue plus un rôle déterminant dans les décisions d'investissement.

Les chiffres récents confirmant le caractère durable de cette rigidité dans les comportements des investisseurs qui se traduit par le maintien d'une très faible proportion de leurs portefeuilles investis dans l'activité de capital-risque au sens strict. Ainsi, en France, les investissements en capital-risque (phase d'amorçage et de création) ne représentent en 2005 que 6 % (481 millions d'euros) de l'ensemble du capital-investissement contre 20 % lors du point haut historique de 2000. Les opérations de LBO/capital-transmission (6,3 milliards d'euros) représentant quant à elle la plus grande partie (75 %) des investissements (AFIC, 2006).

CONCLUSION

L'étude des comportements d'investissement des capital-risqueurs au cours de la période récente est riche d'enseignements dans le cadre de l'élaboration d'une analyse des décisions de financement en information imparfaite. Les caractéristiques spécifiques aux start-up technologiques soulignent la nécessité de développer une approche théorique prenant explicitement en compte la forte incertitude pesant sur l'activité des firmes technologiques en phase de démarrage et donc indirectement sur les sociétés de capital-risque. Les décisions d'investissement de ces dernières se prêtent alors difficilement à une analyse recourant aux outils traditionnels de l'optimisation mais n'en sont pas pour autant irrationnelles. La forme différente de rationalité qui est à l'œuvre est intéressante à plus d'un titre.

Elle permet d'intégrer dans l'analyse des choix d'investissement en capital-risque des éléments souvent sous-estimés ou ignorés dans la plupart des approches empiriques ou théoriques (17). Parmi ces éléments omis dans la littérature, nous avons mis l'accent sur la confiance et les procédures heuristiques particulières utilisées par les investisseurs en situation d'incertitude. Toutes ces notions sont, comme nous l'avons montré, centrales car elles expliquent à la fois l'existence de rigidités (et de stabilité) dans les comportements mais aussi le caractère brutal et intense des changements d'opinion des capital-risqueurs (et plus généralement des investisseurs en situation d'incertitude) sur la viabilité de leurs choix d'investissement.

Elles permettent également de mieux comprendre – c'était l'objectif essentiel de ce travail – la déconnexion observée ces dernières années entre le montant des investissements et l'un des indicateurs économiques habituellement considérés comme essentiels dans l'activité de capital-risque, l'évolution des marchés financiers.

(17) Ces dernières sont le plus souvent formulées en intégrant des asymétries d'information dans un environnement de simple risque probabilisable.

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3. Perspectives de Recherche et Travaux en Cours

3.1. Politique prudentielle et instabilité financière :

Bruno, O., Cartapanis, A. et Nasica, E. (2010), “Bank behaviour, financial fragility and prudential regulation”, *Colloque annuel du GDRE Monnaie Banque et Finance*, 27èmes Journées d’Économie Monétaire et Bancaire, Bordeaux, GREThA et LARE-efi, 17-18 juin.

Paper given at the 27th Symposium on
Money, Banking and Finance

Bordeaux, 17 and 18 June 2010

Bank Behaviour, Financial Fragility and Prudential Regulation

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Preliminary Draft

June 2010

1. INTRODUCTION

The financial crisis of 2008 is generally attributed to a number of factors associated with the housing and credit markets. Suggested causes include the inability of homeowners to make their mortgage payments, overbuilding during the boom period, high personal and corporate debt levels, financial product innovation (such as adjustable-rate mortgages; mortgage-backed securities or collateralised debt obligations), the failure of key financial institutions and errors of judgment by credit rating agencies in the rating of structured products. Macroeconomic factors such as monetary policy, international trade imbalances, and government regulation (or lack thereof) are also considered to have played a direct or indirect role in the crisis.

Without denying the exacerbating effects of the above factors, this paper submits that the roots of the current financial crisis lie in one main cause: the rational profit-seeking behaviour of banks. More precisely, we believe that the rational behaviour of banks during a phase of economic expansion is the key reason behind the procyclical financial fragility of the economic system and its increased sensitivity to a (financial or economic) shock.

The relationship between bank behaviour and financial instability has been studied by economists basing their analysis on a variety of analytical tools and hypotheses. One approach underlines the role played by uncertainty and confidence in the emergence of an endogenous mechanism of financial fragility and instability driven by the dynamics

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of asset prices and banking behaviour. The most representative and influential work adopting this approach was developed by Hyman P. Minsky. As is well known, for forty years starting in the mid-1950s, this author developed an original business cycle theory based on a financial concept of economic fluctuations and more specifically the “financial instability hypothesis” (Minsky, 1975, 1982 and 1986). A central aspect of this theory is the economy’s inherent tendency to transform itself into an unstable ‘financially fragile’ system through the simple interplay of the profit-seeking behaviour of economic agents. Banks are at the core of the Minskian model of financial instability: their rational profit-seeking behaviour in an uncertain decision-making environment leads them to promote financial practices which give rise to a situation of growing financial fragility. More recently, macroeconomic models based on asymmetric information also placed the role played by banks at the centre of the analysis of financial instability. A distinctive feature of these models is that the root causes of currency and financial crises lie in the vulnerabilities of the banking sector.

Our paper is in line with the ideas developed by both these approaches. In the same vein, we propose to show why bank behaviour is at the heart of financial fragility and instability. However, unlike these approaches, our analysis is not focused on the problems of imperfections or uncertainty. On the contrary, we show that financial fragility can emerge even though banks make their decisions in a decision-making environment without any kind of imperfect information and comply with the requirements laid down by the Basel II Accord on banking sector regulation.

However, Minsky, who died in 1996, analysed bank behaviour within the institutional framework implemented by the Basel Accord of 1988. The first Basel Accord is now being replaced by a new accord, Basel II.¹ The new accord is being introduced to keep pace with the increased sophistication of lenders' operations and risk management and overcome some of the distortions caused by the lack of granularity in Basel I. Lenders had been able under Basel I to reduce required capital in ways that did not reflect lower real risk (in what has become known as regulatory capital arbitrage). The intention is that Basel II will align required minimum capital more closely with lenders' real risk profile. Indeed, Basel I required lenders to calculate a minimum level of capital based on a single risk weight for each of a limited number of asset classes, e.g., mortgages, consumer lending, corporate loans, exposures to sovereigns. Basel II goes well beyond this, allowing some lenders to use their own risk measurement models to calculate required regulatory capital whilst seeking to ensure that lenders establish a culture with risk management at the heart of the organisation.²

¹ In the EU all deposit takers had to implement Basel II by no later than 1 January 2008.

² The three Pillars of Basel II enshrine the key principles of the new regime. Pillar 1 covers the calculation of risk weights to determine a basic minimum capital figure. The Accord provides for a choice of ways to calculate required capital. The simplest is the standardized approach, which provides set risk weights for some asset classes and requires the weight on others to be determined by the public credit rating assigned to the particular asset by the rating agencies. Lenders are able to choose the more sophisticated “internal ratings based” (IRB) approach, either foundation, advanced or retail. These allow lenders to use their own risk models to determine appropriate minimum capital. Pillar 1 also requires lenders to assess their market and operational risk and provide capital to cover such risk. Under Pillar 2, lenders are required to assess risks to their business not captured in Pillar 1, for which additional capital

The aim of this paper is to study whether the main conclusions of Minsky's analysis or more recent financial instability models concerning the relationship between banks' behaviours and financial fragility are still valid within the new prudential framework set up by Basel II. The first part of the paper (Section 2) analyses the theoretical background to our work. More specifically, it aims to recall the main features of the recent approaches on financial instability placing banks at the centre of the analysis. In the second part of the paper (Section 3), we develop a model of banking and financial fragility *à la Minsky* (1986). We show in particular how banks' rational behaviour leads to an increase in the financial fragility of the economy during a period of economic expansion due to a rise in the equilibrium level of bank leverage (see also E. Nasica, 2010). However, unlike most previous models of financial instability, our results are obtained in a decision-making environment without any kind of imperfect information and where banks meet the requirements set out by the Basel II agreement. In our conclusion (Section 4), we show that the introduction of maximum leverage is completely justified, *ceteris paribus*, from the viewpoint of control of financial stability and that this leverage ratio actually curtails credit supply. However, the effects on economic growth are complex. They depend on the level of maximum bank leverage, but also on the weighting assigned to the social utility of the available volume of credit and to the disutility of the risk of a financial crisis.

2. THE ROLE OF BANKS IN RECENT (AND LESS RECENT) MODELS OF FINANCIAL INSTABILITY

The devastating consequences of the ongoing financial crisis on economic activity and unemployment have reignited the debate, both theoretical and empirical, on the causes of and possible remedies for financial fragility and instability.

Empirically³, the seeds of the crisis can be traced to the low interest rate policies adopted by the Federal Reserve and other central banks after the collapse of the technology stock bubble. The appetite of Asian central banks for (debt) securities also contributed to lax credit. These factors helped fuel a dramatic increase in house prices in the United States and several other countries, including Spain and Ireland. Taylor (2008) documents that these were the countries where monetary policy was loose according to standard measures. This bubble reached its peak in the United States in 2006 when house prices there and elsewhere started to fall and interest rates began to rise. Defaults on a significant proportion of subprime mortgages produced spillover effects around the world, via the securitised mortgage derivatives into which these mortgages were bundled, on the balance sheets of the investment banks, hedge funds and conduits (which are bank-owned but off their balance sheets) which intermediate between mortgage and other asset-backed commercial paper and long-term securities.

may be required (for example the risk caused by interest rate mismatches between assets and liabilities). Finally, Pillar 3 requires lenders to publish information on their approach to risk management and is designed to raise standards through greater transparency.

³ A thorough overview of the events preceding and accompanying the current financial crisis is provided in Allen and Carletti (2010), Brunnermeir (2009), Greenlaw et al. (2008) and Taylor (2008).

Uncertainty about the value of the securities collateralised by these mortgages developed into uncertainty about the soundness of loans for leveraged buyouts. All of this led to the freezing of the interbank lending market in August 2007, followed by substantial liquidity injections by the Federal Reserve and other central banks.

During the autumn of 2007, the prices of subprime securitisations continued to tumble and many financial institutions started to feel the strain. Although the financial system and banks in particular came under tremendous pressure during this time, the real economy was not seriously affected. All this changed in September 2008 when Lehman's demise forced markets to reassess risk. While Lehman's bankruptcy generated substantial losses for several counterparties, its more disruptive consequence was the signal it sent to the international markets that credit risk in the banking sector and financial industry was a serious concern. Reassessing risks previously overlooked, investors withdrew from the markets and liquidity dried up.

At a theoretical level, these dramatic events have opened a debate on the relevance of traditional economic models. In particular, some leading economists (Colander, Goldberg, Kirman et al., 2008, Acemoglu, 2009, Stiglitz, 2009) have denounced the inadequacy of the traditional macroeconomic models in foreseeing this major event of contemporaneous economic history.⁴ In our opinion, one of the main weaknesses of these models is that they neglect the role of banks' behaviours in explaining the procyclical financial fragility of the economic system and its increased sensitivity to a financial or economic shock (the fall in house prices and the rise in interest rates in the present case).

Our paper is thus in the tradition of a relatively small number of works which underline the relationship between bank behaviour and financial instability. During recent decades, this point has been studied by economists basing their analysis on a variety of analytical tools and hypotheses. These differences concern in particular the decision-making environment of banks.

A common feature of a first family of works is consideration of the imperfection of financial markets, and in particular information asymmetries, as the root cause of financial instability. For instance, in Mishkin's approach (1999a and 1999b), an increase in information asymmetry generates *ex ante* an increasing risk of adverse selection. Financial intermediaries react to this fear by reducing their amount of capital invested. Similarly, it generates *ex post* an increase in moral hazard, which intermediaries also manage by cutting credit. Since asymmetries of information are pervasive on financial markets, any shock which increases asymmetries of information (such as deterioration of banking or non financial agents' balance sheets, increase in interest rates, drop in asset prices, or increase in uncertainty), will result in a cut in credit, and therefore investment.⁵

Along the same lines, "third-generation" models materialised ten years ago to explain the events in emerging countries during the 1997 Asian crisis. These models have

⁴ On this point, see also Cartapanis (2010).

⁵ See Bruno (2009) for the differential impact of a capital crunch on small and large firms' investment capabilities.

sought to supersede the traditional framework that placed the balance of payments at the centre of the analysis by instead shifting attention to the financial system and, more precisely, to the role of the banking system. In particular, the models underline the role of banking fragility caused by balance-sheet mismatches. Different third-generation models explore various mechanisms through which balance-sheet exposures may lead to a currency and banking crisis. Thus, according to Allen *et al* (2002), four types of balance sheet mismatches can be identified: (i) maturity mismatches, where the gap between short term liabilities and liquid assets leaves an institution incapable of pledging its contractual commitments if lenders refuse to roll over debt, or creates exposure in the face of rising interest rates (Bernanke and Gertler, 1989); (ii) currency mismatches, where sudden changes in exchange rates lead to a capital loss; (iii) capital structure problems, where excessive leverage leaves a firm or bank exposed to uncertain revenue shocks in adverse market conditions; (iv) solvency problems, in cases where assets are insufficient to cover liabilities. Solvency risk can arise for various reasons. For instance, Chang and Velasco (2001) show that a liquidity exposure leads to the possibility of a Diamond and Dybvig (1983) style bank run. According to Caballero and Krishnamurthy (2001), firms face a liquidity problem because they finance risky long-term projects with foreign loans but have access to limited amounts of internationally accepted collateral. In all these models, information asymmetries and their consequences play a central role. For instance, in both Krugman (1998) and Corsetti *et al.* (1998), the emphasis is on the moral hazard phenomenon, which would seem to have induced many banks in southeast Asia to grant high-risk, low profitability loans, in the belief that, in a worst case scenario, the economic policy authorities would intervene to bail them out.

A second type of approach present in literature since the 1970s and 1980s and based on Minsky's works (1975, 1982), obtains similar results using different methodological tools. A central aspect of Minsky's approach is the economy's inherent tendency to transform itself into an unstable 'financially fragile' system, through the simple interplay of the profit-seeking behaviours of economic agents. The decision-making environment of economic agents is characterised by strong (Keynesian) uncertainty rather than asymmetric information.

Over the years Minsky tried to improve his description of the nature of the mechanism underlying financial fragility. As early as 1977 he defined it as follows: "Over a period in which the economy does well, views about acceptable debt structure change. In the deal-making that goes on between banks, investment bankers, and businessmen, the acceptable amount of debt to use in financing various types of activity and positions increases" (Minsky, 1982, pp. 65–6).

Choosing the appropriate financial structure falls to two sets of decision-makers: the owners of capital assets and the financial community. Both will require 'margins of safety'. These margins of safety are the central pillar of Minsky's theory of financial fragility. They can be identified by "the payment commitments on liabilities relative to cash receipts, the net worth or equity relative to indebtedness [...]. The size of the margins of safety determines whether a financial structure is fragile or robust and in turn

reflects the ability of units to absorb shortfalls of cash receipts without triggering a debt deflation" (Minsky 1986, p. 79-80).

Thus, as tranquil conditions turn to upswing, bankers are induced to sanction lending based on pro formas with lower margins of security. Projects where receipts always covered outflow commitments by a large margin are followed by projects where expected earnings in particular periods may fall short but over the life of the project still cover gross cash commitments by a large margin. The result is a shift from hedge to speculative financing units. Accordingly, the concept of financial fragility is built around changes in these margins of safety. It is the slow and imperceptible erosion of these margins of safety that produces financial fragility (Kregel, 1997).

This process of procyclical fragility also affects banks' balance sheets. Indeed, competition among banks leads them to increase their indebtedness in proportion to the amount of their equity, reserves and safe assets (such as government securities). How banks undergo the process of balance sheet fragilisation is explained in Chapter 10 of *Stabilizing an Unstable Economy*, which Minsky devotes to banking (Minsky, 1986, p. 223–253). He shows very simply that the profit-seeking behaviour of banks leads them to deliberately reduce their equity-to-assets ratio when their activity is expanding. They do this because even a small reduction in this ratio is likely to generate large increases in the rate of profit as well as a rapid increase in the volume of the banks' total assets. Expansion thus encourages them to engage in financial operations involving high leverage.⁶ Conversely, when the economy is slowing down, banks will seek to increase their equity-to-assets ratio in order to protect their shareholders against possible losses resulting from borrower default. Thus, as a result of competition, the equity-to-assets ratio of commercial banks is subject to change during the business cycle, inasmuch as its evolution tends to be countercyclical.

In short, during periods of financial and economic "tranquillity" – when actual profits are at least equal to expected profits and outstanding debts are easily serviced – the confidence of economic agents grows. This leads to an erosion of the margins of safety, an increase in the maximum level of indebtedness that banks deem prudent or acceptable and a process of procyclical financial fragility.⁷

We develop below a model of banking and financial fragility whose results are similar to those obtained using both the aforementioned approaches. However, unlike these approaches, our analysis is not focused upon problems of uncertainty or asymmetric information. On the contrary, we show that financial fragility can emerge even though banks take their decisions in a decision-making environment without any kind of imperfect information and meet the requirements laid down by the Basel II accord.

⁶ 'The impact of increased leverage on bank profits is impressive: if a bank that makes 0.75 percent on assets decreases the ratio of capital to assets to 5 per cent from 6 percent, the profit rate on book value will be 15.0 percent rather than 12.5 percent. If such an increase in leverage takes place over several years, the profit rate will rise each year. With a constant dividend on book value ratio, this implies that the growth rate mandated by retained earnings will rise from 7.5 to 10 percent.' (Minsky, 1986, p. 237).

⁷ Minsky also underlines that financial fragility and instability is increased by the innovative behaviour of banks on money and credit markets. On this point, see Nasica (2010).

3. THE MODEL

We consider three classes of agents – firms, individual investors and a bank – and two periods. In the first period, entrepreneurs need external funds in order to invest in a risky project subject to a macroeconomic shock. We assume that firms have access to bank loans only. In this period, financial contracts are signed between lenders and the bank and investment decisions are made. In the second period, the value of the macroeconomic shock and the effective return on investment are known. Non-defaulting firms have to pay for their external funds whereas defaulting firms are liquidated. We assume that all parties are risk-neutral and protected by limited liability.

3.1. Firms and bank behaviours

Firms have access to a risky investment project that requires one unit of wealth in order to be undertaken in period 1. We assume there is no financial market and that firms lack capital and need to borrow the total amount of their investment from a bank.

The returns on investment projects vary from one firm to another and are uniformly distributed on $[0, \bar{X}]$ with x_i the return on the project i undertaken by firms i . The value x_i is known at the beginning of period 1 by firms and by the bank.

In period 2, projects are subjected to a macroeconomic shock θ (it is similar to systematic risk for a project). The total return on project i is thus given by $V_i = \theta x_i$ with $\theta = \bar{\theta} + dz$ the value of the macroeconomic shock with $\bar{\theta} > 0$ and $dz = \varepsilon \sigma_\theta \sqrt{dt}$ a Brownian motion. σ_θ is a measure of the volatility of the shock, $\varepsilon \sim N(0,1)$ is a normally distributed stochastic variable and $dt = 1$ (the length of the period). Consequently, the value of the shock in period 2 is equal to $\theta = \bar{\theta} + \varepsilon \sigma_\theta$ and only depends on realisation of the stochastic variable ε . As $E[\varepsilon] = 0$, the expected value of the macroeconomic shock in period 1 is given by $E[\theta] = \bar{\theta}$.

Lastly, we assume that firms must provide an asset as collateral for their loan, with Z^e the expected value of this collateral at period 1, and Z^e is the same for all firms with $Z^e \in]0, 1[$.

There is one bank in the economy endowed with its own capital and individual investors' deposits. These deposits are insured through a government-funded scheme and receive the risk-free return $\gamma > 1$ (which is also the opportunity cost of the funds). The bank is owned by shareholders who provide it with the equity capital required by banking regulation.⁸ At the beginning of period 1, the bank decides to finance the various investment projects proposed by entrepreneurs at a rate $R > \gamma$. There is no moral hazard between the bank and firms, as the value of x_i is common knowledge.

⁸ As capital is more costly than deposits, the bank will retain the minimum level required by banking regulation

We assume that firms apply for credit in period 1 and that the bank finances them as long as the expected value of their projects exceeds the rate of return they must pay back in period 2, such that

$$E[V_i] = \bar{\theta}x_i \geq R \quad (1)$$

From equation (1) it is easy to show that the last firm financed by the bank is given by

$$\bar{x}_i(R) = \frac{R}{\bar{\theta}} \quad (2)$$

and the total quantity of financing in the economy is given by

$$D = (\bar{X} - \bar{x}_i(R)) \text{ with } \bar{X} > R \quad (3)$$

3.2. Bank regulatory capital and firms' probability of default

We assume that the bank's level of capital is exactly equal to that required by the Basel II IRB approach. According to this approach, the level of bank capital requirement is linked to the level of risk of its loan portfolio. In order to calculate the bank's capital requirement, we need to calculate the probability of default of each project it finances.

A project i is in default if the firm cannot repay the value R in period 2. Formally, the probability of default of each project is given by the following conditional equation

$$P[V_i < R / x_i \geq \bar{x}_i(R)] \quad (4)$$

As $V_i = \theta x_i = \bar{\theta}x_i + x_i \varepsilon \sigma_\theta$ we obtain

$$\begin{aligned} P[\bar{\theta}x_i + x_i \varepsilon \sigma_\theta < R / x_i \geq \bar{x}_i(R)] \text{ and} \\ P\left[\varepsilon < \bar{\varepsilon}_i = \frac{R - \bar{\theta}x_i}{x_i \sigma_\theta} / x_i \geq \bar{x}_i(R)\right] = \phi(\bar{\varepsilon}_i) \end{aligned} \quad (5)$$

where ϕ denotes the cumulative distribution function of a standard normal random variable. This equation means that project i defaults if the realised value of the shock ε is larger than the critical value $\bar{\varepsilon}_i$. This probability of default is an increasing function of the bank's rate of return (R) and of the volatility of the macroeconomic shock (σ_θ). Conversely, this probability of default decreases in line with the value of x_i i.e. the intrinsic "quality" of project i . Finally, the last project financed by the bank $\left(\bar{x}_i(R) = \frac{R}{\bar{\theta}}\right)$ has a constant probability of default given by $\phi(0) = 1/2$.

According to Basel II, the minimum level of capital requirement must cover the bank's loss in $\alpha\%$ of cases (normally $\alpha = 99.99$). Consequently, the bank capital requirement for project i , in accordance with Basel II, is given by the following formula:

$$k_i = LGD \times EAD \times (\phi(\bar{\varepsilon}_i) - \phi(\varepsilon_\alpha)) \text{ where } \phi(\varepsilon_\alpha) = (1 - \alpha)\% \quad (6)$$

In our case, the Exposure at Default (EAD) is equal to 1 (the amount of the loan) while the LGD is given by $\lambda = 0.45$ (as in Basel II). Equation (6) becomes

$$k_i(R) = \lambda(\phi(\bar{\varepsilon}_i) - \phi(\varepsilon_\alpha)) \quad (7)$$

The level of regulatory capital required to cover the bank's loss at $\alpha\%$ is a decreasing value of x_i . It is possible to find the last project x_{\max} financed by the bank that requires regulatory capital. We look for the last x_i such that $\bar{\varepsilon}_i = \frac{R - \bar{\theta}x_i}{x_i\sigma_\theta} = \varepsilon_\alpha$ with $\bar{\varepsilon}_i < 0, \varepsilon_\alpha < 0$

$$x_{\max}(R) = \frac{R}{\bar{\theta} + \varepsilon_\alpha\sigma_\theta} \quad (8)$$

We assume that $|\bar{\theta}| > |\varepsilon_\alpha\sigma_\theta|$ and $\bar{X} < \frac{\gamma}{\bar{\theta} + \varepsilon_\alpha\sigma_\theta}$, which means that the bank must provide regulatory capital for each project it finances.

The total amount of regulatory capital required to cover the bank's loan portfolio is given by

$$K(R) = \int_{\bar{x}_i(R)}^{\bar{X}} k_i(R) dx_i = \int_{\bar{x}_i(R)}^{\bar{X}} \lambda(\phi(\bar{\varepsilon}_i) - \phi(\varepsilon_\alpha)) dx_i \quad (9)$$

3.3. Bank's equilibrium rate of return and the total value of financing

The net expected return on the bank portfolio depends on the number of projects financed by the bank and the number of defaulting loans. When the bank finances a project, it receives the rate of return R if the project succeeds and the expected value of the collateral Z^e if the project fails.⁹ Project i 's probability of default is given by $\phi(\bar{\varepsilon}_i)$ and its probability of success is given by $1 - \phi(\bar{\varepsilon}_i)$. Moreover, we know that the last project financed by the bank is $\bar{x}_i(R)$ and that the financing cost for the bank (opportunity cost of the funds) is given by $\gamma > 1$. The net expected return on the bank portfolio ($V_b^e(R)$) is equal to

$$\begin{aligned} V_b^e(R) &= \int_{\bar{x}_i(R)}^{\bar{X}} [(1 - \phi(\bar{\varepsilon}_i))R + \phi(\bar{\varepsilon}_i)Z^e] dx_i - \int_{\bar{x}_i(R)}^{\bar{X}} [\gamma(1 - k_i(R))] dx_i - \int_{\bar{x}_i(R)}^{\bar{X}} R_b k_i(R) dx_i \\ V_b^e(R) &= \int_{\bar{x}_i(R)}^{\bar{X}} [(1 - \phi(\bar{\varepsilon}_i))R + \phi(\bar{\varepsilon}_i)Z^e - \gamma] dx_i - \int_{\bar{x}_i(R)}^{\bar{X}} k_i(R)(R_b - \gamma) dx_i \end{aligned}$$

⁹ We assume the project has no residual value of in the event of a default.

where R_b is the gross return on the bank's capital.

We assume that the bank seeks to maximise its net expected RORAC (Return On Risk Adjusted Capital) defined as

$$\text{RORAC} = \Gamma = \frac{\text{Net expected return on bank portfolio}}{\text{Economic Capital}}$$

As the bank simply provided the level of capital required by banking regulation, this means that in our model economic capital is equal to regulatory bank capital. Thus

$$\text{RORAC} = \Gamma = \frac{\text{Net expected return on bank portfolio}}{\text{Regulatory Bank capital}}$$

As the regulatory capital requirement is given by (9), the value of the expected RORAC is equal to

$$\Gamma(R) = \frac{\int_{\bar{x}_i(R)}^{\bar{X}} [(1 - \phi(\bar{\varepsilon}_i))R + \phi(\bar{\varepsilon}_i)Z^e - \gamma] dx_i}{\int_{\bar{x}_i(R)}^{\bar{X}} \lambda(\phi(\bar{\varepsilon}_i) - \phi(\varepsilon_\alpha)) dx_i} \quad (10)$$

Proposition 1.

- a. For $\bar{X} > \frac{Z^e + \sqrt{4A}}{\theta}$ where $A = \left(\frac{\gamma - \phi\left(\bar{\varepsilon}_i\left(\frac{\theta\bar{X}}{2}\right)\right)}{\phi'_\varepsilon\bar{\varepsilon}'_i\left(\frac{\theta\bar{X}}{2}\right)} \right)$ and $Z^e + \frac{1 - \phi(\bar{\varepsilon}_i(\gamma))}{\phi'_\varepsilon\bar{\varepsilon}'_i(\gamma)} > \gamma$,

there is a unique value $R^* \in [\gamma, \bar{R}]$ that maximises the net RORAC of the bank where $\Gamma(R^*) > 0$.

b. The total level of financing in the economy is given by $D^*(R^*) = (\bar{X} - \bar{x}_i(R^*)) > 0$

$$\text{where } \frac{\partial D^*(R^*)}{\partial R^*} < 0.$$

c. The equilibrium level of the bank's leverage is equal to $\ell^*(R^*) = \frac{D^*(R^*)}{K^*(R^*)}$ where

$$\frac{\partial \ell^*(R^*)}{\partial R^*} < 0.$$

Proof of Proposition 1: see appendix

According to part a of proposition 1, if the size of the market is sufficiently large (conditional on a sufficiently large \bar{X}) the bank can always find a unique value of its rate of return that maximises its RORAC. Moreover, as stated in part b of proposition 1, the total quantity of financing in the economy is a decreasing function of the bank's equilibrium rate of return (R^*), since when the bank's equilibrium rate of return on loans falls, some new firms find it profitable to apply for credit.

Finally, part c proves that the equilibrium level of bank leverage is a decreasing function of the rate of return it charges to firms. This result can be easily understood. The probability of default of each firm financed by the bank is a decreasing function of R^* : *ex ante, ceteris paribus*, a firm's ability to repay its loan improves as the rate of return charged by the bank decreases. Consequently, based on our assumption, the total quantity of capital provision decreases with R^* and $K(R)$ is an increasing function of the rate of return. Thus, when the bank cuts the rate of return it charges to the companies, its level of assets is increasing whereas its level of regulatory capital is decreasing, leading to a rise in its equilibrium level of leverage.

3.4. Expected value of the collateral and equilibrium level of bank leverage

It should be noted that the equilibrium rate of return charged by the bank is a function of the expected value of the collateral Z^e and of the value of the opportunity cost of the funds γ . Below, we study the impact of a change in the expected value of the collateral on bank behaviour. We show that when the bank expects an increase in the value of the collateral provided by firms, it can cut the value of its rate of return. In such cases, a higher expected collateral value leads to an increase in the equilibrium level of leverage of the bank.

Proposition 2.

If $\phi'_\varepsilon < \frac{1}{\theta} \frac{R^* \sigma_\theta}{\bar{\theta} \bar{X} - R^*} \phi(\varepsilon_i(R^*))$, this means $\frac{\partial R^*(Z^e)}{\partial Z^e} < 0$ and a rise in the value of the collateral Z^e leads to a decrease in the equilibrium value of the rate of return charged by the bank.

Proof of Proposition 2: see appendix

The concept behind proposition 2 is easy to understand. The rise in the value of the collateral has a direct positive impact on the bank's net expected profit since, *ceteris paribus*, it increases the expected return in the event of a firm defaulting. Formally, we

have $\frac{\partial B(R^*, Z^e)}{\partial Z^e} > 0$. On the other hand, in line with proposition 2, this rise leads to a

decrease in the bank's marginal net expected profit, since $\frac{\partial B'(R^*, Z^e)}{\partial Z^e} < 0$.

Remember that for R^* the bank maximises the value of its RAROC when $B'(R^*, Z^e)K(R^*) - B(R^*, Z^e)K'(R^*) = 0$ or $\frac{B'(R^*, Z^e)}{B(R^*, Z^e)} = \frac{K'(R^*)}{K(R^*)}$. Accordingly, at this equilibrium, the rate of growth in the net expected profit due to a change in the rate of return (measured by $\left(\frac{B'(R^*, Z^e)}{B(R^*, Z^e)} \right)$) should be equal to the rate of growth in the quantity of regulatory capital $\left(\frac{K'(R^*)}{K(R^*)} \right)$ implied by this change.

Note also that a change in the expected value of the collateral directly alters the bank's net expected (and marginal) profit, but keeps its required level of regulatory capital unchanged. Consequently, the bank must change its behaviour in order to reach a new equilibrium.

As $\left(\frac{B'(R^*, Z^e)}{B(R^*, Z^e)} \right)$ decreases and $\left(\frac{K'(R^*)}{K(R^*)} \right)$ is constant, the rise in the expected value of the collateral means that for the previous rate of return charged by the bank we have $\frac{B'(R^*, Z^e)}{B(R^*, Z^e)} < \frac{K'(R^*)}{K(R^*)}$. The bank must improve this situation by raising its net expected marginal profit and decreasing its marginal level of regulatory capital. This can be done by cutting the rate of return charged on each loan. In this case, the quantity of funds requested by firms increases, leading to a rise in the marginal rate of profit. Incidentally, the *ex ante* probability of default of each project falls as the rate of return charged on each firm decreases. Consequently, the required level of regulatory capital for each firm that is financed decreases and the bank can restore the equilibrium value of its RORAC. Lastly, as the quantity of financing increases while the provision of regulatory capital decreases on each project, the equilibrium level of leverage increases in line with the rise in the expected value of the collateral (see proposition 1).

3.5. Bank leverage and financial fragility

The value of the bank at period 2 comprises two parts. The first is the provision of regulatory capital that allows the bank to absorb a part of the macroeconomic shock, whereas the second is determined by the value of the bank's assets. This second part is linked to the realised value of the macroeconomic shock and to the realised value of the collateral Z . For simplicity, we assume that the realised value of the collateral is equal to the expected value ($Z = Z^e$), in other words the value of the bank in period 2 essentially depends on the realisation of the macroeconomic shock.

$\varepsilon_c < 0$ is defined as the value of the macroeconomic shock for which financed firms with $\bar{x}_i < x_i \leq x_c = \frac{R^*}{\bar{\theta} + \sigma_\theta \varepsilon_c}$ are in default. It means that financed firms with $x_i \in [x_c, \bar{X}]$ are successful. Consequently, the equilibrium value of the bank in period 2 is given by

$$V_b(R^*) = K(R^*) + \int_{x_c(R^*)}^{\bar{X}} R^* dx_i + \int_{\bar{x}_i(R^*)}^{x_c(R^*)} Z^e dx_i - \int_{\bar{x}_i(R^*)}^{\bar{X}} \gamma dx_i \quad (11)$$

Or equivalently

$$V_b(R^*) = K(R^*) + R^* [\bar{X} - x_c(R^*)] + Z^e [x_c(R^*) - \bar{x}_i(R^*)] - \gamma [\bar{X} - \bar{x}_i(R^*)]$$

$$\text{where } x_c(R^*) = \frac{R^*}{\bar{\theta} + \varepsilon_c \sigma_\theta}, \bar{x}_i(R^*) = \frac{R^*}{\bar{\theta}}$$

Lemma 2.

When $\varepsilon \leq \varepsilon_c < 0$ where $\varepsilon_c \equiv \frac{\bar{\theta}[(R^* - \gamma)(R^* - \bar{\theta}\bar{X}) - K^*(R^*)\bar{\theta}]}{\sigma[\bar{\theta}(K^*(R^*) - \gamma\bar{X}) + R^*(\bar{\theta}\bar{X} + \gamma - Z^e)]}$ we have

$V_b(R^*) \leq 0$ and the bank goes into bankruptcy.

Proof of Lemma 2: see Appendix

The value ε_c can be considered as a measure of financial fragility, as it defines the critical level of macroeconomic shock at which the bank goes into bankruptcy. A rise in ε_c means that the bank is more sensitive to a macroeconomic shock in the sense that the value of the shock that is required to make it fail is lower: thus financial fragility increases. It is possible to show that financial fragility is a function of the expected level of the collateral and of the level of bank leverage.

Proposition 3.

For $\underline{\gamma} < \gamma < \bar{\gamma}$, there is a critical value of bank leverage $\ell_c^*(R^*(Z_c^e))$ such that for $\ell^*(R^*(Z^e)) > \ell_c^*(R^*(Z_c^e))$ where $Z^e > Z_c^e$, financial fragility is an increasing function of bank leverage.

Proof of Proposition 3: see Appendix

Proposition 3 can be used to understand the impact on financial fragility of a constant increase in the expected value of collateral during a period of economic expansion. During such expansion, along with the increase in collateral, the bank cuts the equilibrium value of the rate of return it charges to entrepreneurs (see proposition 2). As a consequence, firms' *ex ante* probability of default falls and the value of the bank's provision of regulatory capital declines. These two mechanisms induce a rise in the equilibrium level of bank leverage. Accordingly, the *ex post* value of the bank depends more and more on the value of its assets. However, the *ex post* value (the realised value) of the bank's assets depends on the level of the macroeconomic shock. Consequently, there is a critical value for the level of leverage, beyond which the bank becomes more sensitive to the value of the macroeconomic shocks. From that value, financial fragility increases in line with the level of the collateral and with bank leverage.

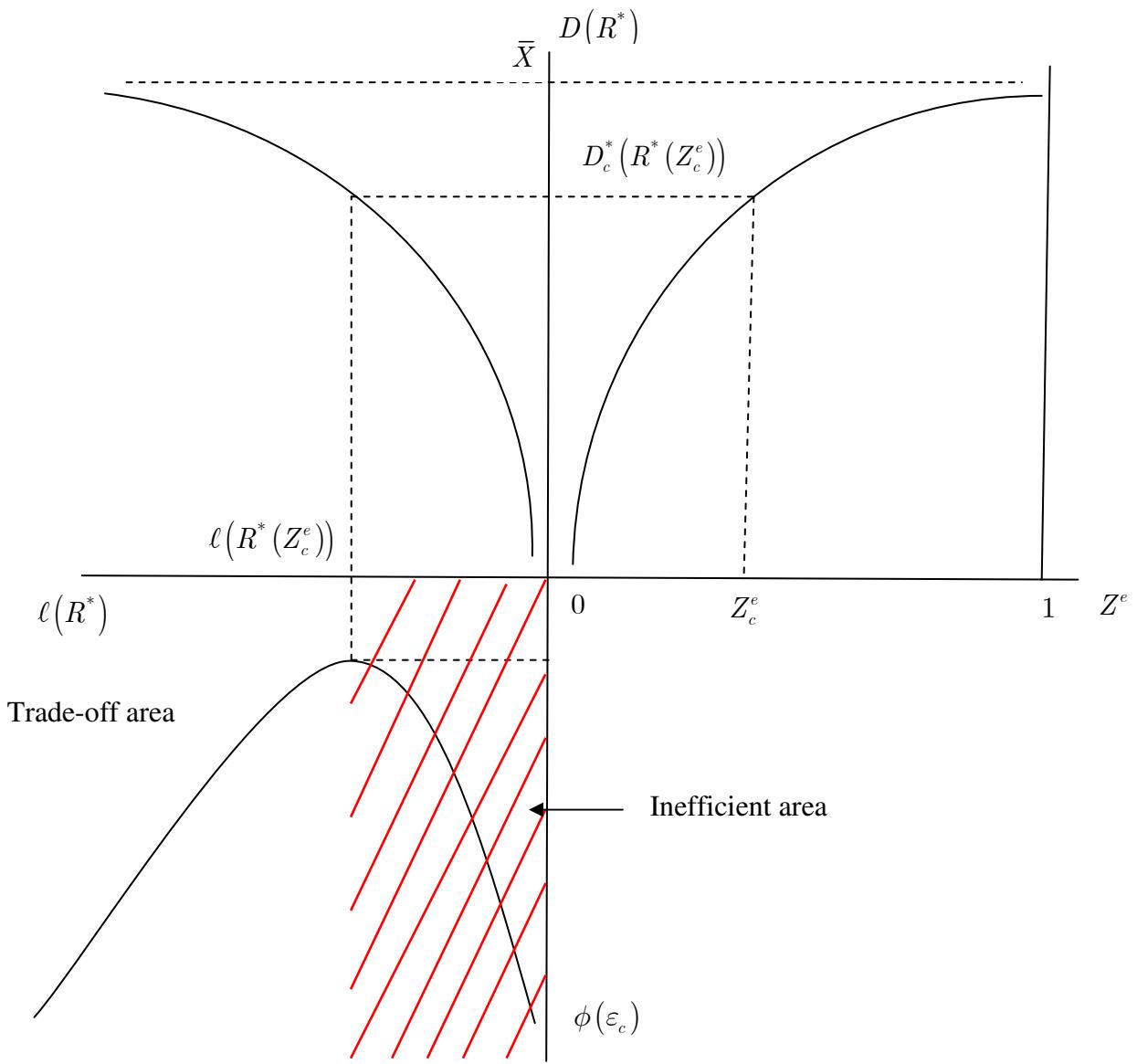
This result shows that there is a trade-off between the availability of credit to firms and financial stability. During economic expansion, along with the decrease in the rate of return charged by the bank, the quantity of funds available to firms rises and more projects can be undertaken. Simultaneously, this rise in the quantity of financing leads to a rise in the equilibrium level of bank leverage. Lastly, when the equilibrium level of bank leverage becomes higher than $\ell_c^*(R^*(Z_c^e))$, the probability of the bank defaulting increases in line with the level of financing. Consequently, from that point, higher credit availability is possible if one accepts a higher level of financial instability.

It is possible to depict this mechanism in graph form.

The first quadrant describes the relationship between the expected value of the collateral and the quantity of credit available to firms ($D(R^*)$). This relationship is increasing since a rise in the expected value of the collateral leads to a decrease in the rate of return charged by the bank, which in turns increases credit availability.

The second quadrant links the equilibrium quantity of credit to the equilibrium value of the bank's leverage ratio. The higher the equilibrium quantity of credit distributed by the bank, the higher its leverage ratio. Lastly, the last quadrant gives the probability of the bank defaulting ($\phi(\varepsilon_c)$), according to the value of the leverage ratio.

The following graph shows that there is a value of the leverage ratio for which the probability of the bank defaulting is at its minimum, which means that financial stability is at its maximum. For a higher or lower level of leverage ratio, bank probability of default increases along with financial fragility. This result shows that lowering bank leverage excessively can increase financial fragility. Conversely, a rise in the leverage ratio above the "maximum stability value" (defined in our model by $\ell_c^*(R^*(Z_c^e))$) also increases financial fragility. Thus, there is a trade-off between financial stability and credit availability: if one decides to raise the quantity of credit available to firms above $D_c^*(R^*(Z_c^e))$, a higher degree of financial fragility can be accepted.



In a sense, the model leads to a fundamental Minskyan result: in a phase of economic expansion during which banks' expectations of the future value of their collateral improve (when Z^e increases in our model), the profit-seeking behaviour of banks implies an erosion of their "margins of safety" (as illustrated by the decrease in the provision of their regulatory capital K). At macroeconomic level, these rational behaviours result in a procyclical financial fragility. The latter is reflected both in the deterioration in the bank's equilibrium level of leverage and the increased sensitivity of its probability of default to a macroeconomic shock.

It is important to note that this rise in financial fragility appears in the model even though the bank is always in compliance with the regulatory capital ratio required by Basel II regulations. This means that banking regulation based only on the assessment of microeconomic risk is unable to capture the increase in financial fragility due to a

higher level of leverage. Our results support macro-prudential regulation that takes banks' level of leverage into account.

4. CONCLUSION: LESSONS FOR PRUDENTIAL REGULATION AND LEVERAGE RATIO THRESHOLD

The pro-cyclical behaviour of credit supply fuels financial fragility and the risks of crises. But we have just seen that, in theory, it does not respond only to the imperfection of information. An endogenous process is at work at the core of the relationships between credit cycle and asset prices, given the transfer of this dynamic to banks' balance sheets similar to the mechanism analysed by Minsky and by more recent models of financial instability.

Our model also shows that the existing prudential mechanisms are inefficient at thwarting the process of financial fragility induced by banks' profit-seeking behaviour. Their capacity to stabilise the extent of economic fluctuations and to constrain market agents to undertake only moderately risky actions varies greatly over time. Interestingly, this idea is also discussed by Minsky (Minsky 1992, Ferri and Minsky 1992), who points out that some regulatory interventions and mechanisms which are initially stabilising may develop into factors of instability and inefficiency.

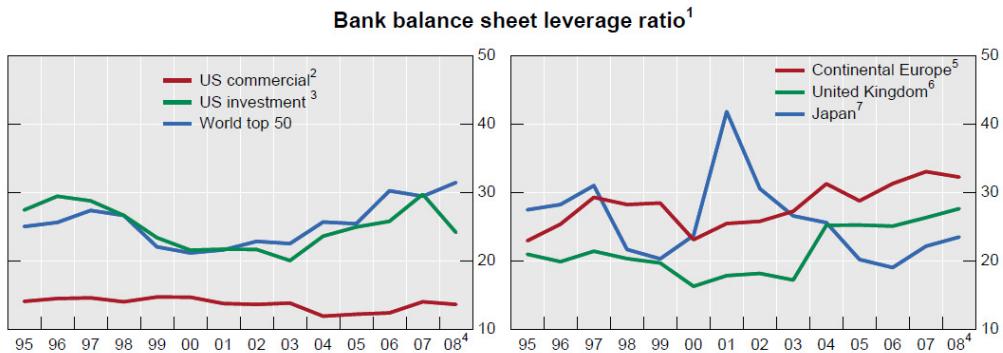
Finally, this result justifies the introduction of a maximum leverage threshold in the new macro-prudential regulations. *Ceteris paribus*, when it comes to the key intervention rates applied by the central bank in particular, a limit on maximum leverage automatically exerts a restrictive effect on credit availability. However, the model presented shows that an excessively low threshold, below $\ell_c^*(R^*(Z_c^e))$, may result in a credit crunch while increasing the risk of financial instability. Conversely, above $\ell_c^*(R^*(Z_c^e))$, there is a trade-off between the risk of financial instability and the volume of credit.

The suggested model is unable to provide a definition of an optimal level of leverage. Everything depends on the weighting granted to the social utility of the available volume of credit ($D(R^*)$) and to the disutility of the risk of a financial crisis ($\phi(\varepsilon_c)$).

However, this issue can be clarified by moving on to a purely empirical level.

In fact, the levels of bank leverage increased significantly in the 4-5 years preceding the crisis of the summer of 2007 and the panic of the autumn of 2008, in particular for the major European banks and for US investment banks, even though this was not the case for US commercial banks or Japanese banks. The increase in bank leverage was around 50% in some cases. This can be seen from the chart below, presented in a joint report by the Financial Stability Forum (now the Financial Stability Board) and one of the committees attached to the BIS, the Committee on the Global Financial System. We see that the levels of bank leverage remained quite close to a range of 20-25, i.e. leverage ratios of 5% to 4%, until 2003-2004, with significant differences according to regions or categories of banks. The fact that the top 50 major global banks, US investment banks and European universal banks had a leverage close to or even exceeding 30, and

therefore a ratio of only 3%, between 2005 and the crisis, fully confirms the theoretical analysis carried out above.



¹ Balance sheet leverage ratio (total assets divided by total equities) of individual banks weighted by asset size. ² Bank of America, Citigroup, JPMorgan Chase, Wachovia Corporation, Washington Mutual and Wells Fargo & Company. ³ Bear Stearns, Goldman Sachs, Lehman Brothers, Merrill Lynch and Morgan Stanley. ⁴ Latest quarter. ⁵ ABN AMRO Holding, Banco Santander, BNP Paribas, Commerzbank, Crédit Agricole, Credit Suisse, Deutsche Bank, Société Générale, UBS and UniCredit SpA. ⁶ Barclays, HSBC, Lloyds TSB Group and Royal Bank of Scotland. ⁷ Mitsubishi UFJ Financial Group, Mizuho Financial Group and Sumitomo Mitsui Financial Group.

Source: Bankscope.

Source: Joint FSF-CGFS Working Group, *The Role of Valuation and Leverage in Procyclicality*, March 2009, p. 7.

This excess leverage prior to the crisis and the deleveraging during its outbreak explain why the G20 and all the supervisors were converted to the idea that a leverage ratio should be added to the prudential measures. It would serve as a complementary instrument to risk ratios, and consequently not as a replacement for Basel II or Basel III under preparation.

So far, two countries are already using a bank leverage ratio, namely the United States and Canada, although Switzerland also has plans to implement it in 2013. In the case of the United States, the simplest form of leverage ratio has been chosen, i.e. the relation between Tier I capital and total adjusted assets (i.e. after deduction of intangible assets, goodwill and software spending, and deferred tax). The threshold has been set at 3% for banks deemed by the regulatory watchdog to be the most solid, and at 4% for the others. In the United States, this ratio applies both on a consolidated level and at the level of each individual bank, but without taking into account off-balance sheet items. Above all however, when the major US investment banks were supervised by the SEC, they were not subject to these measures of limits on leverage, even though specific controls applied to some of them before the crisis (Goldman Sachs, Morgan Stanley). In Canada, the authorities require compliance with a leverage multiplier, also supposed to include economic leverage, which applies on a consolidated level while including certain off-balance sheet items, but not securitised assets: thus, total adjusted assets must not represent more than 20 times capital, while a lower multiplier can be set for individual banks as decided by the OSFI, the Canadian regulatory watchdog. The requirements are therefore more stringent than in the United States, and this greater strictness concerning the leverage ratio has been presented by the Canadian prudential authorities as one of

the explanations for the greater resilience of Canadian banks to the crisis, in addition to a very strict application of capital adequacy ratios. In end-2008, given the threats looming over the Swiss banking system as a result of the crisis, the Swiss supervisory authority, FINMA, decided to introduce such a minimum leverage ratio under the Second Pillar of Basel II, but only for two banks, Credit Suisse and UBS. This ratio will be calculated from Tier 1 capital as a percentage of total adjusted assets, and will have to be maintained at a level of at least 3% on a consolidated basis, and at 4% for each individual bank. It is probably as a result of these three experiences that a bank leverage regulation at a G20 level is likely to be established in the future, according to a schedule still to be defined.

While our theoretical analysis has shown a clear trade-off between the risk of financial instability and the volume of credit, it is far more difficult to predict precisely what effects across-the-board implementation of such regulation of bank leverage levels of around 20 to 25 - 4 to 5% in leverage ratio terms – will have on credit supply, and in the final analysis on growth. To answer these questions, we have to go beyond this type of analysis, as everything will depend on the effects exerted by the new financial regulations: first, on risk premia and systemic risk, and hence on the cost of capital, and second, on the counter-cyclical leeway that macroeconomic policy will enjoy in the future if the sources of financial instability are better managed.

APPENDIX

Preliminary

Remember that

$$K(R) = \int_{\bar{x}_i(R)}^{\bar{X}} k_i(R) dx_i = \int_{\bar{x}_i(R)}^{\bar{X}} \lambda (\phi(\bar{\varepsilon}_i) - \phi(\varepsilon_\alpha)) dx_i \text{ and}$$

$$B(R) = \int_{\bar{x}_i(R)}^{\bar{X}} [(1 - \phi(\bar{\varepsilon}_i(R)))R + \phi(\bar{\varepsilon}_i(R))Z^e - \gamma] dx_i$$

Note that $K(R)$ and $B(R)$ are continuous and differentiable on $R \in [0, \infty[$ with

$$K'_R(R) = \frac{\partial K(R)}{\partial R} = \lambda \left\{ -\bar{x}'_i(R) [\phi(\bar{\varepsilon}_i(R)) - \phi(\varepsilon_\alpha)] + \phi'_\varepsilon \bar{\varepsilon}'_i(R) (\bar{X} - \bar{x}_i(R)) \right\} > 0$$

If $\phi'_\varepsilon \bar{\varepsilon}'_i(R) (\bar{X} - \bar{x}_i(R)) > \bar{x}'_i(R) [\phi(\bar{\varepsilon}_i(R)) - \phi(\varepsilon_\alpha)]$ which means that the capital gain generated by the decrease in the rate of return charged by the bank (the right side of the equation) is higher than the additional level of capital generated by financing the new projects (the left side of the equation). We assume in the following that this condition is fulfilled.

$$\begin{aligned} B'_R(R) &= \frac{\partial B(R)}{\partial R} = -\bar{x}'_i(R) [(1 - \phi(\bar{\varepsilon}_i(R)))R + \phi(\bar{\varepsilon}_i(R))Z^e - \gamma] \\ &\quad + (\bar{X} - \bar{x}_i(R)) [(1 - \phi(\bar{\varepsilon}_i(R))) + (Z^e - R)\phi'_\varepsilon \bar{\varepsilon}'_i(R)] \end{aligned}$$

where $\bar{x}'_i(R) = \frac{\partial \bar{x}_i(R)}{\partial R} = \frac{1}{\theta} > 0$ as $\bar{x}_i(R) = \frac{R}{\theta}$,

$$\frac{\partial \phi(\bar{\varepsilon}_i(R))}{\partial R} = \frac{\partial \phi(\bar{\varepsilon}_i(R))}{\partial \bar{\varepsilon}_i(R)} \frac{\partial \bar{\varepsilon}_i(R)}{\partial R} = \phi'_\varepsilon \bar{\varepsilon}'_i(R) > 0 \quad \text{where } \phi'_\varepsilon > 0 \quad \text{and}$$

$$\bar{\varepsilon}'_i(R) = \frac{1}{x_i \sigma_\theta} > 0 \text{ as } \bar{\varepsilon}_i(R) = \frac{R - \theta x_i}{x_i \sigma_\theta}$$

LEMMA 1. If $\bar{X} > \frac{Z^e + \sqrt{4A}}{\theta}$ where $A = \left(\frac{\gamma - \phi\left(\bar{\varepsilon}_i\left(\frac{\bar{\theta} \bar{X}}{2}\right)\right)}{\phi'_\varepsilon \bar{\varepsilon}'_i\left(\frac{\bar{\theta} \bar{X}}{2}\right)} \right)$ and

$$Z^e + \frac{1 - \phi(\bar{\varepsilon}_i(\gamma))}{\phi'_\varepsilon \bar{\varepsilon}'_i(\gamma)} > \gamma \text{ there is a unique } \bar{R} \in \left[\gamma, \frac{\bar{\theta} \bar{X}}{2} \right] \text{ such as } B'_R(\bar{R}) = 0.$$

Proof of Lemma 1.

$$\lim_{R \rightarrow \frac{\bar{\theta}\bar{X}}{2}} B'_R(R) = \frac{1}{\bar{\theta}} \left(\gamma - \phi \left(\bar{\varepsilon}_i \left(\frac{\bar{\theta}\bar{X}}{2} \right) \right) \right) + \frac{1}{2} \bar{X} \left(Z^e - \frac{\bar{\theta}\bar{X}}{2} \right) \phi'_e \bar{\varepsilon}'_i \left(\frac{\bar{\theta}\bar{X}}{2} \right)$$

Since $\left(\gamma - \phi \left(\bar{\varepsilon}_i \left(\frac{\bar{\theta}\bar{X}}{2} \right) \right) \right) > 0$, $\lim_{R \rightarrow \frac{\bar{\theta}\bar{X}}{2}} B'_R(R) < 0$ if $\bar{X} \left(\frac{\bar{\theta}\bar{X}}{2} - Z^e \right) > \frac{2}{\bar{\theta}} \left(\frac{\gamma - \phi \left(\bar{\varepsilon}_i \left(\frac{\bar{\theta}\bar{X}}{2} \right) \right)}{\phi'_e \bar{\varepsilon}'_i \left(\frac{\bar{\theta}\bar{X}}{2} \right)} \right)$

which means $\frac{\bar{\theta}}{2} \bar{X}^2 - Z^e \bar{X} - \frac{2}{\bar{\theta}} A > 0$ where $A = \frac{\gamma - \phi \left(\bar{\varepsilon}_i \left(\frac{\bar{\theta}\bar{X}}{2} \right) \right)}{\phi'_e \bar{\varepsilon}'_i \left(\frac{\bar{\theta}\bar{X}}{2} \right)}$. This condition is fulfilled for $\bar{X} > \frac{Z^e + \sqrt{4A}}{\bar{\theta}}$

$$\lim_{R \rightarrow \gamma} B'_R(R) = -\frac{1}{\bar{\theta}} [(Z^e - \gamma) \phi(\bar{\varepsilon}_i(\gamma))] + \left(\bar{X} - \frac{\gamma}{\bar{\theta}} \right) [(1 - \phi(\bar{\varepsilon}_i(\gamma))) + (Z^e - \gamma) \phi'_e \bar{\varepsilon}'_i(\gamma)]$$

As $\left(\bar{X} - \frac{\gamma}{\bar{\theta}} \right) > 0$ and $(Z^e - \gamma) \phi(\bar{\varepsilon}_i(\gamma)) < 0$ for $\lim_{R \rightarrow \gamma} B'_R(R) > 0$ it is sufficient to have $(1 - \phi(\bar{\varepsilon}_i(\gamma))) + (Z^e - \gamma) \phi'_e \bar{\varepsilon}'_i(\gamma) > 0$ which means $Z^e + \frac{1 - \phi(\bar{\varepsilon}_i(\gamma))}{\phi'_e \bar{\varepsilon}'_i(\gamma)} > \gamma$

Moreover

$$B''(R) = -\phi'_e \bar{\varepsilon}'_i(R) [2(\bar{X} - 2\bar{x}_i(R)) + Z^e \bar{x}'_i(R)] - 2\bar{x}'_i(R)(1 - \phi(\bar{\varepsilon}_i(R))) < 0 \quad \text{since}$$

$$(\bar{X} - 2\bar{x}_i(R)) = \left(\bar{X} - \frac{2R}{\bar{\theta}} \right) > 0 \text{ as } R \in \left[\gamma, \frac{\bar{\theta}\bar{X}}{2} \right].$$

Consequently, as $\lim_{R \rightarrow \gamma} B'_R(R) > 0$, $\lim_{R \rightarrow \frac{\bar{\theta}\bar{X}}{2}} B'_R(R) < 0$ and $B''(R) < 0$ there is only one

$\bar{R} \in \left[\gamma, \frac{\bar{\theta}\bar{X}}{2} \right]$ such that $B'_R(\bar{R}) = 0$ and we assume that $B(\bar{R}) > 0$ ■

Proof of part a of proposition 1.

We are looking for a unique $R^* \in [\gamma, \bar{R}]$ that maximises $\text{RORAC} = \Gamma(R) = \frac{B(R)}{K(R)}$.

First part of the proof: there exists R^* such that $\Gamma'(R^*) = 0$ where

$$\Gamma'(R) = \frac{\partial \Gamma(R)}{\partial R} = \frac{B'(R)K(R) - B(R)K'(R)}{K^2(R)}$$

Let us label $H(R) = B'(R)K(R) - B(R)K'(R)$ with $B(R), B'(R), K(R), K'(R)$ as defined above.

$\lim_{R \rightarrow \gamma} H(R) = B'(\gamma)K(\gamma) - B(\gamma)K'(\gamma) > 0$ as according to Lemma 1 $B'(\gamma) > 0$,

$$K(\gamma) > 0, K'(\gamma) > 0 \text{ and } B(\gamma) = \int_{\bar{x}_i(\gamma)}^{\bar{X}} [(1 - \phi(\bar{\varepsilon}_i(\gamma)))\gamma + \phi(\bar{\varepsilon}_i(\gamma))Z^e - \gamma] dx_i < 0.$$

$$\lim_{R \rightarrow \bar{R}} H(R) = B'(\bar{R})K(\bar{R}) - B(\bar{R})K'(\bar{R}) < 0 \quad \text{as according to Lemma 1}$$

$$B'(\bar{R})K(\bar{R}) < 0 \text{ as } B'(\bar{R}) < 0, K(\bar{R}) > 0 \text{ and } B(\bar{R}) > 0, K'(\bar{R}) > 0.$$

Consequently, as $\lim_{R \rightarrow \gamma} H(R) > 0$ and $\lim_{R \rightarrow \bar{R}} H(\bar{R}) < 0$ there is at least one $R^* \in [\gamma, \bar{R}]$ such that $H(R^*) = 0$ implying that $\Gamma'(R^*) = 0$.

Moreover, as $R^* < \bar{R}$, $B(\bar{R}) > 0$ and $B''(R) < 0$, this gives us $B(R^*) > 0$. Since $K(R^*) > 0$ we also have $\Gamma(R^*) > 0$.

Lastly, we know that $B(\gamma) < 0$ and $B(R^*) > 0$. Consequently, there is a value $R_c > \gamma$ such that $B(R) > 0 \quad \forall R \in [R_c, \bar{R}]$. As $\lim_{R \rightarrow \gamma} H(R) > 0$ and $H(R^*) = 0$ we must have $R^* > R_c$. Consequently, no equilibrium is possible in the range $[\gamma, R_c]$ and $R^* \in [R_c, \bar{R}]$. Lastly, note that for all $R \in [R_c, \bar{R}]$ we always have $H'(R) < 0$. As $H'(R)$ is continuously decreasing we can conclude that R^* is unique.

Second part of the proof:

R^* is a maximum if $\Gamma''(R^*) < 0$ where

$$\Gamma''(R^*) = \frac{\partial^2 \Gamma(R)}{\partial R^2}(R^*) = \frac{H'(R^*)K^2(R^*) - 2H(R^*)K'(R^*)K(R^*)}{K^4(R^*)} = \frac{H'(R^*)K^2(R^*)}{K^4(R^*)}$$

As $H(R^*) = 0$.

$H'(R^*)K^2(R^*) = B''(R^*)K^3(R^*) - B(R^*)K''(R^*)K^2(R^*) < 0$ since
 $B''(R^*)K^3(R^*) < 0$ and $B(R^*)K''(R^*)K^2(R^*) > 0$. Consequently, as $K^4(R^*) > 0$ we have $\Gamma''(R^*) < 0$ and R^* is a maximum.

Part b of proposition 1 is obvious as $\frac{\partial \bar{x}_i(R^*)}{\partial R^*} = \frac{1}{\theta} > 0$ and \bar{X} is constant, implying

that $\frac{\partial D(R^*)}{\partial R^*} = D'(R^*) < 0$.

Concerning part c of proposition 1, $\frac{\partial \ell^*}{\partial R^*} = \frac{D'(R^*)K(R^*) - D(R^*)K'(R^*)}{K^2(R^*)} < 0$ as

$D'(R^*) < 0$, and $K(R^*), D(R^*), K'(R^*) > 0$.

Proof of proposition 1 is completed ■

Proof of proposition 2.

R^* is a decreasing function of Z^e . R^* is defined as the value such that

$$\Gamma'(R^*) = \frac{\partial \Gamma(R)}{\partial R}(R^*) = \frac{B'(R^*)K(R^*) - B(R^*)K'(R^*)}{K^2(R^*)} = 0$$

where $B'(R^*)K(R^*) - B(R^*)K'(R^*) = H(R^*)$. Note that R^* is a function of Z^e and we can write $H(R^*(Z^e), Z^e) = B'(R^*(Z^e), Z^e)K(R^*) - B(R^*(Z^e), Z^e)K'(R^*)$.

Taking the total derivative of $H(R^*(Z^e), Z^e)$ and making it equal to zero gives

$$\begin{aligned} dH(R^*(Z^e), Z^e) &= \left[\frac{\partial B'(\bullet)}{\partial Z^e} K(\bullet) + \frac{\partial B'(\bullet)}{\partial R^*} \frac{\partial R^*}{\partial Z^e} K(\bullet) + B'(\bullet) \frac{\partial K(\bullet)}{\partial R^*} \frac{\partial R^*}{\partial Z^e} \right] - \\ &\quad \left[\frac{\partial B(\bullet)}{\partial Z^e} K'(\bullet) + \frac{\partial B(\bullet)}{\partial R^*} \frac{\partial R^*}{\partial Z^e} K'(\bullet) + B(\bullet) \frac{\partial K(\bullet)}{\partial R^*} \frac{\partial R^*}{\partial Z^e} \right] = 0 \\ dH(R^*(Z^e), Z^e) &= \frac{\partial B'(\bullet)}{\partial Z^e} K(\bullet) + B''(\bullet) K(\bullet) \frac{\partial R^*}{\partial Z^e} + B'(\bullet) K'(\bullet) \frac{\partial R^*}{\partial Z^e} - \frac{\partial B(\bullet)}{\partial Z^e} K'(\bullet) \\ &\quad - B'(\bullet) K'(\bullet) \frac{\partial R^*}{\partial Z^e} - B(\bullet) K'(\bullet) \frac{\partial R^*}{\partial Z^e} = 0 \\ dH(R^*(Z^e), Z^e) &= \frac{\partial B'(\bullet)}{\partial Z^e} K(\bullet) - \frac{\partial B(\bullet)}{\partial Z^e} K'(\bullet) + \frac{\partial R^*}{\partial Z^e} [B''(\bullet) K(\bullet) - B(\bullet) K'(\bullet)] = 0 \end{aligned}$$

and

$$\frac{\partial R^*}{\partial Z^e} = \frac{\frac{\partial B(\bullet)}{\partial Z^e} K'(\bullet) - \frac{\partial B'(\bullet)}{\partial Z^e} K(\bullet)}{[B''(\bullet) K(\bullet) - B(\bullet) K'(\bullet)]}$$

As $[B''(\bullet)K(\bullet) - B(\bullet)K'(\bullet)] < 0$ we have $\frac{\partial R^*}{\partial Z^e} < 0$ if

$$\frac{\partial B(\bullet)}{\partial Z^e} K'(\bullet) - \frac{\partial B'(\bullet)}{\partial Z^e} K(\bullet) > 0.$$

$$\frac{\partial B(\bullet)}{\partial Z^e} = \int_{\bar{x}_i(R^*)}^{\bar{X}} \phi(\bar{\varepsilon}_i(R^*)) dx_i > 0$$

$$\frac{\partial B'(\bullet)}{\partial Z^e} = \phi'_\varepsilon \bar{\varepsilon}'_i(R^*) (\bar{X} - \bar{x}_i(R^*)) - \phi(\bar{\varepsilon}_i(R^*)) \bar{x}'_i(R^*)$$

Using the fact that $\bar{x}_i(R) = \frac{R^*}{\bar{\theta}}$ and $\bar{\varepsilon}'_i(R^*) = \frac{\bar{\theta}}{R^* \sigma_\theta}$ we have $\frac{\partial B'(\bullet)}{\partial Z^e} < 0$ if

$$\phi'_\varepsilon < \frac{1}{\bar{\theta}} \frac{R^* \sigma_\theta}{\bar{\theta} \bar{X} - R^*} \phi(\varepsilon_i(R^*)).$$

The proof is completed ■

Proof of Lemma 2.

$$V_b(R^*) = K(R^*) + R^* [\bar{X} - x_c(R^*)] + Z^e [x_c(R^*) - \bar{x}_i(R^*)] - \gamma [\bar{X} - \bar{x}_i(R^*)]$$

where $x_c(R^*) = \frac{R^*}{\bar{\theta} + \varepsilon_c \sigma_\theta}$, $\bar{x}_i(R^*) = \frac{R^*}{\bar{\theta}}$. Substituting these values in the first equation

we obtain

$$V_b(R^*) = K(R^*) + R^* \left[\bar{X} - \frac{R^*}{\bar{\theta} + \varepsilon_c \sigma_\theta} \right] + Z^e \left[\frac{R^*}{\bar{\theta} + \varepsilon_c \sigma_\theta} - \frac{R^*}{\bar{\theta}} \right] - \gamma \left[\bar{X} - \frac{R^*}{\bar{\theta}} \right] = 0 \text{ for}$$

$$\varepsilon_c = \frac{\bar{\theta} [(R^* - \gamma)(R^* - \bar{\theta} \bar{X}) - K^*(R^*) \bar{\theta}]}{\sigma [\bar{\theta} (K^*(R^*) - \gamma \bar{X}) + R^* (\bar{\theta} \bar{X} + \gamma - Z^e)]}$$

We know that $(R^* - \gamma) > 0$ and $(R^* - \bar{\theta} \bar{X}) < 0$ since $\frac{R^*}{\bar{\theta}} = \bar{x}_i(R) < \bar{X}$.

Consequently $\bar{\theta} [(R^* - \gamma)(R^* - \bar{\theta} \bar{X}) - K^*(R^*) \bar{\theta}] < 0$.

Moreover, as $\gamma > Z^e$ and $R^* \bar{X} \bar{\theta} > \gamma \bar{X} \bar{\theta}$ we have

$$\sigma [\bar{\theta} (K^*(R^*) - \gamma \bar{X}) + R^* (\bar{\theta} \bar{X} + \gamma - Z^e)] > 0 \text{ and } \varepsilon_c < 0 \blacksquare$$

Proof of proposition 3.

Let us show the condition under which there is a critical value Z_c^* from which ε_c is an increasing function of the expected value of the collateral.

$$\varepsilon_c(R^*(Z^e)) = \frac{\bar{\theta}[(R^*(Z^e) - \gamma)(R^*(Z^e) - \bar{\theta}\bar{X}) - K^*(R^*(Z^e))\bar{\theta}]}{\sigma[\bar{\theta}(K^*(R^*(Z^e)) - \gamma\bar{X}) + R^*(Z^e)(\bar{\theta}\bar{X} + \gamma - Z^e)]}$$

Define $A(Z^e)$ and $C(Z^e)$ such that

$$A(Z^e) = \bar{\theta}[(R^*(Z^e) - \gamma)(R^*(Z^e) - \bar{\theta}\bar{X}) - K^*(R^*(Z^e))\bar{\theta}] < 0 \text{ and}$$

$$C(Z^e) = \sigma[\bar{\theta}(K^*(R^*(Z^e)) - \gamma\bar{X}) + R^*(Z^e)(\bar{\theta}\bar{X} + \gamma - Z^e)] > 0$$

We have

$$\frac{\partial \varepsilon_c(Z^e)}{\partial Z^e} = \frac{\left(\frac{\partial A(Z^e)}{\partial Z^e}\right)C(Z^e) - A(Z^e)\left(\frac{\partial C(Z^e)}{\partial Z^e}\right)}{C(Z^e)^2}$$

where

$$\frac{\partial A(Z^e)}{\partial Z^e} = \frac{dR^*}{dZ^e} \left[\frac{dA(Z^e)}{dK^*(R^*)} \frac{dK^*(R^*)}{dR^*} + \frac{dA(Z^e)}{dR^*} \right]$$

$$\frac{\partial C(Z^e)}{\partial Z^e} = \frac{dR^*}{dZ^e} \left[\frac{dC(Z^e)}{dK^*(R^*)} \frac{dK^*(R^*)}{dR^*} + \frac{dC(Z^e)}{dR^*} \right] + \frac{dC(Z^e)}{dZ^e}$$

where

$$\frac{dR^*}{dZ^e} < 0 \text{ under the condition stated by proposition 2.}$$

$$\frac{dK^*(R^*)}{dR^*} > 0$$

$$\frac{dA(Z^e)}{dK^*(R^*)} = -\bar{\theta}^2 < 0 \text{ and } \frac{dC(Z^e)}{dK^*(R^*)} = \bar{\theta} > 0$$

$$\frac{dA(Z^e)}{dR^*} = \bar{\theta}(2R^*(Z^e) - \gamma - \bar{\theta}\bar{X}) < 0 \text{ if } 2R^*(Z^e) < \bar{\theta}\bar{X} + \gamma \text{ which always holds true}$$

$$\text{since } R^* \in [\gamma, \bar{R}] \text{ where } \bar{R} \in \left[\gamma, \frac{\bar{\theta}\bar{X}}{2}\right].$$

$$\frac{dC(Z^e)}{dR^*} = (\gamma - Z^e + \bar{X}\bar{\theta}) > 0$$

$$\frac{dC(Z^e)}{dZ^e} = -\sigma R^* < 0$$

$$\text{Consequently } \frac{\partial A(Z^e)}{\partial Z^e} > 0 \text{ and } \frac{\partial C(Z^e)}{\partial Z^e} < 0.$$

It results from the preceding calculation that $\frac{\partial \varepsilon_c(Z^e)}{\partial Z^e} > 0$ if

$$\underbrace{\left(\frac{\partial A(Z^e)}{\partial Z^e} \right) C(Z^e)}_{+} > \underbrace{A(Z^e)}_{-} \underbrace{\left(\frac{\partial C(Z^e)}{\partial Z^e} \right)}_{-}$$

Note that

$$\lim_{Z^e \rightarrow 0} \left(\frac{\partial A(Z^e)}{\partial Z^e} \right) C(Z^e) < \lim_{Z^e \rightarrow 0} A(Z^e) \left(\frac{\partial C(Z^e)}{\partial Z^e} \right) \text{ for } \gamma < \bar{\gamma}$$

$$\text{where } \bar{\gamma} = \frac{R^*(0) \left[(\bar{\theta} \bar{X} - R^*(0)) + T \bar{\theta} (K' (R^*(0)) - \bar{X}) \right] + K (R^*(0)) \bar{\theta} (1 - 2T)}{(\bar{X} \bar{\theta} - R^*(0)) - T (2 \bar{X} \bar{\theta} - R^*(0))} > 0$$

$$\text{and } T = \frac{dR^*}{dZ^e}$$

$$\lim_{Z^e \rightarrow 1} \left(\frac{\partial A(Z^e)}{\partial Z^e} \right) C(Z^e) > \lim_{Z^e \rightarrow 1} A(Z^e) \left(\frac{\partial C(Z^e)}{\partial Z^e} \right) \text{ for } \gamma > \underline{\gamma}$$

where

$$\underline{\gamma} = \frac{R^{*2}(1) \left[(\bar{\theta} \bar{X} - R^*(1)) + T [1 + \bar{\theta} (K' (R^*(1)) - \bar{X})] \right] + K (R^*(1)) \bar{\theta} (T + R^*(1)) - T R^*(1) \bar{\theta} (2K (R^*(1)) + K' (R^*(1)))}{R^*(1) \left[(\bar{X} \bar{\theta} - R^*(1)) - T (2 \bar{X} \bar{\theta} - R^*(1)) \right] + T \bar{X} \bar{\theta}}$$

Consequently, this gives $Z_c^e \in]0, 1[$ such that

$$\left(\frac{\partial A(Z_c^e)}{\partial Z^e} \right) C(Z_c^e) = A(Z_c^e) \left(\frac{\partial C(Z^e)}{\partial Z^e} \right) \text{ and } \frac{\partial \varepsilon_c(Z^e)}{\partial Z^e} < 0 \text{ for}$$

$$Z^e \in]0, Z_c^e[\text{ and } \frac{\partial \varepsilon_c(Z^e)}{\partial Z^e} > 0 \text{ for } Z^e \in]Z_c^e, 1[.$$

The proof is completed ■

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3. Perspectives de Recherche et Travaux en Cours

3.2. Private equity, compétences et syndication :

Dufour, D., Nasica, E. et Torre, D. (2011), “Specialization, experience and heterogenous forms of venture capital syndication”, *Workshop Heterogeneity and Performance in the European Venture Capital Industry*, GREDEG-CNRS et Université de Nice Sophia Antipolis, 17-18 novembre.

Specialization, experience and heterogeneous forms of venture capital syndication*

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November 2011

Abstract

The observation of venture capitalists syndicates suggests that they are characterized by a heterogeneous form concerning both the nature of the skills of their members and the nature of funds providers which finance them. Some syndicates associate for example leaders and partners having different levels of specialization and/or experience while others consist of members with similar skills. Heterogeneity also concerns the sources of finance: some syndicated deals are financed by banks, while others are funded by institutional investors (pension funds, insurance companies, funds of funds...).

The goal of the paper is to develop a theoretical model aiming to analyze why the features of the leaders' skills influence both the form of partnership in the syndicate and the nature of the funds providers financing the syndication deal. The model is built and analyzed in two steps. First, we study if and how the specific skills of the lead venture capitalist influence the characteristics of the optimal form of partnership set up with the other members of the syndicate. In a second step, we study if and how the specific skills of the lead venture capitalist determine the optimal form of funding of syndicated deals, that is the choice between a financing by a bank or by an institutional investor.

We show that skills matter in syndication choices but, most importantly, it is underlined that not only the level but also the nature of skills matter. Indeed, first, the model points out that the level of experience of the lead venture capitalist is an important determinant of syndication choices since it influences the form of partnership in the syndicate, that is, the choice between experienced partners or specialized partners. Second, it is shown that the level of specialization of the lead venture capitalist is also a crucial factor in syndication choices because it determines the nature of the funds providers financing the syndicated deal. Third, the model shows that this relationship between specialization and the sources of finance will appear when funds providers are

*We would like to thank Patrick Artus, André Cartapanis, Muriel Dal Pont, Sophie Pommet and Tom Vanacker for their useful remarks on a previous version of this paper.

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“hands-on”, that is when they actively use the compensation scheme linking them to the leader as an incentive mechanism to influence syndication choices. Finally, if we compare the theoretical results of the model with the situation prevailing in the French market, the model suggests that venture capital in this country is characterized by a hands-on governance exerted by the funds providers.

JEL Classification: G2, G3

Keywords: Venture capital, syndication, fund providers, skills, incentives.

1 Introduction

The syndication of investments is one of the most common screening and monitoring mechanism used by venture capitalists aiming at reducing information problems regarding their portfolio firms (Tykova, 2007; Manigart *et al.* 2006; Gompers and Lerner, 2004). Such syndicates involve two or more venture capital firms taking an equity stake in an investment for a joint payoff (Wilson, 1968), either in the same investment round or, more broadly defined, at different points in time (Brander, Amit, and Antweiler, 2002). Syndicates are typically formed by a lead investor (or leader) who contacts other potential investors and records their commitments to invest. Syndication is widely observed: the typical share for European markets is between 40% and 50% (Wright and Lockett, 2003), and the corresponding figure for US markets is closer to 80% (Jääskeläinen *et al.*, 2006).

The observation of venture capitalists syndicates shows that they are characterized by a heterogeneous form concerning both the nature of the skills of their members and the nature of funds providers which finance them. Some syndicates associate for example leaders and partners having different levels of specialization and/or experience while others consist of members with similar skills. Heterogeneity also concerns the sources of finance: some syndicated deals are financed by banks, while others are funded by institutional investors (pension funds, insurance companies, funds of funds...) ¹.

The purpose of this paper is to show that this heterogeneity is induced by the specific skills of lead venture capitalists which determine the optimal form of association between leaders, syndicates’ partners and funds providers.

The paper is organized as follows. First, we recall the main results obtained by the literature concerning the relationships between skills, funds providers and the choices of syndication. We complete these works by our own statistical analysis of the French venture capital market. This analysis allows us identifying a number of stylized facts about the kind of partnerships prevailing in observed syndicated

¹Other important funds providers are corporate investors, government agencies and private individuals. In this paper, we focus on banks and institutional investors that are historically two major actors, especially in European countries: taken together, they represent more than half of the total of funds raised (55.3% in 2008 and 55.6% in 2009 according to the 2010 EVCA Yearbook).

deals (Section 2). Second, we present the main assumptions of a theoretical model which analyzes the investment behavior of a lead venture capitalist. The latter has to determine the optimal methods of funding (choice of the funds provider) and of partnership (choice of the other syndicate's members) for an investment project (Section 3). Section 4 aims to show that the specific skills of the lead venture capitalist influence the characteristics of the optimal form of partnership set up with the other members of the syndicate. It is shown that the optimal partnership is conditioned by two parameters: the level of experience of the lead venture capitalist on the one hand and the level of return of funded projects on the other hand. In Section 5 we show that the skills of the lead venture capitalist also determine the optimal form of funding of syndicated deals. Our main result is that the choice between a financing by a bank or by an institutional investor is, under certain conditions relative to the kind of governance exerted by funds providers, dependent on the level of specialization of the lead venture capitalist. Section 6 concludes.

2 Related literature and stylized facts

In this section, we recall the main results obtained by two branches of the literature. A first set of works studies the relationship between venture capitalists' skills and syndication (2.1) and a second branch analyzes the link between the nature of funds providers and the investment strategies of venture capitalists (2.2). We complete these results with stylized facts observed in the French venture capital market.

2.1 Skills and syndication

A crucial factor in the efficiency of a syndicated venture capital investment is the level and the nature of skills of the partners of this operation. Venture capitalists' skills are mainly determined by two factors. The first factor is the venture capitalists' level of experience. The idea being that experience drawn from past investments improves, by a learning effect, the efficiency of the venture capitalist to interpret the information provided by the portfolio companies through the business plan or monthly reports of the portfolio companies for instance (Gorman and Sahlman, 1989; Sapienza, 1992; Cohen and Levinthal, 1990). In the same vein, Bottazzi et alii (2004a, 2008) show that venture capital firms with associates that have prior business experience provide more support and governance. They are more active recruiting managers and directors, helping with fundraising, and interacting more frequently with their portfolio companies. Finally, Mortensen (2007) finds that experienced venture capitalists add more value, bring companies public at a higher rate and invest in better companies.

The second crucial element determining the venture capitalists' skills is their level of specialization. Specialization in a particular stage of development and/or industry sector allows reducing screening and monitoring costs (Manigart, 1994; De Clercq and Dimov, 2003). According to Gupta and Sapienza (1992) and Wright and Robbie (1998) a limited industry, or development stage, scope of investments

facilitates control over the management of the financed companies by the venture capitalist firm; *i.e.* it may be more difficult for portfolio companies to hide issues of management incompetence or other crucial information regarding company performance due to the venture capitalist firms more in-depth understanding of the industry or development stage. Thus, in summary, a venture capitalist is characterized by a specific level of skill determined by a specific experience-specialization combination. This combination determines its ability to screen, control and manage the investment projects.

Moreover, whatever its own level of skill, a venture capitalist can have an interest in syndicating in order to benefit from the skills of the other members of the syndicate because the pooling of skills is likely to enhance the value of investment portfolios.

Indeed, first, syndicating a deal may be an efficient method to reduce the probability of failure of investment projects. Some works show that, by syndicating, a venture capitalist benefits from long-term relationships and professional networks set up by the other members of the syndicate and the project will be more likely to succeed (Gorman and Sahlman 1989; Macmillan *et al.* 1989; Sapienza *et al.* 1996; Hellmann and Puri, 2002). Here, the crucial kind of skill is the level of experience of the syndicate members, which determinates the quality of networks and thus the efficiency of syndication.

Second, syndication is likely to ameliorate the value of investments by improving their performance. Here, the relevant skill is the level of specialization of the syndicate members. If several venture capitalists pool their highly specialized skills and share the information they have about a particular industry or stage of investment, the management and the monitoring of investment projects will be more efficient and their performance will improve (Lerner 1995; Sorenson and Stuart 2001; Fritsch and Schilder 2006; Meuleman *et al.* 2009).

Despite many works have analyzed the role of skills in the efficiency of venture capital investments and syndication choices, few papers focus on the relation between the nature of skills of venture capitalists and the optimal choices of syndication induced by these skills. Among them, a theoretical model by Casamatta and Haritchabalet (2007) points out that the level of experience can be a major determinant of the syndication decision. The main result of this model is that syndication is negatively related to the level of experience of venture capitalists. Experienced venture capitalists have more accurate appraisals and have more to lose when disclosing the existence of an investment opportunity to another venture capitalist. They are thus reluctant to syndicate to avoid the conditions for profit-dissipating competition. This idea is supported by the empirical results obtained in the German venture capital industry by Hopp and Rieder (2011) who find that more experienced venture capitalists syndicate much less than inexperienced ones.

However, these works do not study if, and how, the specific skills of a given ven-

ture capitalist may influence the optimal form of partnership with the other members of the syndicate. For instance, they don't analyze if it is more interesting for an experienced venture capitalist to associate with a syndicate of experienced venture capitalists either with a syndicate made up of specialized venture capitalists. Now this question is of interest in as much as a relationship between the skills of venture capitalists and the kind of syndication they privilege can be empirically highlighted.

To that end, we have selected a sample from the Diane database (Bureau Van Dijk) in 2009. This database contains economic and financial information on more than 300,000 French companies - from 2000 to the present. The choice of the French venture capital market is partly related to the relative importance of syndicated deals in this market: about 50% of venture capital investments were syndicated in France in 2009, compared to about 40% in Europe (EVCA Yearbook Data, 2010).

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The initial sample consists of all venture capital-backed companies in this database. In total there are 1989 companies. Using information given by venture capitalists themselves, mostly in their internet sites, we could determine the specific level of sector specialization and experience of each venture capitalist. A venture capitalist firm was considered as experienced when it is older than the sample's median: 16.2 years. Information could be collected on 198 venture capitalists firms. With regards to the forms of syndication, we focused on the two kinds of syndicates defined above: experienced syndicates and specialized syndicates. We considered that a syndicate is specialized when most of his members are specialized. We regarded a syndicate as experienced when most of his members are experienced. Syndicates composed of the same percentage of specialized and experienced members were excluded from the sample. In total there are 226 different syndicates in our sample associated with 144 different leaders. The statistical analysis consists in studying the features, in terms of skills, of the observed combinations "leader - other partners" of the syndicate. We restricted our analysis to syndicates whose leaders are financed by two major funds providers in the French market: institutional investors and banks. In each syndicate, we considered as the leader the venture capitalist firm whose share participation is the most important.

Finally, since literature suggests a relationship between venture capitalists' skills and the level of performance of syndicated investments, we also used our data to compute the returns (profits before interest and taxes divided by total assets) of venture capital-backed firms financed by the syndicates of the sample. This allowed us to distinguish between "low return projects" (firms whose returns are lower than the median) and "high return projects" (firms whose returns are higher than the median).

Table 1 summarizes the results of our observations relatively to the relationships between leaders' skills, syndicates' skills and returns of the funded projects.

Table 1: Experience of leaders and forms of syndication

	Low return projects		High return projects	
	Experienced syndicates	Specialized syndicates	Experienced syndicates	Specialized syndicates
Low experienced leaders	$n = 24$	$n = 27$	$n = 20$	$n = 38$
	$q_{le} = 0.529$		$q_{le} = 0.655$	
	$z = 0.42$		$z = 2.36$	
	$p = ns$		$p < 0.01$	
High experienced leaders	$n = 44$	$n = 18$	$n = 22$	$n = 33$
	$q_{hee} = 0.710$		$q_{hee} = 0.600$	
	$z = 3.30$		$z = 1.48$	
	$p < 0.01$		$p < 0.10$	

where:

- n is the size of the considered subset (for instance, $n = 44$ means that for low return projects, there are 44 observed combinations "high experienced leaders - experienced other partners"),
- q_{le} is the proportion of low experienced leaders which syndicate with specialized syndicates,
- q_{hee} is the proportion of high experienced leaders which syndicate with experienced syndicates,
- q_{hes} is the proportion of high experienced leaders which syndicate with specialized syndicates
- z and p are the results of the binomial test with the null hypothesis: $q_{le} \geq 0.50$ (resp. $q_{he(eors)} \geq 0.50$), versus the alternative hypothesis: $q_{le} < 0.50$ (resp. $q_{he(eors)} < 0.50$).

In summary, the observation of the French venture capital market suggests that the syndication choices are conditioned by two parameters: the level of experience of the lead venture capitalist on the one hand and the level of return of funded projects on the other hand. More precisely, if a lead venture capitalist is rather inexperienced, it tends to associate with a syndicate made up of specialized venture capitalists. However, the difference in proportion is statistically significant only when projects returns are relatively high.

Stylized facts also indicate that the lower are the returns of the project the more experienced leaders tend to syndicate with experienced venture capitalists. More profitable investment projects lead instead experienced leaders to syndicate with specialized venture capitalists. For high experienced leaders, the difference in proportion is statistically significant whatever the level of return of funded projects.

2.2 Funds providers and syndication

Providing empirical evidence on different periods and countries, a number of empirical works have pointed out that funds providers' investment preferences matter for venture capital investment characteristics. These works show in particular that venture capitalists funded by banks behave differently than venture capitalists funds financed by institutional investors such as pension funds or insurance companies. This is partly due to the fact that even if banks, as all funds providers, aim at receiving an appropriate rate of return on their funds, they may differ from institutional investors with respect to additional goals. For instance, Hellman, Lindsey and Puri (2004) find that, in the US venture capital market, banking organizations invest in venture capital funds to build relationships which are in the long run beneficial for their lending activities (the so-called "relationship hypothesis"). More precisely, they find a strong relationship between banks making venture investments and companies subsequently raising loans. Furthermore, they show that having a prior venture capital relationship significantly increases a bank's chance of participating in a company's loan deal.

Using a European panel data set, Schertler (2005) also presents evidence of the influence of funds providers' characteristics on venture capital firms' strategies of investment. She finds that funds providers differ regarding their propensity to invest in firms that are in different development stages: banks tend to invest more in later-stage companies whereas institutional investors prefer to invest in early-stage².

Other empirical works have analyzed funds providers' strategies of investment by distinguishing between captive bank-affiliated venture capitalists and independent venture capitalists (such as funds financed by institutional investors). Van Osnabrugge and Robinson (2001) utilizing interviews and questionnaire responses from venture capitalists in the UK show that, compared to captive bank-affiliated venture capitalists, independent venture capitalists firms claim to follow those investment behaviors and preferences which can be seen and used to signal competence to their fund providers to a greater degree than captive venture capitalists. In particular, they find that independent venture capitalists are more attracted to investments with high expected The independent venture capitalists' greater concern for high rate of return is endorsed by Wright and Robbie (1996) and Robbie *et al.* (1997).

²Note that this result contradicts the evidence found by Mayer *et al.* (2004) who use a micro data set of venture capital companies operating in the UK, Germany, Israel and Japan. They have found evidence that venture capital companies raising funds from pension funds and banks tend to favor firms at a later stage of development (only corporate and individual investors are actively involved in early-stage investments).

Finally, using a data set of 179 German private equity-backed companies, Tykvova (2006) finds that independent (and corporate) private equity investors tend to have a more pronounced role in corporate governance and monitoring of the companies they finance. They usually take larger equity positions, at earlier stages, and finance their companies for longer period of times. In comparison, bank-dependent (and government funds) often act only as bridge investors. The same kind of results had been obtained in an earlier study by Bottazzi *et al.* (2004b) from a hand-collected dataset of European venture capital investments.

To sum up, all these works show that venture capitalists funded by institutional investors and by banks differ in their investment strategies. However, they do not study the influence of the source of finance on the form of syndication. In particular, they don't analyze if there is a relationship between the source of finance and the skills characteristics of the venture capitalists partners in syndication deals. Now this question seems important in as much as our data set on French venture capital industry, described in table 2, highlights such a relationship.

Table 2: Origin of funds and specialization of leaders

	Bank funding	Institutional investors funding
Low specialized leaders	$n = 56$	$n = 42$
		$q_{lsb} = 0.571$
		$z = 1.41$
		$p < 0.10$
High specialized leaders	$n = 22$	$n = 46$
		$q_{hsi} = 0.676$
		$z = 2.91$
		$p < 0.01$

where:

- n is still the size of the considered subset (for instance $n = 56$ means that 56 low specialized leaders are financed by banks),
- q_{lsb} is the proportion of low specialized leaders financed by banks,
- q_{hsi} is the proportion of high specialized leaders financed by institutional investors,
- z and p are the results of the binomial test with the null hypothesis: $q_{lsb} \geq 0.50$ (resp. $q_{hsi} \geq 0.50$) versus alternative hypothesis: $q_{lsb} < 0.50$ (resp. $q_{hsi} < 0.50$).

Results presented in table 2 suggest that the source of finance of syndication is not independent from the skills characteristics of the members of syndicates. In the French market, the level of specialization of the lead venture capitalist seems to be an important factor in determining the nature of the funds providers financing the syndicated deals. Stylized facts suggest that when the lead venture capitalist is not very specialized, he tends to be funded by a bank, while if he is very specialized, he tends to be financed by an institutional investor.

In the rest of the paper, we develop a theoretical model aiming to analyze why, in accordance with the stylized facts observed in the French market, the features of the leaders' skills influence both the form of partnership in the syndicate and the nature of the funds providers financing the syndication deal. We present first the hypotheses of the model which reflect the main results of the literature recalled above.

3 The model

The model analyses the optimal partnerships of a venture-capitalist potentially in charge of a risky project. This venture-capitalist - that we label the leader - can manage the project within a two stages setting. During the early stage or seed stage (time 1), the leader is alone to decide if - according to his views - the project is a good or a bad project. If it is considered as bad, the project is liquidated at the end of the seed stage. If not, it is qualified for the development phase (time 2). This development phase associates the participation of a syndicate and a financial partner. The leader can choose the nature and characteristics of the syndicate and of the financial partner.

3.1 The projects

Projects correspond to different sectors of activity. Whatever the sector of activity, there are also different classes of projects characterized by their respective levels of risk and return: the higher is the expected return, the greater is the risk. A project of class j is defined as following:

- Whatever its class, a project has the probability μ to be a high risk / high return project and $(1 - \mu)$ to be low risk / low return project.
- If it is a high risk project, a project of class j has the probability p_j to provide a gross return R_j where $R_j = R_j(p_j)$ is a decreasing function of p_j and a probability $(1 - p_j)$ to fail, *i.e.* to provide no return.
- If it is a low risk project, it has the probability q to provide a return R , with $\forall j, p_j < q$ and $qR < R_j(p_j)p_j$, and a probability $(1 - q)$ to fail.

The sector of activity of the project, the class of the project and all the attributes of this class (*i.e.*, μ , p_j , R_j , q and R) are observable but not the exact nature of the project (if it is a high risk or a low risk project).

3.2 Leaders and syndicates

Lead venture capitalists take all the strategic decisions relative to the selection of the project, its time of liquidation, and the choice of the partners. They also contribute by their own skills to screen the projects in the early phase. Syndicates are associated to leaders during the development phase during which their own skills contribute to improve the characteristics of the projects still not liquidated.

3.2.1 Leaders' skills

Leaders are defined by their level of expertise. We suppose that expertise has two origins: experience and specialization.

Experience is the result of a repetition of previous observations of projects, of trials, successes and failures. The experience of a leader increases slowly, and does not depend on the nature of the project under observation for a given leader at a moment of time. We then suppose that, for a given VC, experience is inversely related to λ' , ($0 \leq \lambda'$).

Specialization corresponds to specific knowledge on the diverse technologies and industrial activities, acquired at school or by other ways. The level of specialization of a leader depends on the technological nature of the project he observes³. A given leader presents various degrees of specialization in the different technologies: his level of specialization for the observed project is inversely related to λ'' ($0 \leq \lambda''$) and his average level of specialization when all possible projects are considered is inversely related to $\bar{\lambda}''$ ($0 \leq \bar{\lambda}''$).

To make things simple, we suppose that the level of expertise of a given leader facing a given project is the average of his levels of experience and specialization for this project. This level is then inversely related with the size of the positive parameter λ with $\lambda = (\lambda' + \lambda'')/2$.

3.2.2 Leaders' skills and screening efforts

The risk of the projects is not initially perfectly observable by the lead venture capitalist (or leader) but uncertainty can be reduced after the leader would have devoted time and effort during the seed period to scrutinize. The efficiency of the screening and monitoring tools used by the leader depends on his or her level of expertise (specialization and experience): it is thus inversely related to λ .

We suppose that each project requires in seed a first capital contribution S . This contribution is provided by the leader from its own reserves. The leader also applies a costly screening effort e , ($e \in [0, 1]$) to disclose the bad projects. When a level of effort e is applied, the probability to disclose a project likely to fail is

³Specialization depends also on geographical, cultural and institutional factors that we neglect to simplify the analysis

also e , independently of the level of risk of the project. The cost of e is defined by the continuous and two time derivable function $\lambda c(e)$ with $\{\forall e, e \neq 0, c'(e) > 0, c''(e) > 0\}, c(0) = 0, c'(0) = 0$ and $\lim_{e \rightarrow 1} c(e) = +\infty$. When a given project is revealed as a bad project by application of the screening effort of a leader of class λ , it is liquidated at the end of the seed period. The proportion of early liquidated high risk projects is then $\mu(1 - p_j)e$ and the proportion of early liquidated low risk projects is $(1 - \mu)(1 - q)e$.

At the end of the seed period, when the project is not liquidated, the leader must associate a financial partner to help him funding the financial expenses involved at this stage, that we suppose amounting to D . The leader monitors the development of the project at a fixed cost \bar{c} . To help him in this task which requires expertise, the leader can also associate a syndicate whose components are other venture capitalists, simultaneously involved as leaders or partners in other seed or development projects.

3.2.3 Syndicates' skills

The members of syndicates are venture capitalists - potential leaders - associated with the aim of giving mutual support. These syndicates provide additional skills to the leaders who call upon them to assist the development of the project not yet liquidated in seed. As in the stylized facts considered in section 2, we introduce two kinds of syndicates which differ by the nature of their skills. They are defined as follows.

Experienced syndicates

A first style of syndication (s1) has the objective to reduce the number of non-viable low risk projects. The efficiency of this kind of syndicate is strongly influenced by the level of experience of each syndicated partner: the higher the level of experience of the syndicated partners, the smaller the variable costs of effort of this kind of syndicate. For the need of reciprocity, syndicates of this style are composed of members of the same level of experience. We then suppose that the parameter λ' , ($\lambda' \geq 0$), of each leader also corresponds to the level of experience of the style (s1) syndicate he can associate to the project during the development phase. When this style of syndicate applies the level of effort d ($d \in [0, 1]$), the proportion of the low risk projects able to succeed increases by $(1 - \mu)(1 - q)(1 - e)d$ and the proportion of the low risk projects able to fail decreases by the same amount. The cost of effort d is then given by $\lambda' c_{s1}(d)$ where the function $c_{s1}(d)$ is such that $d \neq 0 \Rightarrow c'_{s1}(d) > 0, c''_{s1}(d) > 0, c_{s1}(0) = 0, c'_{s1}(0) = 0$ and $\lim_{d \rightarrow 1} c_{s1}(d) = +\infty$.

Specialized syndicates

This second style of syndication (s2) is defined by the level of specialization of the members of the syndicate. Higher is the specialization of the members in the technology corresponding to the project, higher is its potentiality to improve the return of the good project. In this case also, given the reciprocity principle, a given leader cannot access to a highly specialized syndicate if his own average level of spe-

cialization $\bar{\lambda}''$ is low. We then suppose that this average level of specialization of the leader determines the performance of the style (s2) he can access to. The variable of effort h of a style (s2) syndicate is defined on the segment $[0, 1]$. The cost $\bar{\lambda}''c_{s2}(h)$ corresponding to this effort is such that $h \neq 0 \Rightarrow c'_{s2}(h) > 0, c''_{s2}(h) > 0, c_{s2}(0) = 0, c'_{s2}(0) = 0$ and $\lim_{h \rightarrow 1} c_{s2}(h) = +\infty$. When a style (s2) syndicate is associated with the project in the development phase, the return of the low risk (resp. high risk) projects able to succeed is increased to $R(1 + \alpha h)$ (resp. $R_j(p_j)(1 + \alpha h)$) where α is a strictly positive constant.

As syndicates are made by venture capitalists defined themselves both by a level of experience and by an average level of specialization, the syndicates have themselves these two properties. As a simplifying assumption, we however suppose that only one property is targeted (or “optimized”) when each syndicate is built, and that the second property is finally not efficient during the development phase.

3.3 Funds providers’ compensation schemes

We introduce compensation schemes linking the lead venture capitalist to its funds providers. These compensation schemes reflect the theoretical and empirical results outlined in the literature recalled above.

We retain the idea that the main goal of institutional investors is to get high financial returns. In our setting, the compensation structure set up by institutional investors is thus designed to induce the lead venture capitalist to generate the highest financial return. The institutional investor acquires a share δ of the capital D necessary for the development of the project. A corresponding proportion δ of the projects and of the losses is attributed to the institutional investor as an incentive device and the remaining part remains to the leader. The rest of the capital necessary for the development is also provided by the institutional investor but it is equivalent to a loan without interest. The return corresponding to this amount remains for the leader who also supports as a counterpart the risk of loss of the fraction of capital $(1 - \delta)D$.

In contrast, as pointed out by the literature, we suppose banks “strategically” engage in VC financing with the aim to build long-term relationships with portfolio companies for their core lending activities. Thus, if the funds provider is a bank, we suppose that return maximization is not the sole objective assigned to the lead venture capitalist. The compensation scheme is dependent of non-return variables such as the proportion of investment projects brought to a successful completion. In our setting, we suppose that when the leader is funded by a bank, the latter provides all the capital D needed during the development phase, earns the profits and covers the losses corresponding to its share of capital $D/(S + D)$. We also consider that banks use as an incentive device the redistribution to the leader of a fixed bonus P , when a project is led to its term.

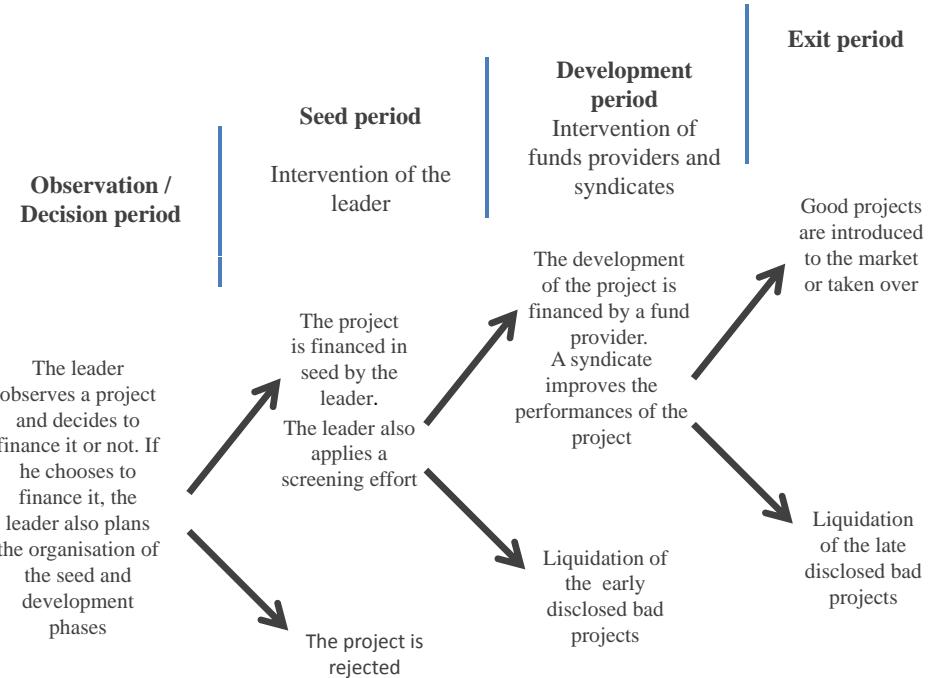


Figure 1: sequence of actions

3.4 Sequence of actions

The sequence of actions (see figure 1) is the following:

- (i) During the observation / decision period, the leader observes a project. He identifies its class of risk j . From the technological nature of the project, he deduces his specialization parameter λ'' . He observes the financial conditions proposed by the banks and institutional investors. He decides to finance or not the project in seed and the way he will develop the project if it is not early liquidated at the end of the seed period. This development plan includes the financial solution he chooses to rise additional fund and, the style of syndicate he associates to the project.
- (ii) During the seed period, the leader applies a level of effort e to distinguish good from bad projects.
- (iii) At the end of the seed period, if the leader identifies the project as a bad project, the project is liquidated.
- (iv) At the beginning of development period, if the project has not been identified as a bad project, it is developed by the leader with the financial partner (bank or institutional investor) and the syndicate chosen during the observation period ⁴. His own degree of specialization and of experience determines the level of expertise of the syndicate he can associate to the development of the project ⁵.

⁴Our assumption about the available information during the observation period exclude that the leader could regret his initial choice at this stage

⁵Note that the information collected during the seed period does not allow to reconsider the nature of the association with the financial partner and - optionally - the syndicate chosen by the leader in seed

(v) At the end of development period, the remaining bad projects are liquidated. The good projects are realized and provide to the leader and his financial partners a return corresponding to their level of risk, to the effort of the leader and the syndicate to develop them and to the level of incentives chosen by the financial partners.

4 Optimizing the form of partnership

In this section, we study if and how the specific skills of the lead venture capitalist influence the characteristics of the optimal form of partnership set up with the other members of the syndicate.

4.1 The choices of the leader

At the beginning of seed period, when a leader with an experience index λ' faces a given project, he can observe the risk index p_j of the project under consideration and associate to this style of project his level of specialization given by λ'' . He then compares (i) the reservation possibility and the 4 possible forms of development, *i.e.* (ii) developing the project with a bank and with a syndicate able to reduce the number of failures, or (iii) with a bank and a syndicate able to improve the performance of the risky projects, or (iv) with an institutional investor and with a syndicate able to reduce the number of failures, or (v) with an institutional investor and a syndicate able to improve the performance of the risky projects.

The values of the profits are given for each possible VC “technology” as following:

(i) The reservation profit is conventionally defined as (1):

$$\Pi^{res} = 0 \quad (1)$$

(ii) The profit corresponding to a development phase with a bank and a syndicate able to reduce the number of failures is the solution to the following optimization problem in e and d :

$$\begin{aligned} \Pi_{s1}^{bank} = \max_{e \in [0,1], d \in [0,1]} & \left[\frac{S}{D+S} \right] [\mu p_j R_j(p_j) + (1-\mu)(q + (1-q)(1-e)d)R] \\ & + [\mu p_j + (1-\mu)(q + (1-q)(1-e)d)]P \\ & - \left(\frac{\lambda' + \lambda''}{2} \right) c(e) - \bar{c}[1 - (\mu(1-p_j) + (1-\mu)(1-q))e] \quad (2) \\ & - S[\mu(1-p_j) + (1-\mu)(1-q)(1-(1-e)d)] \\ & - C - \lambda' c_{s1}(d) \end{aligned}$$

(iii) The profit corresponding to a development phase with a bank and a syndicate able to improve the performance of the projects is the solution to the following optimization problem in e and h :

$$\begin{aligned} \Pi_{s2}^{bank} = \max_{e \in [0,1], h \in [0,1]} & \left[\frac{S}{D+S} \right] [\mu p_j R_j(p_j) + (1-\mu)qR](1+\alpha h) \\ & + [\mu p_j + (1-\mu)q]P \\ & - \left(\frac{\lambda' + \lambda''}{2} \right) c(e) - \bar{c}[1 - (\mu(1-p_j) + (1-\mu)(1-q))e] \\ & - S[\mu(1-p_j) + (1-\mu)(1-q)] \\ & - C - \bar{\lambda}'' c_{s2}(h) \end{aligned} \quad (3)$$

(iv) The profit corresponding to a development phase with an institutional investor and a syndicate able to reduce the number of failures is the solution to the following optimization problem in e and d :

$$\begin{aligned} \Pi_{s1}^{ii} = \max_{e \in [0,1]} & \left[\frac{S+(1-\delta)D}{S+D} \right] [\mu p_j R_j(p_j) + (1-\mu)(q + (1-q)(1-e)d)R] \\ & - \left(\frac{\lambda' + \lambda''}{2} \right) c(e) - \bar{c}[1 - (\mu(1-p_j) + (1-\mu)(1-q))e] \\ & - S[\mu(1-p_j) + (1-\mu)(1-q)(1-(1-e)d)] \\ & - (1-\delta)D[\mu(1-p_j) + (1-\mu)(1-q)(1-d)](1-e) \\ & - C - \lambda' c_{s1}(d) \end{aligned} \quad (4)$$

(v) The profit corresponding to a development phase with an institutional investor and a syndicate able to improve the performance of the projects is the solution to the following optimization problem in e and h :

$$\begin{aligned} \Pi_{s2}^{ii} = \max_{e \in [0,1], h \in [0,1]} & \left[\frac{S+(1-\delta)D}{S+D} \right] [\mu p_j R_j(p_j) + (1-\mu)qR](1+\alpha h) \\ & - \left(\frac{\lambda' + \lambda''}{2} \right) c(e) - \bar{c}[1 - (\mu(1-p_j) + (1-\mu)(1-q))e] \\ & - S[\mu(1-p_j) + (1-\mu)(1-q)] \\ & - (1-\delta)D[\mu(1-p_j) + (1-\mu)(1-q)](1-e) \\ & - C - \bar{\lambda}'' c_{s2}(h) \end{aligned} \quad (5)$$

4.2 Heterogeneity in experience: the case of perfect correlation between the experience of the leader and his specialization for an observed project

We assume in this subsection that specializations are uniformly and independently distributed among VC. In this case, all leaders have the same average level of specialization (i.e. the same $\bar{\lambda}''$) and can access to the (s2) syndicates with the same efficiency (also given by $\bar{\lambda}''$). The leaders however differ by their level of experience (associated to λ) and by their level of specialization (associated to λ''). These factor of heterogeneity generate differences in their efficiency to apply their screening effort in seed (associated to $\lambda' + \lambda''$) and to access to a (s1) style syndicate (associated to λ'). We consider in this sub-section the special case where the leaders observe projects for which their level of specialization and experience are homogeneous (i.e. for which $\lambda' = \lambda''$). This is a special case where a few experienced VC observes a project corresponding to a technology of which he is few specialist and an experienced VC observes a project corresponding to a technology of which he is specialist. We then explore the effect of leaders expertise (or efficiency in screening). This expertise is inversely related to the level of $\lambda = (\lambda' + \lambda'')/2$. We then consider the effect of an improvement of the efficiency of the leader on the intensity of effort in seed of the leader and on his choice to associate to the development phase a syndicate of style (s1) or (s2). We limit the analysis to the cases where reservation is not the best solution. We obtain the following results:

Lemma 1. *All things equal, when the level of specialization of a leader for an observed project is correlated with his experience,*

- (i) *an increase of the expertise of the leader has still a positive effect on his optimal level of effort in seed and on his profit when the optimal technology involves a syndicate of style (s2);*
- (ii) *an increase of the expertise of a leader has not always a positive effect on his optimal level of effort in seed when the optimal technology involves a syndicate of style (s1). In all situations, it however increases his profit.*

Proof: see Appendix 1.

The effects of a change in the efficiency of the screening effort in seed are then different according to the type of syndicate associated during the development phase. When the syndicate is able to improve the return of the good projects, the leader and the syndicate add - in a sense independently - their efforts, to increase the expected return of the projects. The leader has the objective to exclude in seed the bad projects: his action results in an increased expected return of the remaining projects during the development phase. The role of the syndicate (s2) is then to enhance the return of the good projects. When the efficiency of the leader increases, the effort of the leader also increases and the profit consequently increases without any change in the level of action of the syndicate. Given that the proportion of good projects is bigger during the development phase, the “indirect” efficiency of the syndicate improves also during the development phase. These two effects contribute to enhance the expected profit of the project.

When the syndicate has the capacity to decrease the number of failures, the screening efforts of the leader and of the syndicate are partly substitutes, partly complements. The substitutability is associated to the natures of their interventions. The leader tries to eliminate the bad projects and the syndicate tries to improve the quality of the remaining bad projects. If we neglect the cost of effort of the syndicate, the greatest efficiency of the syndicate is then obtained when the leader abstains to eliminate any bad projects in the initial period. But the effort is costly for the leader as for the syndicate: the complementarity of the intervention of the leader and the syndicate is then associated with the increasing form of these costs. When the efficiency of the syndicate and of the leader are similar and when the costs increase sharply, it could be interesting to combine a moderate screening effort of the leader in seed with a moderate effort of the syndicate during the development phase. This “technology” offers the best compromise in terms of costs. As for $e = 0$ the marginal costs of effort of the leader vanishes, it is then never optimal (except for the limit value $\lambda = 0$) for the leader to avoid any screening in seed. When the expertise of the leader increases, given that his experience of and his specialization for the observed project are correlated, the efficiency of the syndicate (s_1) also increases and the resulting effect on the optimal efforts of the leader and the syndicate depends on the respective forms of $c(e)$ and $c_{s_1}(d)$: in all cases, the effect of substitution tends to dominate the effect of complementarity as λ decreases and the profit increases.

Proposition 1. *All things equal, when the level of specialization of a leader for an observed project is correlated with his experience,*

- (i) *an expert leader determines the nature of the syndicate to associate during the development phase according with the level of risk, of return, and other characteristics of the projects.*
- (ii) *an inexpert leader tends always to syndicate with a specialized syndicate.*

Proof: see Appendix 2.

When the leader is associated to a style (s_2) syndicate, only the efficiency of the screening effort is improved when the expertise of the leader increases. When there is a style (s_1) syndicate, both the efficiency of the leader and of the syndicate improve with the experience of the leader. The efforts of the leader and of the style (s_1) syndicate become more substitutable and less complementary when λ decreases. The optimal allocation of effort $\{e^*, d^*\}$ between the leader and the syndicate tends in this case to a corner solution $\{e^*, 0\}$ or $\{0, d^*\}$. The comparison between the “technology” associating a given leader to a style (s_1) or to a style (s_2) syndicate provides a result depending on parameters. When the limit corner solution is $\{0, d^*\}$ for the technology including a style (s_1) syndicate and when there is a large proportion of low risk (and return) bad projects, compared to the expected return of the risky good projects, the syndicate (s_1) provides a more advantageous service, while the syndicate (s_2) offers a more advantageous solution when the return of the good projects is hight.

As we have supposed in this subsection that experience and the level of specialization for the observed project are correlated, the leader cannot access to an

experienced syndicate (able to reduce the number of failures). When specializations among the diverse technologies are uniformly and identically distributed among leaders and if we suppose that VCs constitute syndicates based on the reciprocity principle of mutual services, poorly experienced leaders have few access to experienced syndicates. Even if we dampen this rule by supposing that this access is possible but costly, we would be obliged to consider that this cost is inversely related to his level of experience. For an inexpert leader, the only efficient solution is then to associate a specialized syndicate.

4.3 Heterogeneity in experience: the case of inverse correlation between the experience of the leader and his specialization for an observed project

We test in this subsection the cases where a leader with few experience observes a project corresponding to his specialization and the opposite case where an experienced leader observes a project in which he is not specialized. We limit the analysis to the cases where reservation is not the best solution.

Lemma 2. *All things equal, suppose that the level of specialization of a leader for the observed project is inversely correlated with his experience. Then*

- (i) *when the leader has few experience and observes a project corresponding to his specializations, he tends to syndicate with a specialized VC,*
- (ii) *when the leader has few experience and observes a project which does not correspond to his specializations, he chooses the style of syndicate to associate during the development phases according the risk, the return, and other characteristics of the project.*

Proof: see Appendix 3.

Proposition 2. *All things equal, when there is an inverse correlation between the experience of the leader and his specialization for the observed project,*

- *experienced partners match more easily with experienced but non specialized leaders*
- *specialized partners match more easily with specialized but poorly experienced leaders.*

This proposition is the consequence of Lemma 2. In the case of inverse correlation, specialized (and poorly experienced) leaders still suffer great difficulties to syndicate with experienced style (s1) syndicates. They have no other possibilities than to syndicate with specialized syndicates. Experienced (and not specialized) leaders have more possibilities and decide according to the return of the project and the type of incentives proposed by the funds providers. Proposition 2 is the same story presented from the syndicates point of view.

Lemma 2 and Proposition 2 introduce a correction to Lemma 1 and Proposition 1. If the level of expertise of the leader determines his choice of syndication in Lemma 1 and Proposition 1, it is only a consequence of the correlation between

experience and specialization that we introduced there. When we drop this assumption as in Lemma 2 and Proposition 2, only the level of experience of the leader matters. In summary, Proposition 1 and 2 - which cover opposite cases of correlation between the experience of a leader and his specialization for the observed project - provide general results, independent on the correlation between experience and specialization:

- (i) poorly experienced leaders tend to associate with specialized syndicates
- (ii) experienced leaders have more possibilities:
 - when the return (and the risk) of the project are quite high, they tend to syndicate with a specialized syndicate
 - when the return (and the risk) of the project are quite low, they tend to syndicate with an experienced syndicate

5 Optimizing the kind of funding

In this section we study if and how the specific skills of the lead venture capitalist determine the optimal form of funding of syndicated deals, that is the choice between a financing by a bank or by an institutional investor.

In contrast to the precedent Section, we no longer consider funds providers as passive investors, without any action to control the choices of the lead venture capitalists. Their objective is to select the leaders presenting skills and making the choices the more adapted to their own objectives. Typically, those leaders must contribute to increase the return of the investment of the institutional investors or the number of the firms that partners banks could fund in the future. As the level of effort of the leaders and the nature of syndicates that the leaders choose can infer on the capacity of the projects to attain these objectives, they use the compensation schemes as incentive devices to select the most appropriate leaders and to control the effort and syndication choices of the latter. We analyze below the influence of these incentives on the nature of the optimal associations between leaders, syndicates and funds' providers.

5.1 The nature of the incentives

Banks are interested in creating long term partnerships with the companies and managers that they fund. This motivation has an influence on the current value of their expected profits which integrates positively two terms: (i) the immediate profits they expect from funding a project during its development phase and (ii) the differed advantages x they expect from the partnership with the managing team of each succeeded project. The costs associated with a given partnership are: (i) the capital D they advance to the project if it is not early liquidated and (ii) the bonus P payed to the leader of the project when the project is successful. If we note symbolically $\Delta(P, s)$ the expected gross profit associated with a funded project,

where $s = \{s1, s2\}$ refers to the type of syndication associated with the project, $\Delta'(P, s)$ the expected proportion of successful projects, and $\Delta''(P, s)$ the probability for the fund provider to incur a loss in capital, the current value of the expected profit of the banks is given by:

$$\Pi_s^{bank} = \max_{P \geq 0} \left(\frac{D}{S+D} \right) \Delta(P, s) + (x - P) \Delta'(P, s) - D \Delta''(P, s) \quad (6)$$

where

$$\Delta(P, s) = \begin{cases} \mu p_j R_j(p_j) + (1 - \mu)[q + (1 - q)(1 - e(P))d(P)]R & \text{when } s = s1 \\ (\mu p_j R_j(p_j) + (1 - \mu)qR)(1 + \alpha h(\delta)) & \text{when } s = s2 \end{cases}$$

$$\Delta'(P, s) = \begin{cases} \mu p_j + (1 - \mu)q & \text{when } s = s2 \\ \mu p_j + (1 - \mu)[q + (1 - q)(1 - e(P))d(P)] & \text{when } s = s1 \end{cases}$$

and

$$\Delta''(P, s) = \begin{cases} \mu(1 - p_j) + (1 - \mu)(1 - q) & \text{when } s = s2 \\ \mu(1 - p_j) + (1 - \mu)(1 - q)[1 - (1 - e(P))d(P)] & \text{when } s = s1 \end{cases}$$

Institutional investors are motivated by the net return of their investment D . Their incentive scheme must be a way to stimulate leaders and syndicates to increase the net return of investment. Given that we have excluded that VCs and institutional investors have different risk aversion, the only motive for a leader and a syndicate to reduce their tendency to increase their effort in the objective top increase the profits of the project is - given the increasing costs of efforts - their limited share of this profit, i.e. the limited participation of the leader in the capital of the firm. If the institutional investor finds a way to increase this participation and to stimulate the leader and syndicate by this change in the distribution of property right, this fund provider can find the relevant incentive scheme. To explore this intuition, we have chosen as control variable of the institutional investor his share of capital δ in the VCs in charge of the projects. Using the style of notations previously defined, their profit can then be expressed in the following way:

$$\Pi_s^{ii} = \max_{\delta \in [0, 1]} \left(\frac{\delta D}{S+D} \right) \Delta(\delta, s) - \delta D \Delta''(\delta, s) \quad (7)$$

where

$$\Delta(\delta, s) = \begin{cases} \mu p_j R_j(p_j) + (1 - \mu)[q + (1 - q)(1 - e(\delta))d(\delta)]R & \text{when } s = s1 \\ (\mu p_j R_j(p_j) + (1 - \mu)qR)(1 + \alpha h(\delta)) & \text{when } s = s2 \end{cases}$$

and

$$\Delta''(\delta, s) = \begin{cases} \mu(1 - p_j) + (1 - \mu)(1 - q)[1 - (1 - e(\delta))d(\delta)] & \text{when } s = s1 \\ \mu(1 - p_j) + (1 - \mu)(1 - q) & \text{when } s = s2 \end{cases}$$

A first step of the analysis is to examine the optimal level of incentives proposed by banks and institutional investor with each kind of syndication solution.

5.2 The effect of banks incentives

We analyze the optimal bonus P the bank proposes to a VC, given the nature of his choice of syndication, his specialization and experience.

Lemma 3.

- (i) *It is optimal for the bank to pay no bonus when the VC in charge of the project is associated with a style (s2) syndicate.*
- (ii) *There exists an optimal level of the bonus P^* maximizing the profit of the bank when the syndicate associated to a given project is a style (s1) syndicate. This bonus increases the profit of the VC in charge of the project, has a positive effect on the effort of the syndicate and a negative effect on the effort of the leader.*

Proof: see Appendix 4.

This lemma shows that the interest of the bank is more aligned with those of a leader associated with a style (s1) syndicate than with those of a leader associated with a style (s2) syndicate. It also exhibits the capacity of the bank to stimulate the substitution effects between the effort of the leader and the effort of the style (s1) syndicate. The interest of the bank is not the quality of the selection in seed but the capacity of the style (s1) syndicate to rehabilitate as many bad projects as possible: this is why the bonus P activates the syndicate and reduces the activity of the leader.

When they have the possibility to choose the VC with whom they will collaborate, banks can use or not the bonus to attract the style of association they wish between leaders and syndicates. The level of the bonus can indeed motivate a given leader to choose a bank as financial partner instead of an institutional investor. The incomplete structure of the model cannot provide a complete view of this competition between fund providers to attract the ideal leaders. In a simplifying way, we could however admit that, the more competitive is the fund providers side of the market, larger should the bonus P payed to a given leader to convince him to choose a bank and not an institutional investor. The following proposition illustrates the role of this “competitive” determinant of the bonus.

Proposition 3. *When the VC in charge of the project is associated with a style (s1) syndicate, all things equal, higher is the experience of the leader, smaller is the optimal bonus paid by the bank. In the same circumstances, higher is the specialization of the leader, higher is also the bonus paid by the bank.*

Proof: see Appendix 5.

A large bonus is then not always synonymous of a large advantage for the bank in its capacity to fund a given project. When the leader is experienced and poorly specialized, the bank has a great advantage in terms of bargaining power: given lemma 3, the leader tends to syndicate with a style (s1) syndicate and the bank is naturally the best partner for such an association. With the same level of experience but a more adapted specialization, the leader has a great choice and can select the

solution the more adapted (a style (s1) syndicate coupled with a bank, or a style (s2) syndicate coupled with an institutional investor) according to the level of the incentives offered by the financial partners. The consequence is an increase of the level of the bonus necessary for the banks to retain this kind of project under their influence. In this case, the bonus P is used by the bank to motivate the leader to choose a style (s1) syndicate while simultaneously the bonus δ is chosen by the institutional investors to convince the leader to choose a style (s2) syndicate.

A consequence of Proposition 3 is that for a bank, the best association is with a leader highly experienced and poorly specialized, associated with a syndicate able to increase the probability of success of bad projects.

5.3 The effect of institutional investors incentives

A increased participation of the leader in the capital of the project in seed corresponds to an increase of the incentives from the institutional investors to the VCs in charge of the project, devoted to enhance the profitability of the projects funded by this kind of fund providers. The effect of these incentives can be considered at first on the effort of the leaders and of the syndicate they associate during the development phase of the projects. We then derive the following lemma:

Lemma 4. *When the fund provider is an institutional investor,*

- (i) *When the leader is associated to style (s2) syndicate, there exist an optimal rate $(1-\delta^*)$ of participation of the leader to the return in the development phase maximizing the profit of the institutional investor. When $\delta^* \neq 1$, this level of participation increases the profit of the VC in charge of the project and has a positive effect on the effort of the syndicate and of the leader.*
- (ii) *The effect of the incentive of the institutional investor is ambiguous on the efforts of the leader and the syndicate when this last is of style (s1).*

Proof: see Appendix 6.

The institutional investors can then use efficiently their incentive scheme when the syndicate has the objective to increase the return of the good projects. This result is not really surprising as, in this case, the objective of the fund riser is aligned with the objective of the syndicate.

It is also interesting to note that there is no systematic influence of the incentive of the institutional investors on the level of effort of the leader and of the style (s1) syndicate when the leader exerts a screening activity in seeds. The reason is that when the style (s1) syndicate is involved with the leader, the relative proportion of the gross profit and of the additional capital required in the development stage is not neutral in the evolution of the good technology when the level of incentives of the institutional investors varies. According the fourth row of expression (4), all decrease of δ has indeed as consequence to increase the weight of the expected loss of capital of the leader. All increase of the screening effort in seeds tends to limit this loss and all effort of the style (s1) syndicate to improve the quality of the

project has the same consequence. For this reason, the incentive of the institutional investor can activate as well the properties of complementarity and substituability of the leader and the style (s1) syndicate.

The observation of expressions (4) and (5) reveals that institutional investors match rather well with efficient leaders associated with syndicates able to enhance the profit of the good projects. In this case, a relatively small incentive can have a large effect: a small value of λ generates a non-negligible increase of the effort of the leader who can then liquidate rapidly the major part of the bad projects: when δ decreases, the expected losses then increase not too much since the effort of the leader increases efficiently in seed. Simultaneously, a small value of $\bar{\lambda}''$ is associated with a high level of the effort h of the style (s2) syndicate: the result is an increase of the profit of the good projects. When δ decreases and until some critical level given by the quadratic form of expression (7), this increase of the profit of the VC is profitable for the institutional investors.

Proposition 4. *When the VC in charge of the project is associated with a style (s2) syndicate, all things equal,*

- (i) *higher is the specialization of the leader in the sector of the project, the more is efficient the incentive of the institutional investor,*
- (ii) *higher is the average level of specialization of the leader in the different sectors, the more is efficient the incentive of the institutional investor.*

Proof: see Appendix 7.

Proposition 5 exhibits the existence of a new efficient combination: institutional investors tend to associate with specialized leaders and specialized syndicates, *i.e.* syndicates able to increase the return of the good projects.

If the characteristics of the leader play a decisive role on the success or failure of an association, other parameters are also important. They tends to enhance or reduce the effect of the investor incentive on the effort of the leader and of the style (s2) syndicate. Proposition 5 characterizes their influence:

Proposition 5. *When the VC in charge of the project is associated with a style (s2) syndicate, all things equal,*

- (i) *the effect of the incentive of the institutional investors on the screening effort of the leader increases with the ex-ante probability of loss and with the level of the new financial resources required during the development phase,*
- (ii) *the effect of the incentive of the institutional investors on the effort of the syndicate increases with the expected profit of the project and with the proportion of the funds required in the development phase relatively to the total financial resources required for the project.*

Proof: see Appendix 8.

The consequence of Proposition 5 is that the level of the incentive of the institutional investors is not always an increasing function of the intrinsic quality of the leader and syndicate. Other elements can have a role. For instance, the expected profit of the project and the share of the financial resources required during the development phase on the total funds needed to fund the project also matter. Institutional investors should then have a tendency to stimulate more easily / efficiently the effort of the leaders when the context associated with these elements is more adapted. When the probability of success of a project is relatively low but the expected profit high, it is efficient to stimulate the screening effect of the leader and of the syndicate. In a less contrasted case concerning the risk and return characteristics of the project, the efficiency of the incentives decrease: it could even be interesting for the investor to cut all incentive and to take all the risk by itself. But in the same case, depending the experience of the leader, another financial solution, involving banks, can challenge the proposition of the institutional investor. This context of competition among fund providers - that we have neglected since there - can explain that the institutional investors could maintain a positive level of incentive, even when the optimal solution would have been $\delta^* = 1$ without competitors.

Propositions 3, 4 and 5 indicate jointly that the specific skills of the lead venture capitalist determine the optimal form of funding of syndicated deals. The main result is that the choice between a financing by a bank or by an institutional investor is dependent on the level of specialization of the lead venture capitalist. Banks tend to fund leaders with a low level of specialization while institutional investors privilege highly specialized leaders.

6 Concluding comments

The aim of this paper was to examine the factors able to explain the heterogeneous forms of syndication in the venture capital market relatively to the nature of the skills of the syndicates' members and the nature of the funds providers financing them.

A central result of our work is to show that skills matter in syndication choices but, most importantly, we show that not only the level but also the nature of skills matter.

Indeed, a first conclusion of our model is that the level of experience of the lead venture capitalist is an important determinant of syndication choices since it influences the form of partnership in the syndicate. More exactly, if the lead venture capitalist is rather inexperienced, it will be in his interest to associate with a syndicate made up of specialized venture capitalists, that is, able to improve the performance of funded projects. This result is verified whatever the level of specialization of the leader. In contrast, if the lead venture capitalist is experienced, then it will seek either to syndicate with specialized venture capitalists or, instead, with experienced venture capitalists, that is, able to improve the proportion of successful projects. In this case, the choice between the two kinds of syndication will depend

only on the level of return of funded investment projects. Indeed, we show that the lower are the expected return of the project the more the lead venture capitalist will tend to associate with a syndicate of experienced venture capitalists. More profitable investment projects lead instead the leader to associate with a syndicate made up with specialized venture capitalists. The second main result of the model is that the level of specialization of the lead venture capitalist is also a crucial factor in syndication choices because it determines the nature of the funds providers financing the syndicated deal. More precisely, if the lead venture capitalist is not very specialized, we show that he will tend to be funded by a bank. On the contrary, if he is very specialized, he will tend to be financed by an institutional investor. The model also shows that this relationship between specialization and the sources of finance will appear when funds providers are "hands-on", that is when they actively use the compensation scheme linking them to the leader as an incentive mechanism to influence syndication choices.

If we compare the theoretical results of the model with the situation prevailing in the French market, the model suggests that venture capital in France is characterized by a hands-on governance exerted both by the banks and institutional investors. This can be partly related to the fact that during the last years the share of independent venture capitalists increased significantly at the expense of the share of captive venture capitalists. In the case of France, the phenomenon is particularly marked since between 2002 and 2007, the amount raised by captives was around 17 percent of the total amount (with a peak at 20.6 percent in 2005). In 2008 and 2009, the proportion of captives collapsed to reach about 2 percent in 2008 and only 0.7 percent in 2009 (EVCA Yearbook 2004 to 2010)⁶. Therefore, lesser and lesser financing relations between funds providers and venture capitalists take place in the framework of a parent company-subsidiary relationship. On the contrary, funds providers have to use more actively the financial incentives mechanisms centered on performance (associated with the quality of projects for banks or their profitability for institutional investors) to align investment strategies - such as syndication - of the independent venture capitalists they fund with their own goals. By doing so, as shown in the model, every kind of funds providers is led to privilege the lead venture capitalist that maximizes the efficiency of the compensation scheme: as in the French case, banks will tend to finance very specialized lead venture capitalists while institutional investors will fund the less specialized ones.

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Appendix

Appendix 1: Proof of Lemma 1

We simplify the notation as following: $A = (1 - \mu)(1 - q)$, $B = \mu p_j R_j(p_j) + (1 - \mu)qR$, $E = [S/(S + D)]$, $F = \frac{S+(1-\delta)D}{S+D}$, $G = \mu(1 - p_j)$.

- Proof of (i): When there is a syndicate of style (s2) with a bank as financial partner, the first order solutions of (3) are respectively $c'(e) = (A + G)\bar{c}/\lambda$ and $c'_{s2}(h) = EB/\bar{\lambda}''$. The second order conditions are still verified. Given the properties of $c(e)$, all decrease of λ increases the optimal level of e while the optimal level of h remains unchanged. The same kind of results is obtained with the analysis of expression (5), i.e. when a style (s2) syndicate is associated with an institutional investor. In both cases, the increase of e results in an increase of the profit.

- Proof of (ii): When the optimal solution integrates a style (s1) syndicate with a bank as financial partner, the first order conditions of (2) are $\lambda c'(e) = -A(ER + P + S)d + \bar{c}(A + G)$ and $\lambda c'_{s1}(d) = -A(ER + P + S)e + A(ER + P + S)$. While the analytical solutions verifying these conditions are not easy to express, the assumptions we made on $c(e)$ and $c_{s1}(d)$ show that at the corner $e = 0$ (resp. $d = 0$) any marginal screening effort of the leader (effort of the syndicate) has no cost while its effect is positive on the profit. We conclude that there exists an interior solution $\{e^*, d^*\}$. An decrease of λ has effects not so easy to analyze on the optimal solution $\{e^*, d^*\}$. In any case, given the properties of $c(e)$ and $c_{s1}(d)$, the effect is however to increase the profit of the project. The same kind of result is associated to the same style of comparative statics if the optimal solution is associated with expression (4), i.e. when an institutional investor finds the project during the development phase ■

Appendix 2: Proof of Proposition 1

Proof of (i): Given lemma 1, when λ is small, e^* and h^* increase when a style (s2) syndicate is associated to the leader in the development phase. Larger is $R_j(p_j)$, broader is the basis on which apply the effort of the style (S2) syndicate. When a style (s1) syndicate is associated to the leader, the solution tends to a corner solution (e^* or d^* evolve in opposite directions), according the parameters of the model. If A (i.e. the proportion of low return bad projects is large), the gain generated by the (s1) syndicate is high when the cost of effort of this syndicate is low. Among other things, the best style of syndicate will then depend - among other parameters - on the respective size of A and $R_j(p_j)$.

Proof of (ii): Suppose that the optimal matching associates banks as financial partners. When $\lambda \rightarrow +\infty$, given the costs of the screening effort of the leader and the cost of the style (s1) syndicate, the optimal solution of the expression (2) tends to $(e = 0, d = 0)$ and the optimal profit tends to $H = E[\mu p_j R_j(p_j) + (1 - \mu)qR] + [\mu p_j + (1 - \mu)q]P - S[\mu(1 - p_j) + A] - C$ while the solution of the expression (3) tends to $(e = 0, h = h^*)$ where h^* is solution of $c'_{s2}(h) = EB/\bar{\lambda}''$. The optimal

profit tends to $H + E[\mu p_j R_j(p_j) + (1 - \mu)qR]ah^* - \bar{\lambda}''c_{s2}(h^*) > H$. It is then excluded that the optimal solution could associate a bank and a style (s1) syndicate. The amount of the fixed costs C determine then the best solution for the VC among choosing to a style (s2) syndicate and the reservation possibility, *i.e.* no syndicating. The conclusions are the same if the optimal solution associates an institutional investor ■

Appendix 3: Proof of Lemma 2

Proof of part (i): when a VC has few experience, λ' is large. According to the properties of the optimum corresponding to expressions (2) and (4), when a syndicate of style (s1) is associated with the project, the level of effort d of this syndicate decreases when λ' increases. Given our remarks of lemma 1, the action of the leader tends to substitute the actions of the style (s1) syndicate, given that the costs of the effort of the syndicate increases as the cost of the effort of the leader remains unchanged (λ' and λ'' evolve in opposite directions). The solution tends to $\{e^*, 0\}$, *i.e.*, it is less interesting to associate a style (s1) syndicate. When the leader has associated a style (s2) syndicate, according the first order conditions corresponding to (3) and (5), the optimal level of effort h of the style (s2) syndicate increases with the decrease the experience of the leader. The style (s2) syndicate has then an increased efficiency. As a consequence, leaders tend to syndicate with (s2) style partners.

Proof of part (ii): Given our assumptions, the case corresponds to an experienced leader with a small λ' . In this case, the style (s1) syndicates are highly efficient. As $\bar{\lambda}''$ is not related only to λ'' , the level of efficiency of style (s2) syndicates is not so small. The two styles of syndicates then compete and the solution is chosen according to the terms of the profit function: when μ and $p_j R_j(p_j)$ increase, the motives to choose a style (s2) syndicate increases ■

Appendix 4: Proof of Lemma 3

It is easily deduced from expression (3), that an increase of P has a (positive) direct influence on the optimal value of Π_{s2}^{bank} but no influence on the optimal level of effort e^* of the leader. Given (2), the direct effect of P on Π_{s1}^{bank} is obviously positive. The indirect effect, resulting from a reallocation of the levels of effort, is less easily deduced from (2). From the first order conditions of (2) in e and d already analyzed in the appendix 1 but considered there in the general case ($\lambda' \neq \lambda$), we observe also that, from whatever initial optimal solution $\{e^*(P), d^*(P)\}$, all increase of P also increases $d^*(P)$ and decreases $e^*(P)$ (see also figure 2). The result is that $\Delta(P, s1)$ and $\Delta'(P, s1)$ all always increase with P while $\Delta''(P, s1)$ always decreases with P . The effect of the increase of $\Delta(P, s1)$ and of the decrease of $\Delta''(P, s1)$ is to increase the profit of the bank Π_{s1}^{bank} while the effect of the increase of $\Delta'(P, s1)$, multiplied by $(-P)$ in the expression of Π_{s1}^{bank} is negative on this profit. As the degree of $(x - P)\Delta'(P, s1)$ is greater than the degree of the increasing terms, the effect of an increase of P is positive on Π_{s1}^{bank} for small values of P , then become negative from a some optimal value P^* ■

3 possible cases analyzed in Lemma 1, we however deduce - as illustrated in Figure 2 -, that when P increases, the optimal effort d^* increases while the optimal effort e^* decreases or remains minimal ■

Appendix 5: Proof of Proposition 3

Higher is the experience of the leader, smaller is λ' *i.e.*, all things equal, larger the optimal effort d^* of the style (s1) syndicate and higher the profit associated with (2) for the leader. Still all things equal, all decrease of λ' increases also the expected profit of the bank given by (6) if the project is funded by a bank or the expected profit of the institutional investor given by (7) if the project is funded by an institutional investor. All decrease of λ' has a positive effect on d^* for a given P and then a positive effect on the term $[\mu p_j + (1 - \mu)(q + (1 - q)(1 - e)d)]P$ for the leader in expression

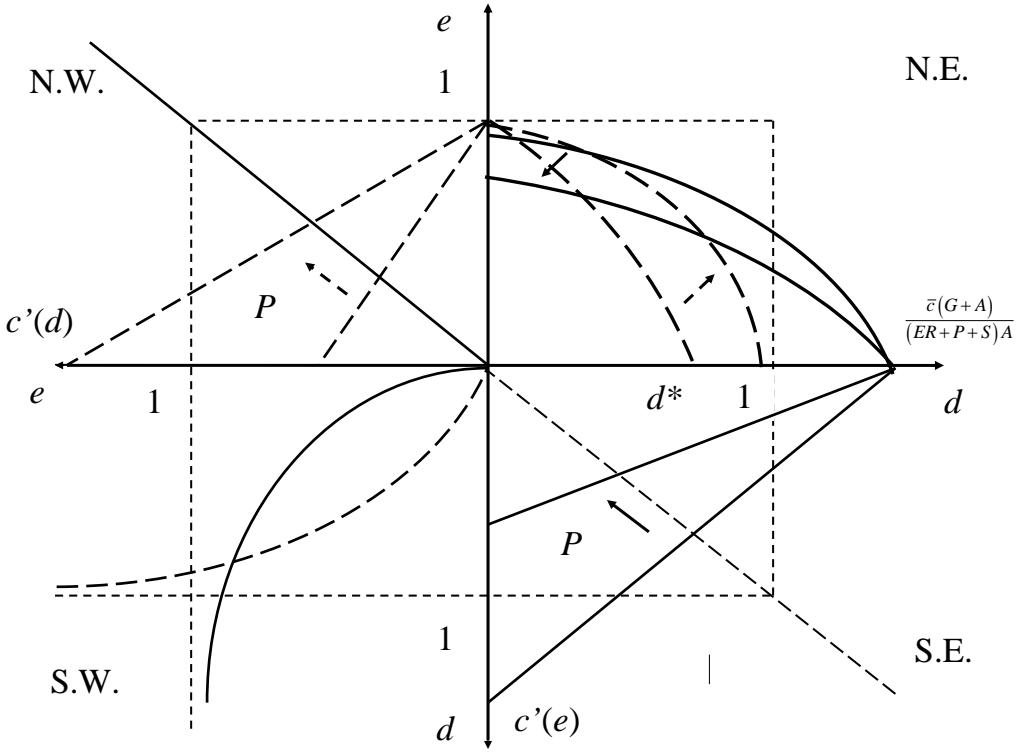


Figure 2: The effect of an increase of P when a syndicate of style (s1) is associated with the project

(2) and on the term $(x - P)\Delta'(P, s)$ in the profit of the bank given by (6). There is no equivalent effect in the profit the leader in expression (4) and of the institutional investor associated with (7). We then deduce all decrease of λ' generates more advantages for the two partners when there is an association between a style (s1) syndicate and a bank than between a style (s1) syndicate and an institutional investor. This advantage results in the capacity for the bank to decrease more easily than institutional investors the level of its incentive, i.e. the bonus P . When the specialization of the leader increases, all things equal, i.e. for a given expertise given by λ , smaller is then his experience and λ' increases. The optimal level of effort d^* of the style (s1) syndicate then decreases for a given P ; the terms $[\mu p_j + (1 - \mu)(q + (1 - q)(1 - e)d)]P$ and $(x - P)\Delta'(P, s)$ also decrease in expressions (2) and (6). This situation of the bank deteriorates in this case more deeply than the situation of the institutional investors. The consequence in a competitive setting is an increase of the optimal premium paid by the bank to the VC to obtain confirmation of its partnership ■

Appendix 6: Proof of Lemma 4

(i) The first order derivatives in e and h of expression (5) attest that e^* and h^* increase when δ decreases. As δ decreases, i.e. the level of the participation of the leader to the profits of the project increases, e^* and h^* however increase at a decreasing rate given the increasing form of the costs $c(e)$, $c_{s2}(h)$, and the natural limit to the effort that the leader and the style (s2) syndicate can devote screen and improve the return of the project. The term $\Delta(\delta, s2)$ then increases at a decreasing rate when δ decreases while $\delta D/(S + D)$ and $\delta D\Delta(\delta, s2)$ decrease at a constant rate. These variations determine the existence of a value δ^* maximizing Π_{s2}^{ii} .

(ii) The study of the conditions of optimality of e and d as a function of δ provides no clear sense

of variation of $e^*(\delta)$ and $d^*(\delta)$ independently of complex relations among parameters ■

Appendix 7: Proof of Proposition 4

- (i) This case corresponds to the expression (5) for the leader. For all amount of δ , there is an interior solution satisfying the first order conditions in e and h . The conditions provide independently the optimal levels of effort of the leader and of the style (s2) syndicate. $(e^*(\delta)$ satisfies $c'(e) = (\bar{c} + D)A/\lambda - \delta DA/\lambda$ which decreases with λ when e is positive.
- (ii) The second first order condition is $c'_{s2}(h) = (B\alpha/\bar{\lambda}'') - (\delta\alpha DB/\bar{\lambda}''(S+D))$ from which we derive a decreasing relation between δ and h (h is in this case always positive) ■

Appendix 8: Proof of Proposition 5

Consider the first order conditions of the appendix 7. When $e > 0$, we obtain also $\partial c'(e)/\partial\delta = -DA/\lambda < 0$ and $\partial c'_{s2}(h)/\partial\delta = -DB\alpha/\lambda''(S+D) < 0$ from which we deduce easily the comparative static effects of proposition 5 ■

IV. CURRICULUM VITAE

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1988 : Licence de Sciences Economiques, Université de Nice-Sophia Antipolis.

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- *Président de la Section de Sciences Economiques* de l'Université de Nice-Sophia Antipolis de septembre 2002 à octobre 2006.
- *Membre du Conseil Scientifique* de l'Université de Nice-Sophia Antipolis depuis avril 2008.
- *Membre du Conseil d'Administration* de la Faculté de Droit, Sciences Politiques, Economiques et de Gestion de 2005 à 2010.
- *Directeur du Master (1 et 2) Banque et Finance Internationale* de l'Université de Nice-Sophia Antipolis.

V. ENCADREMENT ET ANIMATION DE LA RECHERCHE

1. ORGANISATION DE COLLOQUES, CONFERENCES ET JOURNEES D'ETUDES

J'ai participé à l'organisation de plusieurs workshops et colloques :

(1) *Workshop « Heterogeneity and performance in the European Venture Capital industry », Nice, 17 et 18 November 2011, GREDEG (UMR 6227 du CNRS) et Université de Nice-Sophia Antipolis.*

Ce workshop a réuni une dizaine de chercheurs de plusieurs pays européens travaillant dont le domaine du *private equity*, dont Sophie Manigart(Ghent University) et Massimo Colombo (Politecnico di Milano). L'objectif est de présenter des résultats empiriques et théoriques récents relatifs au marché européen du capital-investissement, en mettant l'accent sur les formes d'hétérogénéité (au niveau de la nature des intervenants et de leurs performances) caractérisant ce marché.

(2) *Workshop « New Financial Intermediaries » en partenariat avec le GREDEG (UMR 6227 du CNRS) et le GDRE Monnaie-Banque-Finance, 16 et 17 Octobre 2008, Nice.*

Ce workshop, qui a réuni une quarantaine d'universitaires et de banquiers centraux, de plusieurs pays a permis :

- de discuter des enjeux, performances, risques et incidences macroéconomiques des nouvelles formes d'intermédiation financière (bancaire, de marché, assurantielle), dans un contexte marqué par la convergence des systèmes financiers, l'opacité croissante des canaux de transmission et d'amplification des chocs et l'exposition des économies à de nouveaux risques systémiques ;

- d'envisager, à la lumière des crises récentes et en cours, les régulations prudentielles à l'œuvre et à venir ;

- d'étudier les incidences de la titrisation sur les nouveaux risques de marché et de contrepartie,

- de discuter des potentialités de développement de formules « alternatives » de financement par fonds propres (capital risque) ou capital emprunté (microcrédit).

(3) *Workshop International, La Nouvelle Architecture Financière Européenne en partenariat avec le GREDEG (UMR 6227 du CNRS), l'Université d'Aix-Marseille II et l'Association d'Economie Financière, 1^{er} et 2 février 2007, Monaco.*

Cette conférence a réuni pendant deux jours une quinzaine d'universitaires et de praticiens (dont J. P. Pollin, J.B. Chatelain, A. Cartapanis, P. Artus et C. De Boissieu) sur les questions suivantes :

- Les transformations du marché européen des capitaux ;
- Bâle II et la convergence des dispositifs de supervision prudentielle en Europe ;
- Les technologies financières et la concentration de l'industrie bancaire en Europe ;
- Le financement des activités high-tech et de la recherche-développement en Europe.

(4) *Colloque annuel du GDR d'Economie Monétaire et Financière (21èmes Journées Internationales d'Economie Monétaire et Bancaire), Nice, 10 et 11 juin 2004.*

Sous le parrainage du GDR d'Economie Monétaire et Financière, de l'Université de Nice-Sophia Antipolis et du CNRS, ce congrès a réuni 105 participants d'une quinzaine de nationalités.

2. DIRECTION DE THESE ET MEMOIRES:

J'ai assuré (avec Dominique Torre, Professeur à l'Université de Nice-Sophia Antipolis) la co-direction de la thèse de Doctorat de Mademoiselle Lan Pan intitulée « Les partenariats internationaux en capital-risque en Chine: spécificités, stratégies et conditions de viabilité.» Cette thèse a été soutenue à l'Université de Nice-Sophia Antipolis le 24 janvier 2011.

J'encadre chaque année un quinzaine de mémoire de recherche dans le cadre du Master 1 Banque-Finance.

3 RESEAUX DE RECHERCHE :

Je suis membre et participe régulièrement aux colloques et workshop organisés par les réseaux de recherche suivants :

- Le Groupement de Recherche Européen (GdRE) n°335 « Monnaie, Banque et Finance » ;
- L'European Society for the History of Economic Thought;
- Le réseau DIME (Dynamics of Institutions and Markets in Europe).

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