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The influence of the policy framework and the stance of macroeconomic policies on the banking system stability

Florian Pradines-Jobet

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Florian Pradines-Jobet. The influence of the policy framework and the stance of macroeconomic policies on the banking system stability. Economics and Finance. Université d'Orléans, 2019. English. NNT : 2019ORLE0503 . tel-03003293

HAL Id: tel-03003293

<https://theses.hal.science/tel-03003293v1>

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ÉCOLE DOCTORALE SCIENCES DE L'HOMME ET DE LA SOCIÉTÉ

Laboratoire d'Économie d'Orléans

THÈSE

présentée par :

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soutenue le : **4 Octobre 2019**

pour obtenir le grade de : **Docteur de l'université d'Orléans**

Discipline/ Spécialité : **Sciences Économiques**

L'influence du cadre et de l'orientation des politiques macroéconomiques sur la stabilité du système bancaire.

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Remerciements

En premier lieu, je souhaite adresser mes plus profonds remerciements à Grégory Levieuge, mon directeur de thèse. En dépit de ses nombreuses responsabilités, il a toujours fait preuve d'une grande disponibilité pour répondre à mes interrogations et pour dissiper les doutes inhérents à l'écriture d'une thèse. Sa bienveillance et les qualités humaines dont il a fait montre à mon égard dépassent, je pense, ce que l'on peut attendre d'un encadrant. Je lui en serai à jamais reconnaissant et je me dois de lui témoigner dans ces lignes toute ma gratitude.

J'aimerais aussi remercier Valérie Mignon et Fabien Tripier de m'avoir fait l'honneur de rapporter sur cette thèse, ainsi que Camille Cornand, Etienne Farvaque et Benoît Mojon pour avoir accepté de faire partie de mon jury.

Pour les années de thèse passées à leurs côtés et l'aide qu'ils ont pu m'apporter durant cette période, je remercie l'ensemble des chercheurs du Laboratoire d'Économie d'Orléans. En particulier, merci à Gilbert Colletaz, Christophe Hurlin, Jean-Paul Pollin, Sessi Tokpavi et Patrick Villieu, les remarques et conseils qu'ils ont pu me prodiguer à chacune de mes sollicitations ont toujours été d'une grande utilité. Merci également à l'ensemble des membres du personnel administratif du LEO, leur efficacité à résoudre les problèmes mérite d'être soulignée. Enfin, je tiens à remercier mes collègues doctorants pour les excellents moments de stimulation intellectuelle ou simplement de bonne humeur que j'ai pu partager en leur compagnie tout au long de ma thèse.

Mes remerciements les plus sincères vont aussi à Mădălina Bordianu. Dans les moments les plus difficiles, sa tendresse et ses paroles m'ont apaisé et réconforté. Merci d'avoir été présente quand il le fallait.

À Yannick Lucotte, collègue mais surtout ami, de ceux que l'on compte sur les doigts d'une seule main, j'aimerais dire que je n'ai pas de mot suffisamment fort pour lui exprimer ma gratitude. Son aide, tant sur le plan académique que personnel, a été d'une valeur inestimable et j'espère être en mesure de lui rendre la pareille dans le futur. Merci également à Alexis, Maxime et Thomas, trois frères, toujours présents quelles que soient les circonstances.

Je souhaite enfin remercier du fond du cœur mes parents pour leur soutien inconditionnel au cours de toutes mes années d'études. J'aimerais d'ailleurs terminer ces remerciements, en dédiant cette thèse à ma mère. Merci de m'avoir permis de devenir l'homme que je voulais être.

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Introduction Générale

La crise financière mondiale de 2007-2008 et la crise de la zone euro ont fait voler en éclats le paradigme de la macroéconomie contemporaine qui prévalait depuis la fin des années 1980. Cette période d'avant crise, dite de « grande modération », est marquée par l'absence de choc économique de grande ampleur et une meilleure maîtrise des politiques économiques, notamment de la politique monétaire. Les certitudes prévalant depuis deux décennies ont été largement remises en cause, aussi bien en matière de politique budgétaire, de politique monétaire que de politique prudentielle.

Les postulats d'avant-crise

Avant la crise, la politique budgétaire était reléguée au second plan des politiques économiques du fait de l'émergence d'un consensus dans le milieu académique autour de plusieurs idées. Tout d'abord, les travaux théoriques démontraient que les relances budgétaires ont une efficacité limitée en raison des effets ricardiens qu'elles génèrent (Barro, 1974). Au contraire, l'efficacité de la politique monétaire à stabiliser l'inflation durant les 30 dernières années lui a permis de jouer un rôle prépondérant dans la politique économique, justifiant ainsi un recours moindre à la politique budgétaire. Ensuite, la politique budgétaire a également souffert d'un problème d'instrumentalisation de la part des gouvernements, ces derniers pouvant être incités à détourner son utilisation à des fins électoralistes, au détriment de l'objectif initial, à savoir la stabilité macroéconomique.

En conséquence, la conduite de la politique budgétaire a progressivement visé en priorité la stabilisation des ratios de déficit public et de dette publique (Blanchard et al., 2010). Dans

les pays développés, cela se justifiait d'autant mieux que les niveaux d'endettement étaient déjà relativement élevés avant la crise. Malgré un endettement plus faible que dans les pays développés, les pays émergents ont adopté un comportement similaire, principalement du fait que les marchés financiers, trop peu développés, limitaient la capacité des gouvernements à lever des fonds supplémentaires, en particulier en période de crise.

Afin d'assurer la soutenabilité de la dette publique, le cadre de la politique budgétaire a logiquement été façonné dans le but de limiter l'action publique et l'impact des stabilisateurs automatiques. Concrètement, la pérennisation des dettes souveraines devait notamment être assurée par l'adoption de règles budgétaires, conçues pour lier les mains des décideurs publics et ainsi endiguer les déficits dans les pays développés ou réduire l'occurrence des crises souveraines dans les pays émergents. Les effets contracycliques de la politique budgétaire sur l'économie réelle ont donc été cantonnés aux stabilisateurs automatiques, eux aussi contraints par la mise en place d'un cadre budgétaire restrictif.

La surveillance accrue des finances publiques s'explique également par l'évolution du cadre de politique monétaire. En effet, pour alléger la valeur réelle de la dette publique, mais surtout pour stimuler la croissance économique de court terme et ainsi accroître leur chance de réélection, les gouvernements ont tendance à faire pression sur les autorités monétaires pour que ces dernières tolèrent une inflation effective supérieure à la hausse des prix socialement optimale. Ce biais inflationniste et les problèmes d'incohérence temporelle de la politique monétaire qui en découlent (Barro et Gordon, 1983) ont motivé des réformes importantes au niveau des statuts et des objectifs des banques centrales.

En particulier, une des principales réponses à ce problème a consisté à rendre les autorités en charge de la politique monétaire de plus en plus indépendantes des gouvernements, à partir du début des années 1990 (Cukierman, 2008). Selon les zones monétaires le degré d'indépendance varie, et peut s'apparenter à la possibilité pour les banques centrales d'utiliser librement leurs instruments jusqu'à la prérogative de fixer elles-mêmes le niveau des cibles à atteindre ou la désignation de leurs objectifs.

Concernant le choix des cibles, la période 1990-2007 a été marquée par un consensus des

économistes autour de cibles d'inflation relativement faibles. La disparition des chocs de grande ampleur pendant les décennies de « grande modération », ainsi que la sous-estimation du risque de déflation ont laissé croire qu'une cible basse offrait suffisamment de marge de manœuvre dans le cas où une politique de relance serait nécessaire. Ainsi, les banques centrales des pays développés ont majoritairement choisi des cibles d'inflation proche de 2%.

En matière de lutte contre le biais inflationniste, une autre solution consiste à accroître le degré de conservatisme des banquiers centraux (Rogoff, 1985). Le degré de conservatisme d'une banque centrale correspond au poids que cette dernière assigne à l'objectif d'inflation, relativement à ses autres objectifs. De façon concomitante à l'accroissement du degré d'indépendance de la politique monétaire, les banques centrales se sont focalisées sur le contrôle de l'évolution du niveau des prix et ont donc assigné une importance moindre à l'objectif de stabilisation de l'activité. Dans les cas les plus extrêmes, la stabilité des prix est même devenue l'objectif exclusif des autorités monétaires. Cette orientation s'est également manifestée par l'adoption, dans un nombre croissant de pays, d'un régime de ciblage d'inflation. Ce dernier se caractérise principalement par l'engagement à considérer la stabilité des prix comme l'objectif prioritaire de la politique monétaire, l'annonce publique du niveau de la cible à moyen terme et une amélioration substantielle de l'environnement institutionnel de la banque centrale. Cette modification des préférences des banques centrales témoigne aussi de la croyance du milieu académique et des praticiens en la « divine coïncidence ».

Cette divine coïncidence désigne, dans les modèles néo-keynésiens, le fait qu'en l'absence de rigidité sur les salaires réels¹, maintenir l'inflation à son niveau cible garantit le maintien de l'activité économique à un niveau proche de son potentiel, et *in fine* assure le meilleur niveau de bien-être dans la société. De ce point de vue, quelle que soit la nature du choc auquel ils doivent faire face, les banquiers centraux ne peuvent donc pas aboutir à un meilleur arbitrage entre stabilisation de l'inflation et réduction du chômage que celui qu'ils obtiennent lorsqu'ils maintiennent l'inflation à un niveau stable (Woodford, 2003).

Le mandat des banques centrales quasi-exclusivement en faveur de la stabilité des prix a également pu être justifié par l'adhésion d'une partie du monde académique à l'« hypothèse de

1. Voir Blanchard et Galí (2007).

Schwartz » (Schwartz, 1995). Selon ce principe, garantir la stabilité des prix permet également d'assurer la stabilité financière. La justification de cette hypothèse repose sur le fait que l'inflation empêche les investisseurs d'évaluer avec précision le rendement réel des actifs financiers et conduit donc à une mauvaise allocation du capital (en particulier à des prêts non-performants pour les banques). De plus, une politique monétaire trop accommodante génère de l'instabilité financière à travers le canal de la prise de risque. *A contrario*, une inflation faible et des politiques monétaires restrictives assureraient de meilleures décisions d'investissement et une prise de risque moindre de la part des agents financiers. Dans la pratique, si les banques centrales n'ont pas totalement négligé la stabilité financière, il n'en demeure pas moins que cette dernière n'a pas été considérée comme un objectif à part entière depuis l'abandon du système de Bretton Woods. C'est ce qu'atteste notamment le « consensus de Jackson Hole » qui prévalait avant la crise de 2007, selon lequel il est du ressort des autorités monétaires d'intervenir pour réduire l'instabilité financière uniquement lorsque celle-ci constitue une menace pour l'objectif de stabilité des prix. La politique monétaire n'a donc pas pour objectif de garantir la stabilité financière, qui incombe plutôt à la régulation prudentielle.

L'indépendance progressive, l'accroissement du degré de conservatisme et l'adoption du ciblage d'inflation sont autant de changements dans le fonctionnement des banques centrales qui ont permis un meilleur ancrage des anticipations, une plus grande transparence et un renforcement de la crédibilité de la politique monétaire.

Du côté prudentiel, la réglementation était concentrée sur la stabilité des institutions financières. Que ce soit les mesures visant à assurer la solidité des prêteurs, comme les exigences réglementaires en fonds propres, ou les instruments opérant sur la solvabilité des emprunteurs, tels que les ratios limitant l'utilisation de l'effet de levier, les dispositifs prudentiels avaient comme point commun de n'intervenir qu'à une échelle microéconomique, en considérant les parties prenantes de façon isolée. Par conséquent, le cadre prudentiel a totalement ignoré les possibles implications de l'instabilité financière au niveau macroéconomique, et en particulier le risque systémique. On peut toutefois nuancer ce constat pour certains pays émergents qui avaient déjà adopté, au début des années 2000, des mesures ayant pour but de renforcer la stabilité de l'ensemble de leur système bancaire.

Les conséquences de la crise

Si les cadres et l'orientation des politiques macroéconomiques ont pu paraître adaptés durant la période de « grande modération », la crise financière mondiale de 2007-2008 a montré qu'ils n'ont pas permis d'assurer la stabilité économique. Ce faisant, la crise a remis en cause les arrangements de politique économique et les principes qui avaient conduit à leur mise en place.

Tout d'abord, la crise a permis à la politique budgétaire de recouvrer une importance de premier plan en matière de stabilisation économique. Au commencement de la récession, les politiques monétaires se sont retrouvées dans l'incapacité de garantir le bon fonctionnement de la sphère financière et d'endiguer la récession. En effet, les banques centrales étaient, à ce moment là, réticentes à abaisser fortement leurs taux d'intérêt nominaux car cela aurait conduit à basculer rapidement vers des taux d'intérêt très faibles voire nuls. Les gouvernements se sont donc tournés vers des mesures de relance budgétaire qui avaient pour but de réduire la vulnérabilité du système bancaire, notamment en recapitalisant les banques, et de soutenir la demande globale afin d'éviter une récession mondiale comparable à celle de 1929 (Blanchard et al., 2013).

Cependant, les dépenses sans précédent engendrées par les relances budgétaires et l'importante diminution des recettes fiscales provoquée par la récession ont conduit à une forte hausse des niveaux d'endettement public, notamment dans les pays développés. En particulier, dans le cas des pays de la zone euro, la dégradation des comptes publics des états membres et l'interdiction, *de jure*, pour la Banque Centrale Européenne de refinancer les déficits par la création monétaire a conduit à une seconde crise relative à la capacité des pays européens à faire face aux dettes souveraines contractées. Au contraire, les pays moins endettés ont pu atténuer la récession par le biais de relances budgétaires plus agressives. Ce dernier point conforte l'idée selon laquelle il est primordial pour un état de disposer de marges de manœuvre budgétaire, c'est-à-dire de pouvoir mettre en place les réponses budgétaires adéquates en période de crise sans compromettre sa capacité à rembourser sa dette dans le futur.

Autre aspect important, la crise a mis en lumière le caractère procyclique du cadre budgétaire. En effet, l'expérience a montré que les règles encadrant l'utilisation de la politique

budgétaire avant la crise, en particulier l'existence d'objectifs budgétaires nominaux, n'ont pas permis de consolider suffisamment les comptes publics en période de croissance, lorsque les recettes fiscales sont élevées. Plus grave encore, l'assainissement rapide des déficits publics, imposé par ce même cadre, a également empêché les stabilisateurs automatiques d'apporter une réponse budgétaire plus soutenue durant la phase descendante du cycle, aggravant de ce fait l'ampleur de la récession. Alors même que rien n'indique que laisser les stabilisateurs automatiques fonctionner sans contrainte durant la crise aurait constitué une politique de relance optimale, il apparaît aujourd'hui important de repenser l'environnement dans lequel la politique budgétaire est conduite afin de lui donner un caractère contracyclique, ou *a minima* de limiter son aspect procyclique (Blanchard et al., 2010, 2013).

Les politiques de relance budgétaire n'ont toutefois pas été les seules mesures mises en place pour contrarier la récession. Les autorités monétaires ont également réagi en mettant en place des politiques monétaires très accommodantes, de façon à compenser l'effondrement de la demande globale. Par exemple, le taux de la réserve a été abaissé pour atteindre 0,25% à partir de décembre 2008 aux États-Unis, tandis que le taux des opérations principales de refinancement de la Banque Centrale Européenne a été fixé à 1% en mai 2009, avant d'être de nouveau abaissé à partir du dernier trimestre 2011 jusqu'à atteindre 0% en mars 2016. De surcroît, les banques centrales ont eu recours à des politiques monétaires non-conventionnelles qui n'avaient jusqu'alors jamais été mises en place, exception faite du Japon, afin de compléter la politique de taux accommodante.

Le recours à des politiques monétaires non-conventionnelles vise à restaurer les canaux de transmission traditionnels de la politique monétaire. Ces politiques permettent également d'assouplir les conditions de refinancement sur le marché bancaire, alors même que les taux d'intérêt nominaux ont atteint leur niveau minimum. Ainsi, les banques centrales disposent de marge de manœuvre supplémentaire pour endiguer la récession, au plus fort de la crise. Outre ces mesures, les banques centrales ont aussi été contraintes d'augmenter la portée de leur rôle traditionnel de prêteurs en dernier ressort aux institutions ne collectant pas de dépôts et sont aussi intervenues sur les marchés d'actifs, par des achats directs ou par l'élargissement des actifs acceptés en garantie.

L'instauration de cet environnement de taux d'intérêt bas résulte en grande partie du cadre de politique monétaire en vigueur avant la crise. En effet, le degré de conservatisme élevé, conjugué à une période où l'inflation était relativement stable, a conduit à maintenir les taux d'intérêt relativement bas, réduisant de ce fait les marges de manœuvre avant l'atteinte du « *zero lower bound* ». Dans un contexte dépourvu de pressions inflationnistes, des taux d'intérêt plus élevés auraient conduit à observer des taux d'inflation inférieurs aux objectifs fixés. Étant donné l'importance assignée au maintien d'un écart d'inflation faible, les autorités monétaires ont préféré garder leurs taux à des niveaux faibles. De plus, le fort degré d'indépendance des banques centrales les a conduites à pouvoir fixer des cibles d'inflation basses. Par conséquent, l'écart était relativement faible entre les taux d'intérêt réels et les taux d'intérêt nominaux, réduisant d'autant plus les marges de manœuvre de la politique monétaire.

La crise a également remis en cause la divine coïncidence. Contrairement aux prévisions des modèles théoriques, l'activité économique s'est écartée fortement de son niveau potentiel d'avant crise, alors même que l'inflation est restée relativement stable. Il apparaît donc clairement que la stabilité des prix n'est pas une condition suffisante pour garantir la stabilité de l'économie réelle. Dans ce contexte, il est légitime de reconsidérer la prédominance de l'objectif d'inflation sur les autres objectifs dans le statut des banques centrales. En particulier, la question se pose de savoir si ces dernières ne devraient pas adopter une attitude moins conservatrice en accordant un poids plus important à la stabilité de l'activité économique.

Ce dernier élément soulève une autre interrogation concernant la capacité des banques centrales à contrôler l'inflation, et plus précisément la possibilité d'accroître les prix pour relancer l'activité. Si depuis le début des années 1990, les autorités monétaires ont sans doute mené des politiques plus rigoureuses que par le passé, notamment grâce à une meilleure connaissance des mécanismes de transmission, la crise a montré que la maîtrise constatée des taux d'inflation n'était pas le seul fait des banques centrales. En effet, la grande modération correspond à une période pendant laquelle les économies développées n'ont pas connu de choc important, favorisant de ce fait le maintien des variables macroéconomiques proche de leur niveau cible. De même, le développement concomitant des économies émergentes, et en particulier de la Chine, a fait pression à la baisse sur les prix à l'échelle mondiale, encourageant donc la réussite des

politiques de désinflation menées sur la période. On constate alors, que contrairement à l'idée admise avant la crise, les banques centrales ont des difficultés pour contrôler l'inflation. En particulier ces dernières n'ont pas été capables de rehausser les taux d'inflation après l'éclatement de la crise, au moment où le risque de déflation était très élevé. Ce risque était d'autant plus élevé dans les pays où les banques centrales indépendantes avaient fixé des cibles d'inflation très basses. Par conséquent, la pertinence des réformes visant à lutter contre l'excès d'inflation, notamment par le biais d'une plus grande indépendance des banques centrales et de la nomination de banquiers centraux plus conservateurs, est à nuancer à l'heure où ces derniers échouent à accroître le niveau des prix pour éloigner le spectre de la déflation.

Autre conséquence de la crise, les décideurs politiques ont accordé une plus grande importance à la question de la stabilité financière. Ainsi, le discours dominant tend désormais à considérer les déséquilibres sur la sphère financière, et en particulier les bulles sur les prix d'actifs, comme des menaces contre lesquelles il est préférable de lutter, avant qu'elles n'affectent la sphère réelle. À cette fin, des instruments prudentiels ont été adoptés dans les pays développés. Ils visent à prévenir l'apparition de déséquilibres financiers, notamment sur le secteur bancaire, et à réduire l'amplitude du cycle financier en limitant la procyclicité du crédit. Cette stratégie vise donc à réduire le risque d'apparition d'une nouvelle crise, illustrant de cette façon la maxime selon laquelle il vaut mieux prévenir que guérir.

L'ampleur de la crise a parachevé la démonstration selon laquelle la réglementation financière en place ne constituait pas une garantie suffisante pour prévenir l'instabilité financière et sa contagion au secteur réel. Outre le fait qu'elle n'a pas empêché l'emballement du crédit ou le développement de la bulle immobilière aux États-Unis, la régulation bancaire a également contribué à amplifier les difficultés des institutions relevant de son champ d'action, à travers des mesures procycliques comme les exigences en fonds propres. Pire, sa portée exclusivement microéconomique a également conduit à négliger les interactions néfastes entre les institutions financières, à savoir le risque systémique. C'est pourquoi les régulateurs et le comité de Bâle ont élargi le champ d'action de la politique prudentielle. Cette dernière prend maintenant en compte le caractère systémique et les inter-connexions des institutions financières, au niveau macroéconomique, en plus de leur solidité intrinsèque. Il apparaît donc que la régulation,

dite macroprudentielle, s'impose désormais comme un complément nécessaire pour pallier les manques des réglementations antérieures (Farhi et Tirole, 2012). En termes de fonctionnement, les outils ont par la même occasion été repensés de manière à intégrer un aspect contracyclique dans leur utilisation.

Si avant la crise, le fait d'intégrer les prix d'actifs dans la règle de taux d'intérêt des banques centrales faisait débat, cette proposition semble aujourd'hui avoir été abandonnée. En effet, l'utilisation des taux directeurs n'apparaît pas être l'outil adéquat pour lutter efficacement contre la formation de bulles financières, le recours excessif à l'effet de levier ou la prise de risque excessive des agents financiers (Svensson, 2017). Le principal argument pour justifier cela est que les taux d'intérêt ont un rayon d'action trop important au niveau de la macroéconomie. En voulant réduire l'instabilité financière, les mouvements de taux décidés par les autorités monétaires vont affecter à mauvais escient d'autres variables, notamment le taux d'inflation et l'écart de production.

La réglementation prudentielle intervient, elle, sur la sphère financière de manière plus spécifique. Son action se focalise sur la résolution de déséquilibres financiers particuliers, ce qui lui permet de s'imposer comme l'instrument approprié pour lutter contre ces derniers. Parmi les instruments de la réglementation prudentielle, on peut citer notamment les ratios de fonds propres réglementaires dont les resserrements permettent de réduire la prise de risque des prêteurs, les ratios de liquidité introduits pour garantir la liquidité du système bancaire, ou encore les ratios de prêt-valeur (ratio LTV) permettant de renforcer la solvabilité des emprunteurs. L'intérêt de ces instruments par rapport aux taux directeurs réside bien dans le fait qu'ils agissent de façon ciblée sur les variables qu'ils tentent d'affecter. Disposer de multiples instruments pour la réglementation prudentielle permet également de pouvoir agir sur les différents aspects de la stabilité financière.

La stabilité financière est en effet un concept multidimensionnel. De ce fait, elle est difficile à définir, et il n'y a donc pas de consensus parmi les économistes autour d'une définition commune. Il existe ainsi de nombreuses définitions dans la littérature académique. Pour certains, il apparaît même plus aisé de définir la stabilité financière comme l'opposé de l'instabilité financière, au lieu d'en donner des critères précis. Pour d'autres, la définition s'appuie sur la notion de gestion

du risque et de préservation de la stabilité du système financier. Ainsi on peut comprendre la stabilité financière comme relevant de plusieurs dimensions : la réduction du risque systémique, la résilience de l'économie réelle face aux chocs financiers et le lissage du cycle financier.

Les banques centrales elles-mêmes ont du mal à s'accorder sur une définition précise de la stabilité financière, alors que dans certains pays elles disposent d'un mandat explicite sur cette question. Néanmoins, comme le montre Siklos (2017), les termes de « confiance dans le système financier », « résilience aux chocs », « prévention des perturbations du système financier » et « prévention des effets néfastes des chocs financiers sur l'économie réelle » sont les plus fréquemment utilisés, ce qui renvoie à la définition énoncée plus haut.

Dans cette lignée, Schinasi (2004) propose une définition de la stabilité financière fondée sur trois principales caractéristiques. Premièrement, un système financier stable est capable d'allouer efficacement les ressources économiques. Deuxièmement, les risques financiers relativement bien évalués sont également bien gérés. Troisièmement, le système financier est dans un état tel qu'il est en mesure d'absorber efficacement les chocs financiers. Si l'une de ces caractéristiques n'est pas observée, il est probable que le système financier présente des déséquilibres et donc de l'instabilité. L'instabilité financière se manifeste donc lorsque les prix d'actifs s'écartent excessivement de leurs valeurs fondamentales, que les banques n'osent plus financer les projets rentables ou que les chocs financiers entraînent des dysfonctionnements du système financier.

Cela explique pourquoi la stabilité financière est généralement définie par l'absence d'épisodes systémiques au cours desquels le système bancaire et financier ne fonctionne pas. En particulier, selon la FED (2002), la stabilité financière peut être simplement définie comme le fonctionnement harmonieux et ininterrompu des mécanismes de crédit et de paiement. Les éléments affectant le bilan des banques sont également considérés comme une source de risque et de vulnérabilité pouvant menacer le maintien de la stabilité financière.

La crise de 2007-2008 a affecté l'économie mondiale de façon violente et durable. Dans le contexte post-crise actuel, il est donc raisonnable de s'interroger sur l'élaboration de nouveaux cadres pour les politiques macroéconomiques, dans l'optique d'améliorer la résilience de l'économie réelle, en particulier face aux chocs financiers. À ce stade, il convient de donner une

définition claire de ce que nous entendons par « cadre de politiques macroéconomiques ». Cette notion désigne l'ensemble des dispositifs juridiques et des normes qui ont été mis en place par les pouvoirs publics, dans le but d'encadrer l'utilisation des politiques économiques. Elle englobe à la fois les limites au champ d'action des politiques, la désignation et la hiérarchisation des objectifs d'une politique, et les règles qui contraignent l'utilisation des instruments à la disposition des décideurs. D'une façon globale, il s'agit donc de l'ensemble des caractéristiques qui régissent la conduite des politiques macroéconomiques.

Problématique et objectifs de la thèse

Comme nous l'avons vu, le cadre et l'orientation des politiques économiques ont une influence fondamentale sur les performances macroéconomiques. La crise a également démontré qu'ils ont des effets réels indirects, rétroactifs, de par leur impact sur la stabilité financière (Borio, 2014b). Or l'influence du cadre et de l'orientation des politiques macroéconomiques sur la stabilité financière demeure inexplorée.

L'enjeu de cette thèse est donc de contribuer à la littérature académique en établissant dans quelle mesure le cadre et l'orientation des politiques macroéconomiques, et en particulier de la politique monétaire, influencent la stabilité du système bancaire. Répondre à cette interrogation revêt une importance primordiale. Dans un premier temps, il s'agit de faire un bilan des cadres de politique monétaire face à la crise financière mondiale, de manière à identifier une partie des mécanismes qui en sont à l'origine. Dans un second temps, cela doit permettre de déterminer l'architecture et l'orientation à suivre pour les politiques macroéconomiques afin d'accroître la résilience des économies face aux chocs financiers.

La question soulevée par cette thèse a ceci d'original, qu'elle se situe au croisement de la macroéconomie et de l'économie politique. Il s'agit ici de comprendre comment la stabilité économique, et en particulier la stabilité financière, est intimement liée avec les règles et les normes qui encadrent la conduite des politiques économiques. À l'heure actuelle, cette question reste encore largement inexplorée dans la littérature économique.

L'objectif de la thèse est triple. Le premier objectif consiste à étudier dans quelle mesure le cadre de politique macroéconomique influence la résilience de l'économie réelle suite à l'occurrence d'une crise bancaire systémique. Pour ce faire, nous considérons un ensemble de caractéristiques institutionnelles afin d'identifier celles qui ont permis de réduire l'occurrence et/ou le coût des crises bancaires. Suite à quoi, le deuxième objectif sera d'évaluer l'impact particulier que peut avoir le cadre de la politique économique sur la vulnérabilité du secteur bancaire. Notre analyse se concentrera dans ce cas sur l'influence du cadre de la politique monétaire sur différents aspects du secteur bancaire. Enfin, le dernier objectif vise à établir dans quelle mesure l'orientation de la politique monétaire affecte l'efficacité de la régulation macroprudentielle. L'étude consistera à analyser l'existence ou non d'une potentielle complémentarité entre les politiques monétaire et macroprudentielle pour lisser le cycle financier.

Conformément à la définition multidimensionnelle de la stabilité financière susmentionnée, nous aurons recours dans cette thèse à des mesures alternatives de l'instabilité du secteur bancaire, à savoir : la perte de production liée aux crises bancaires (systémiques), des variables relatives aux bilans des banques, tels que le Z-score ou la part des prêts non performants et également l'excès de crédit. Ainsi, en considérant différentes mesures, nous prenons en compte l'aspect multidimensionnel de la vulnérabilité du secteur bancaire.

Méthodologie et structure de la thèse

Pour répondre à cette problématique la thèse s'articule autour de trois chapitres. Chaque chapitre propose une étude empirique originale, comprenant notamment les récents épisodes de crises financières pour un échantillon de pays se voulant le plus large possible, selon la disponibilité des données.

Le premier chapitre de cette thèse a pour but d'analyser empiriquement l'impact de différents cadres de politiques macroéconomiques selon leur degré de flexibilité, sur le coût des crises bancaires systémiques.² Depuis l'article fondateur de Kydland et Prescott (1977), les politiques discrétionnaires, très flexibles, sont opposées aux politiques établies selon une règle

2. Ce chapitre a donné lieu à un article co-écrit avec G. Levieuge et Y. Lucotte.

qui constitue un cadre rigide. Les politiques discrétionnaires laissent aux décideurs une grande marge de liberté particulièrement utile en cas de choc de grande ampleur ou de circonstances exceptionnelles. Mais le fait de pouvoir se détourner à tout instant des objectifs annoncés rend ce type de politique peu crédible car sujet à servir des intérêts politiques plutôt que le bien-être social. *A contrario*, mener une politique en suivant une règle permet de lier les mains du décideur, assurant ainsi une cohérence temporelle de l'objectif poursuivi. En améliorant de la sorte la transparence et la crédibilité de la politique, il est probable que cette dernière devienne plus efficace. Toutefois, suivre une règle peut également être problématique, dès lors que des circonstances particulières se manifestent.

Eu égard aux avantages et inconvénients des politiques discrétionnaires et des politiques établies selon une règle, l'objectif du chapitre est d'évaluer empiriquement les bénéfices nets associés à un cadre de politique macroéconomique en termes de coût des crises bancaires systémiques. Nous examinons ici le degré de flexibilité de trois politiques économiques : la politique budgétaire, à travers l'adoption de règles budgétaires ; la politique de change, en fonction du régime de change mis en place ; et la politique monétaire, grâce à différentes caractéristiques telles que le degré d'indépendance ou de conservatisme de la banque centrale ou encore l'adoption d'un régime de ciblage d'inflation. À notre connaissance la question du lien entre la flexibilité du cadre des politiques économiques et le coût des crises bancaires a été négligée jusqu'à présent. Une seconde originalité de notre étude réside dans notre approche des pertes en cas de crise, puisque nous considérons ici le coût non-conditionnel des crises bancaires. De cette façon, nous contournons le biais de sélection inhérent au fait de ne s'intéresser qu'au coût des crises conditionnel à l'occurrence d'une crise. Notre analyse est donc ainsi plus à même de délivrer un verdict sur l'effet net d'un arrangement de politique économique.

Les résultats indiquent que les régimes les plus discrétionnaires et les régimes fondés sur des règles rigides ne permettent pas d'obtenir les meilleures performances économiques. Au contraire, un cadre intermédiaire mélangeant à la fois règle et discrétion permet d'avoir une meilleure résilience de l'économie réelle face aux crises bancaires. Ce résultat, plaidant en faveur de politiques fondées sur de la « discrétion contrainte », vient confirmer empiriquement une intuition énoncée il y a plus de 20 ans par Bernanke et Mishkin (1997).

Concernant le degré de conservatisme des banques centrales, il apparaît que plus ce dernier est élevé, plus les crises bancaires s'avèrent coûteuses. Ce résultat est particulièrement intéressant étant donné qu'il contredit totalement « l'hypothèse de Schwartz », communément admise dans le paradigme d'avant crise.

Afin d'approfondir ce résultat, le deuxième chapitre se propose de vérifier empiriquement l'existence d'un lien entre le degré de conservatisme des banques centrales et la vulnérabilité du secteur bancaire.³ Le degré de conservatisme d'une banque centrale au sens de Rogoff (1985) se définit comme le poids attribué à l'objectif de stabilité des prix dans la fonction de perte de la banque centrale, relativement au poids des autres objectifs. Ainsi, il n'est pas si surprenant de trouver qu'un plus fort degré de conservatisme engendre des crises plus sévères. Il existe en effet un arbitrage : l'augmentation du degré de conservatisme permet de réduire la volatilité de l'inflation mais augmente la variabilité de la production en cas de choc d'offre négatif. Par conséquent, durant une crise bancaire, les banques centrales plus conservatrices vont rester focalisées sur la stabilisation de l'inflation et seront donc moins à même de mettre en œuvre des politiques de relance, si l'inflation reste au-dessus de sa cible.

Potentiellement, le degré de conservatisme peut aussi nuire à la stabilité du secteur bancaire *ex ante*. Toutefois, l'hypothèse établie par Schwartz (1995) réfute cette idée et soutient qu'en l'absence d'inflation et donc d'incertitude sur les prix relatifs des actifs financiers, l'allocation des capitaux se fait de manière optimale. Se focaliser sur le maintien d'une inflation faible pouvait ainsi être vu comme un moyen de garantir la stabilité financière. Telle était l'idéologie dominante d'avant la crise. La crise a conduit à développer une théorie alternative selon laquelle une importance trop grande accordée à l'objectif d'inflation conduit à négliger la stabilité financière, en particulier à cause du fait que les cycles financier et réel ne sont pas synchronisés (Borio, 2014a). L'enjeu du chapitre est donc d'étayer empiriquement l'une de ces deux thèses et ainsi compléter la littérature existante sur le sujet. Pour cela, nous cherchons à mesurer l'effet du degré de conservatisme sur six mesures différentes de vulnérabilité du secteur bancaire. Les résultats obtenus montrent que les préférences des banques centrales ont bel et bien un effet sur l'instabilité financière : un degré de conservatisme élevé accroît la vulnérabilité du secteur

3. Ce chapitre a donné lieu à un article co-écrit avec G. Levieuge et Y. Lucotte, publié dans le *Journal of Financial Stability*, Vol.40 pp.110-131 (2019).

bancaire. Ce résultat remet en cause l'hypothèse de Schwartz, et montre que même si un fort degré de conservatisme permet de lutter contre le biais inflationniste, il existe des effets négatifs en termes de stabilité financière à trop se focaliser sur l'inflation.

Un résultat commun aux deux premiers chapitres est que le cadre et l'orientation de la politique monétaire ont un impact sur la stabilité financière. Toutefois la stabilité financière n'est pas un objectif dédié à la politique monétaire, et relève plutôt de la politique prudentielle. Au niveau macroéconomique, la stabilité du système financier est l'objectif visé par la réglementation macroprudentielle. L'efficacité de celle-ci peut toutefois être contrariée par un potentiel conflit d'objectif avec les autorités monétaires. C'est le cas lorsqu'en l'absence de pression inflationniste, les banques centrales maintiennent des taux bas, propices à accroître la prise de risque des agents financiers et la quantité de crédits distribués à travers le canal de la prise de risque (Borio et Zhu, 2012). La prise en compte des interactions entre les politiques monétaire et macroprudentielle est donc primordiale pour lutter efficacement contre l'instabilité financière.

Le troisième chapitre a ici un double objectif.⁴ D'une part, il vise à évaluer l'efficacité des politiques macroprudentielles, ce qui fait déjà l'objet de plusieurs études au sein de cette littérature naissante, sans pour autant proposer de conclusion claire sur le sujet à l'heure actuelle. D'autre part, le chapitre va plus loin et explore l'interaction entre les politiques monétaire et macroprudentielle. Pour cela, nous cherchons à mesurer l'efficacité de la politique macroprudentielle conditionnellement à l'orientation de la politique monétaire. L'enjeu réel de cette partie est de fournir un élément de réflexion au débat portant sur la coordination des deux politiques, et ainsi permettre le design d'un cadre adéquat pour ces deux politiques. Concrètement, nous évaluons l'effet de la politique macroprudentielle sur la croissance du crédit lorsque son orientation est synchronisée avec celle de la politique monétaire. Les résultats de notre analyse empirique montrent qu'une politique macroprudentielle restrictive permet de réduire la croissance du crédit, avec un délai d'environ une année. Toutefois lorsque l'orientation de la politique monétaire va dans le même sens que la régulation macroprudentielle, la réduction du crédit est plus importante et le délai d'action est réduit à un ou deux trimestres. Ce dernier résultat plaide donc en faveur d'une coordination entre les deux politiques, élément essentiel

4. Ce chapitre a donné lieu à un article co-écrit avec J. Garcia Revelo et Y. Lucotte, en révision mineure dans le *Journal of International Money and Finance*.

dans le débat actuel sur la nécessité d'un *policy-mix* entre la politique monétaire et la politique macroprudentielle.

Chapitre 1

The cost of banking crises : Does the policy framework matter ?

1.1 Introduction

Many efforts have been made previously to identify the main causes of banking crises and the drivers of their cost, especially in the aftermath of the global financial crisis.¹ This issue remains important as a decade of easy global monetary and financial conditions may have increased financial imbalances and encouraged financial institutions to increase their risk-taking.

Banking and financial crises are the prime source of balance sheet recessions, which are more harmful than real business cycle recessions (Reinhart and Reinhart, 2010; Taylor, 2015). Surveys indicate the role played by excess credit growth and debt, GDP per capita, exchange rate developments and current account deficits.² Surprisingly, the effects of the macroeconomic policy framework are largely ignored.

In general terms, the macroeconomic policy framework is all the characteristics that define and restrict the conduct of monetary, fiscal and exchange rate policies. This covers formal arrangements such as fiscal rules, pegged or floating exchange rate regimes, inflation targeting,

1. This chapter gave rise to an article co-written with G. Levieuge and Y. Lucotte.

2. See for instance the survey by Frankel and Saravelos (2012).

and the degree of central bank independence. Some further features may be less formal, such as the degree of central bank conservatism. The costs related to past banking crises tend to suggest that there is a trade-off in the degree to which policy frameworks are restrictive, in line with the debate over secular rules versus discretion. The objective of this paper is consequently to assess empirically how monetary policy, fiscal policy and exchange rate frameworks affect the cost of systemic banking crises. More precisely, we focus on how restrictive policy frameworks are, as this may have ambivalent effects.

It can be argued that a restrictive policy framework can yield important benefits. One is that stringent policy arrangements like fiscal rules or inflation targeting should enforce greater accountability and may discipline policymakers.³ This should increase economic and banking sector stability, as fiscal rules may for example push the sovereign premium down (Lara and Wolff, 2014) and reduce the risk of twin sovereign debt and banking crises. By strengthening the time consistency of policies, a second benefit of restrictive policy frameworks is that they should improve the credibility of policymakers. An extensive body of literature since Kydland and Prescott (1977) has indicated how very important credibility is for policy efficiency and success. While independent and discretionary decisions are socially suboptimal because of time inconsistency and political distortions, a restrictive policy framework may strengthen policy stability and thus economic stability (Sargent, 1982). As such, financial disequilibrium and vulnerabilities that lead to financial and banking crises should be less likely. A third point is that a stringent fiscal framework gives financial room or “policy space”, which a policymaker can be expected to use for a bail out in the event of a banking crisis (Romer and Romer, 2017).

It can equally be said though that restrictive frameworks may have some drawbacks, as highlighted by the traditional literature on rules versus discretion. Most notably, they lack the flexibility to respond to unforeseeable and unquantifiable shocks (Athey et al., 2005), and more generally, rules cannot foresee every contingency and are inadequate if the economy has an unstable structure (Mishkin, 2017a). As instability is a key feature of banking crisis episodes, tying the hands of policymakers may make such crises more costly. Next, as indicated by recent experience, restrictive policy frameworks alone are not sufficient to prevent financial

3. There is a vast literature dedicated to the discipline-enhancing effect of fiscal policy rules. See the recent meta-analysis by Heinemann et al. (2018).

and banking crises, and they may in fact be counterproductive. Berger and Kießmer (2013) demonstrate that the more independent central bankers are, the more likely they are to refrain from tightening monetary policy pre-emptively to maintain financial stability. Levieuge et al. (2019) find that the higher the degree of central bank conservatism, the greater the banking sector vulnerabilities. Similarly, while a fixed exchange rate regime *a priori* imposes market discipline, it can also create moral hazard, and by impeding the position of the central bank as the lender of last resort, an excessive focus on parity can ultimately prevent the economy stabilising after a banking crisis.⁴ Finally, some stringent arrangements like fiscal rules can induce procyclicality⁵, which can worsen the negative impact of a banking crisis.

Against this background, we investigate empirically whether or not the discipline-enhancing effects of restrictive policy frameworks exceed the drawbacks of their lack of flexibility and their potential counter-productive effects. The issue of restrictiveness versus flexibility in policy arrangements has earlier been neglected in assessments of the cost of a banking crisis, and so this focus is the first original aspect of our contribution.

The second original contribution of this paper is the focus on the *unconditional* cost of banking crises. The existing literature concentrates on the cost of banking crises *conditional* on a banking crisis actually happening, but this produces selection bias. This leads to the factors that may explain why a crisis does or does not occur being neglected, meaning the vulnerabilities that can lead to a banking crisis are ignored. The policy frameworks can have an impact on these financial vulnerabilities, and from this point of view, the absence of a banking crisis is an important piece of information because a given policy framework can be responsible for either a crisis or a non-crisis. In this sense we propose to gauge the global effect of any policy framework on the unconditional output losses related to banking crises⁶ in a similar way to a cost-benefit analysis for a sample of 146 countries, over the period 1970-2013.

4. See Eichengreen and Hausmann (1999); Domaç and Martinez Peria (2003).

5. See Schaechter et al. (2012, Tab. 1) and Bova et al. (2014).

6. Another strand of the literature aims at explaining the probability of banking crises. Considering only the occurrence of banking crises would also give insufficient information for normative prescriptions. Firstly because a given policy arrangement could have opposite effects on the probability of a crisis occurring and on the conditional losses from it, and secondly because, by definition, such an approach does not address the severity of a crisis. See, e.g., Bussière and Fratzscher (2008). Figure 1.3 in the Appendix shows that the annual output losses associated with banking crises are widely dispersed. Interestingly, approximately 35% of reported banking crises imply negligible losses. Half of the banking crises identified have an annual loss that is lower than 6.50% of the real GDP trend.

Our results reveal that the policy framework as a whole matters for explaining the real costs related to banking crises. More precisely, we find a trade-off between stringency and flexibility, as extremely restrictive policy features such as corner exchange rate regimes, budget balance rules without “friendly” clauses, and a high degree of both monetary policy conservatism and independence tend to make the real costs of crises higher. In contrast, by combining discipline and flexibility, fiscal rules with easing clauses, intermediate exchange rate regimes and an inflation targeting framework can significantly contain the costs of banking crises. As such, we provide evidence of the benefits of policy frameworks that are based on “constrained discretion” to contain the real costs of banking crises.

The remainder of this paper is organised as follows. Section 1.2 reviews the literature on the main determinants of the costs related to banking crises. Section 1.3 presents the data, methodology and baseline estimates obtained with a set of traditional control variables. Then, the effects of fiscal policy rules, exchange rate regimes, and monetary policy arrangements are addressed in Sections 1.4, 1.5 and 1.6, respectively, while Section 1.7 is devoted to robustness checks and Section 1.8 concludes.

1.2 Related literature

Given the serious economic and social damage that banking crises can generate, there is already a lot of academic literature on the causes and consequences of banking crises (see, e.g., Laeven, 2011). We focus, in this section, on studies on the economic determinants of the costs of banking crises, which are important to consider as control variables.

Several papers note that one factor that may drive the real cost of banking crises is the role of excessive leverage and credit growth, particularly when the credit growth feeds bubbles in asset and real estate prices (Berkmen et al., 2012; Frankel and Saravelos, 2012; Feldkircher, 2014). Moreover, as Sachs et al. (1996) argue, rapid credit growth before a crisis is likely to be associated with a decline in lending standards, amplifying the vulnerability of the banking sector and the risk of a credit crunch when the crisis occurs.

Empirical evidence also suggests that the severity of banking crises depends largely on the initial level of financial development and on the size of the banking sector, especially in developing and emerging countries (Kroszner et al., 2007; Furceri and Mourougane, 2012). The level of financial development partly determines the size of banking and financial shocks as economies with deeper financial systems are more severely affected during times of crisis.

Some other papers highlight the role of banking regulation and supervision (see, e.g., Giannone et al., 2011), and Angkinand (2009) finds that bank capital regulation and deposit insurance coverage are negatively related to the real cost of banking crises.

More generally, output losses after a banking crisis are related to such structural features of the economy as trade openness, export diversification, the current account balance, or the quality of domestic institutions. Economies with greater trade openness for example may rely on exports to compensate for lower domestic demand in the aftermath of a banking crisis (Gupta et al., 2007).

Recent work also investigates concerns about the role of domestic macroeconomic policies. Furceri and Mourougane (2012) find that stimulating aggregate demand through a countercyclical fiscal policy and expansionary monetary policy helps to reduce the real cost of banking crises.

Nonetheless, despite the extensive literature on banking crises, relatively little is known about how the policy framework affects the real cost of banking crises. Empirical investigation of the resilience of the inflation targeting framework to large shocks like the recent financial crisis does not provide any clear-cut conclusion (see, e.g., De Carvalho Filho, 2011; Petreski, 2014). The effect of the exchange rate regime is also discussed, and according to what is called the bipolar view, corner regimes of pegging and pure floating should provide better performance. However, this point of view has been challenged. Tsangarides (2012) finds that growth performance for pegs was not statistically different from that of floats during the global financial crisis. On the contrary, according to Berkmen et al. (2012) and Furceri and Mourougane (2012), countries with a flexible exchange rate regime recover more rapidly after a crisis. Finally, Berkmen et al. (2012) find little evidence for the importance of other policy variables.

This all suggests that additional research is needed to investigate empirically how far policy frameworks affect the resilience of economies to a banking crisis.

1.3 Measures, methodology and data

This section is dedicated to the data and methodology that we use in this paper. We also present some preliminary results that are obtained with a set of usual control variables.

1.3.1 Measuring the real cost of banking crises

As mentioned earlier, our dependent variable measures the unconditional cost of banking crises, which is defined as :

$$y_{i,t}^k = \begin{cases} \tilde{y}_{i,t}^k & \text{when a banking crisis occurs} \\ 0 & \text{otherwise} \end{cases} \quad (1.1)$$

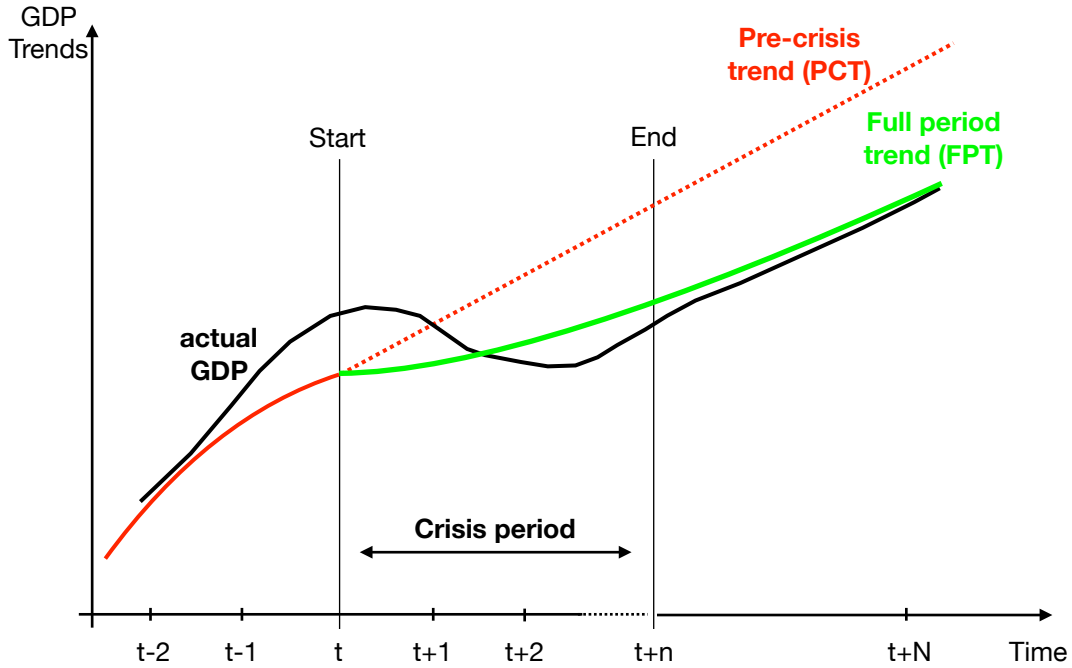
The unconditional cost is equal to $\tilde{y}_{i,t}^k$ in case of a banking crisis at time t in country i , while it is equal to 0 otherwise. In other words, $\tilde{y}_{i,t}^k \in \mathbb{R}^+$ represents the costs conditional on a banking crisis. As is usual in the literature, these conditional costs are measured in terms of output losses. $k = \{5year, all, trend, cycle\}$ corresponds to the four alternative measures that we consider. In line with the usual potential output approach, three of them are based on the loss in GDP with respect to its trend.⁷ Additionally, we provide a measure which is the loss in the trend itself.

Figure 1.1 illustrates these different ways of computing $\tilde{y}_{i,t}^k$. The two thin vertical lines indicate the start and end dates of the banking crisis. To get these, we use the information about the timing of systemic banking crises provided by Laeven and Valencia (2018). The black curve represents actual real GDP. The red dotted line shows the pre-crisis GDP trend, noted as $PCT_{i,t}$, extrapolated regardless of any possible change in the GDP trend caused by

7. See, e.g., Abiad et al. (2009); Angkinand (2009); Feldkircher (2014).

the banking crisis. The green line is the GDP trend, noted as $FPT_{i,t}$, computed over the full period and taking the possible change in the GDP trend into account.

FIGURE 1.1 – Illustration of output and trend losses



In line with Wilms et al. (2018), our first measure, noted $\tilde{y}_{i,t}^{5year}$ (“*loss_5years*” in the tables of results), is computed as the gap between actual GDP and the extrapolated Hodrick-Prescott (HP) pre-crisis trend. The extrapolation is based on the average growth rate of the HP trend over the five years preceding the beginning of the banking crisis. The loss is expressed as a percentage of the pre-crisis GDP trend, so that :

$$\tilde{y}_{i,t}^{5year} = \frac{PCT_{i,t} - GDP_{i,t}}{PCT_{i,t}} \quad (1.2)$$

In Figure 1.1, this measure refers to the difference between the dotted red line, which is the linear extrapolated pre-crisis trend, and the black curve of actual GDP over the crisis period. Such an extrapolated trend may be overstated if there was a boom in activity just before the crisis, so an alternative extrapolation following Laeven and Valencia (2018) is based on the average growth rate of the GDP trend over a longer pre-crisis period running from the first observation to the year before the crisis starts. This second measure of output loss is noted $\tilde{y}_{i,t}^{all}$ (“*loss_all*” in the tables of results).

As banking crises can have hysteresis effects (Furceri and Mourougane, 2012; Cerra and Saxena, 2017), losses in terms of potential GDP can provide another way of gauging their real costs. For this, losses in the GDP trend, which means the difference between the pre-crisis and post-crisis trends, are computed as a proxy for losses in potential GDP.⁸ In Figure 1.1, the corresponding measure refers to the gap between the dotted red line and the green line, over the crisis period. It is labelled $\tilde{y}_{i,t}^{trend}$ (“*trend_loss*”) and is defined as :

$$\tilde{y}_{i,t}^{trend} = \frac{PCT_{i,t} - FPT_{i,t}}{PCT_{i,t}} \quad (1.3)$$

where $FPT_{i,t}$ corresponds to the HP filter trend computed over the full sample, so including the period of the banking crisis.

Finally, if a significant loss is found for a given country i in time t , it is of interest to determine whether this loss is due to a change in the GDP trend, as measured by $\tilde{y}_{i,t}^{trend}$, or due to a temporary deviation of GDP from this trend, which may now be lower and decreasing. In Figure 1.1, this “cycle loss” corresponds to the difference between the green line for the current trend and the black curve of actual GDP. This fourth measure of output loss is noted $\tilde{y}_{i,t}^{cycle}$ (“*cycle_loss*”) and is computed as :

$$\tilde{y}_{i,t}^{cycle} = \frac{FPT_{i,t} - GDP_{i,t}}{FPT_{i,t}} \quad (1.4)$$

Figure 1.4 in the Appendix provides an illustration of the real output losses related to the 2007-2011 U.S. banking crisis. However, it is important to note that there is no unquestioned method for measuring the output losses associated with a banking crisis, and the common potential output approach has been criticised by Devereux and Dwyer (2016) for instance. They argue that the real costs supposedly due to a banking crisis may sometimes be misidentified, in particular when a decline in GDP incidentally occurs before the crisis. Our measures *trend_loss* and *cycle_loss* are less subject to this potential caveat. In contrast, the main alternative approach, which consists of considering the changes in real GDP from peak to trough around a banking crisis, may also yield output losses for economies where there is no contraction in real

8. The data that are required to compute potential output are not available for all the countries in the sample.

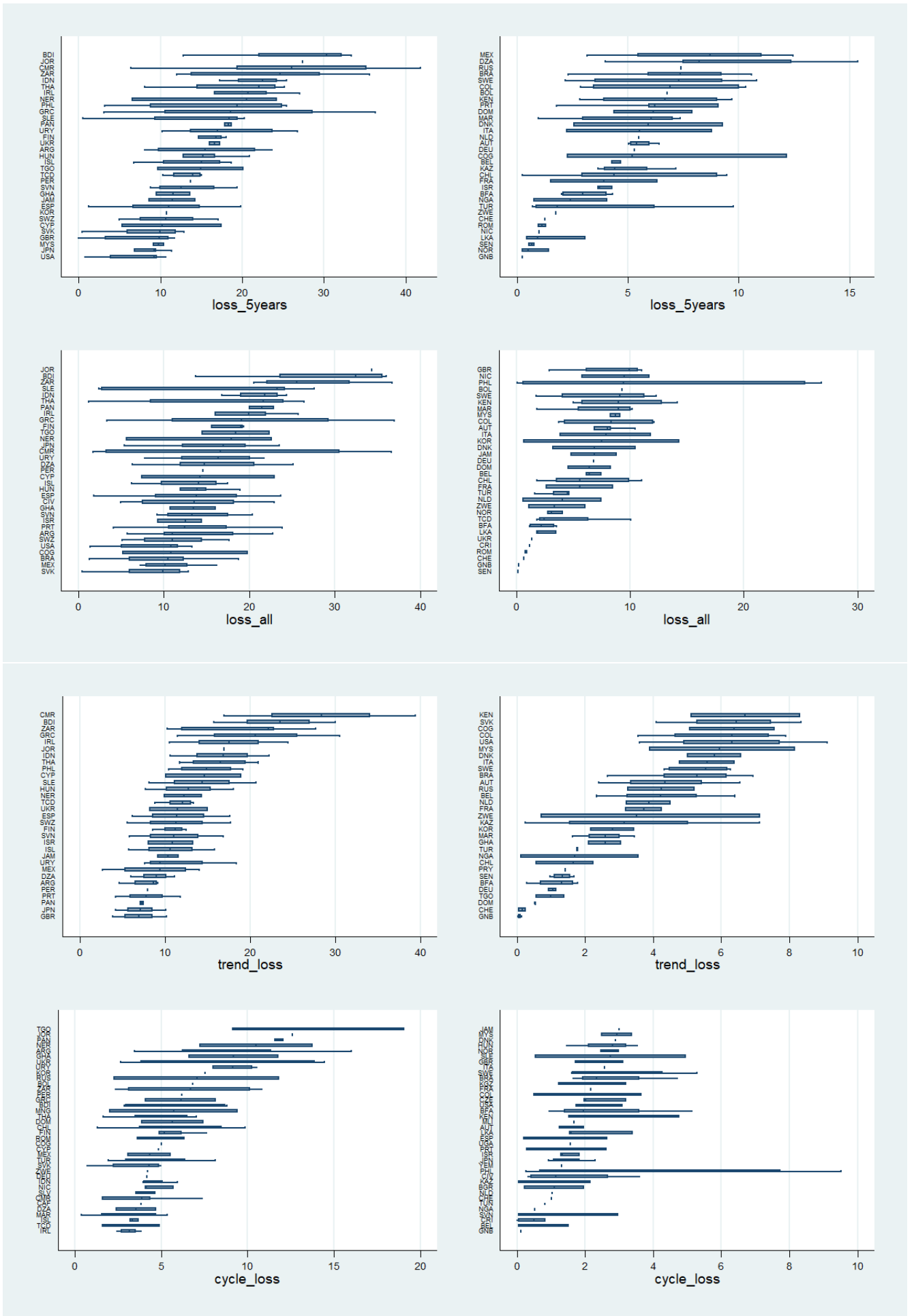
GDP after a banking crisis.

We compute these four alternative measures of real output losses for an unbalanced panel of emerging and industrialised economies. Our sample contains 146 countries over the period 1970-2013. Among these countries, 84 experienced at least one banking crisis during the period considered. The crisis starting dates and the number of yearly crisis observations for each country are detailed in Table 1.9 in the Appendix. However, as mentioned above, a banking crisis is not necessarily costly when viewed over the entire period of the crisis.⁹ The box plots in Figure 1.2 represent a cross-country comparison of the annual positive costs associated with banking crises for each of our measures. As can be seen, the annual costs are relatively heterogenous both across and within countries.

The next section provides details on the econometric approach used to estimate the influence of policy frameworks on our alternative variables measuring the real cost of banking crises.

9. Following Laeven and Valencia (2018), negative losses are censored to zero. They represent around 25% of the yearly crisis observations.

FIGURE 1.2 – Real output costs associated with banking crises



1.3.2 Econometric approach

To gauge the impact of policy framework features on the unconditional cost of banking crises, we have to deal with the nature of our alternative dependent variables. By construction, these take only positive or null values. When the values of the dependent variable of a linear regression model are bounded or censored, the Ordinary Least Squares (OLS) estimator is biased. In our case there are two main options for dealing with this issue. We can use a Tobit approach or a Poisson regression model. The Tobit-type estimator has been used by some papers for analysing the depth of banking crises (see, e.g., Bordo et al., 2001, Angkinand, 2009). However, our four dependent variables have a right-skewed distribution with a mass-point at zero. Zeros occur because some countries did not experience a banking crisis in a given year or because some crises did not trigger significant real losses. The Tobit approach may generate inconsistent and biased estimates because of this large number of zeros.

One solution proposed in the empirical international trade literature for dealing with missing bilateral trade flows is to use a Poisson model (Santos Silva and Tenreyro, 2006). As shown by Santos Silva and Tenreyro (2011), the Poisson Pseudo-Maximum Likelihood (PPML) estimator requires minimal distribution assumptions and is well behaved, even when the proportion of zeros in the sample is very large. It is clear then that the use of the PPML estimator is appropriate in our case.

Formally, the equation that we estimate is :

$$y_{i,t}^k = \alpha_i \exp \left(\beta_0 + \sum_{s=1}^{10} \beta_s X_{s,i,t-1} + \gamma PF_{i,t-1} + \delta_t + \epsilon_{i,t} \right) \quad (1.5)$$

where $y_{i,t}^k$ is one of our measures of real losses associated with banking crises, as defined by Eq. (1.1). $X_{s,i,t-1}$ is the vector of ten control variables, while $PF_{i,t-1}$ refers to the covariates of the policy framework, which are included one by one to capture the individual effect of each of them. δ_t corresponds to the time fixed effects and is introduced to control for time-varying common shocks like the recent global financial crisis. $\epsilon_{i,t}$ is the error term and α_i represents the individual random effects. It is particularly important to include such individual effects

as this deals with unobserved cross-country heterogeneity. As a large number of countries in our sample did not experience a banking crisis episode over the period considered, the use of random effects is considered as an alternative to fixed effects. Indeed, using fixed effects would have dropped all these countries from the sample, and this would then have led to selection bias. Finally, the covariates are lagged by one period to deal with a potential endogeneity issue, primarily because the policy framework may evolve in response to a banking crisis.¹⁰

1.3.3 Preliminary results with control variables

The literature proposes several factors that seem to explain significantly the severity of banking crises. These factors have to be considered as control variables. We retain a set of ten control variables, which can be divided into five groups, and they are described below. More details on the definition and the source for all the data used in the paper are provided in the Appendix. Descriptive statistics are provided in Table 1.10.

Macroeconomic and financial characteristics. We consider three variables covering macroeconomic and financial characteristics. First, the logarithm of real GDP per capita captures the level of economic development. Moreover, it is expected to deal with the heterogeneity of the countries in the sample. Second, we consider the inflation rate, which is expected to affect the banking crises losses positively.¹¹ Indeed, a high pre-crisis inflation rate could reflect poor macroeconomic policies (Bordo et al., 2002; Angkinand, 2009) and give rise to the imbalances that encourage a banking crisis (Demirgüç-Kunt and Detragiache, 1998; Klomp, 2010). Third, we control for the potential effects of the size of the banking sector. Similarly to Abiad et al. (2011), we consider the credit-to-GDP ratio as a proxy for the level of development of the banking sector. This variable is expected to have a positive impact on the real cost of banking crises. These three variables are taken from the World Development Indicators (WDI) database.

10. However, please note that in our sample, policy framework changes during a banking crisis episode are rather rare. For instance, the adoption or abandonment of a corner exchange rate regime only occurs in 14% of yearly crisis observations, while the adoption or abandonment of a budget balance rule during a banking crisis occurs in less than 1% of yearly crisis observations. This is in line with Hallerberg and Scartascini (2015), who find that Latin American countries are less likely to implement fiscal reforms during a banking crisis, but more likely to do so during a fiscal crisis.

11. More precisely, we normalise the inflation rate as $\pi/(1 + \pi)$, where π is the annual percentage change in the consumer price index, to take account of the influence of outliers caused by high inflation episodes.

Real and financial vulnerabilities. We consider the credit-to-GDP gap as a key measure of financial vulnerability. It is widely recognised that excess credit growth can cause distress for the banking sector (Schularick and Taylor, 2012; Aikman et al., 2015). The more excess credit there is, the greater the share of non-performing loans is in a crisis, and thus the higher the inherent real cost is. We also address macroeconomic vulnerability by considering the level of public debt as a percentage of GDP, taken from the database of Abbas et al. (2010). In essence, countries with more pre-crisis debt are supposed to have less fiscal space during a crisis (Romer and Romer, 2017). In addition, some empirical studies indicate that the larger the public debt, the steeper the downturns are in a crisis, and the more severe is the risk of a sovereign-banking loop being formed (Acharya et al., 2014).

Trade and financial openness. The trade and financial openness of an economy can generate cross-border spillover effects. However, the expected impact of trade openness on the cost of banking crises is uncertain. It can be that economies with a higher degree of trade openness are more vulnerable to global trade shocks (Claessens et al., 2010), but equally a higher degree of trade openness can help sustain output during a crisis, since more internationally integrated economies have the ability to export goods when domestic demand falters (Gupta et al., 2007). The impact of the degree of financial openness is also uncertain. This is partly because it depends on the nature of capital flows, as shown by Joyce (2011). An increase in foreign debt liabilities contributes to an increase in the incidence of crises, but foreign direct investment and portfolio equity liabilities have the opposite effect. Moreover, as argued by Abiad et al. (2009), more financial openness can reduce the risk of a sudden stop in capital flows, which may cushion the severity and the real output cost of banking crises. Furthermore, financial market integration makes consumption smoothing and risk sharing opportunities easier. As a result, banking crises are expected to have a smaller effect on consumption when an economy is relatively open financially. However, as shown by Giannone et al. (2011), globally integrated financial systems may be more prone to international financial shocks.

As is usual in the literature, we measure the degree of trade openness by the trade-to-GDP ratio. This ratio corresponds to the sum of exports and imports of goods and services measured as a share of GDP. This variable is taken from the WDI database. The degree of financial

openness is measured using the KAOPEN index developed by Chinn and Ito (2006), which is a *de jure* measure of financial openness that considers the degree of restrictions on cross-border financial transactions and is normalised between 0 and 1. The higher the value of the index is, the more open the country is to cross-border capital transactions.

Twin crises. Many crises, including the Tequila and Asian crises, have seen the coincidence of banking and currency crises, and become what are called “twin crises”. As the large empirical literature shows (see, e.g., Hutchison and Noy, 2005), twin crises tend to be more severe and more costly than individual banking or currency crises. Thus we control for this effect by including a dummy variable which takes the value of 1 when a domestic currency crisis occurred in time t , and 0 otherwise. Following Reinhart and Rogoff (2009), we consider that a currency crisis occurred when the annual nominal depreciation of the national currency against the U.S. dollar exceeds 15%. Data on nominal exchange rates are taken from the International Financial Statistics (IFS) database.

Policy responses. The last set of control variables concerns the fiscal and monetary responses that are intended to sustain economic recovery in the aftermath of a crisis. Because of automatic stabilisers, public spending is endogenous to losses, and so they do not rigorously indicate a deliberate response by fiscal authorities. Discretionary government spending should be considered instead (Gupta et al., 2009; Furceri and Zdzienicka, 2012), and to this end, we use the indicator for discretionary fiscal policy suggested by Ambrosius (2017). It is obtained as the residuals of the regression of the change in fiscal expenditure relative to GDP on both contemporaneous and one-year lagged GDP growth.¹² Next, we control for the cleaning up afterwards performed by monetary policy. In light of the recent crisis, it would be insufficient to consider only the level of the interest rate. Instead, we use the level of central bank assets. Note that these policy variables are lagged one period to address the transmission delay of policy measures and the potential simultaneity bias.

Table 1.1 presents the results that we obtain when we regress our four alternative measures of losses from banking crises on the set of ten control variables. All the control variables except

12. Similarly to Ambrosius (2017), we also include the annual inflation rate and oil prices as control variables.

the currency crisis dummy are lagged one period. Our sample contains 4043 observations, including 330 yearly crisis observations (see Table 1.9 in the Appendix for more details). The results obtained confirm that GDP per capita and inflation positively affect the real cost of banking crises. The credit-to-GDP ratio also has a positive impact, which may come from the larger size of the banking and financial system. As expected, we find that the credit-to-GDP gap and the public debt ratio significantly increase the losses associated with banking crises, while the opposite effect is found for trade and financial openness. The results also confirm that a simultaneous currency crisis significantly increases the losses from a banking crisis. Finally, we find that fiscal and monetary responses significantly contain the real cost of banking crises.

These preliminary results are as expected according to the existing empirical literature. In the next section, we go a step further by investigating the impact of different fiscal, exchange rate and monetary policy features on the unconditional costs of banking crises.

1.4 The impact of fiscal rules

We first focus on fiscal policy rules as a restrictive policy framework. According to a vast literature, fiscal policy rules are restrictions that enhance discipline.¹³ This may reduce the risk of a sovereign debt crisis and the risk of twin sovereign-banking crises. Moreover, rules are a way for policymakers to forge their credibility, which is important for the efficiency and success of economic policies. However, all these advantages may be offset by a lack of flexibility and by possible procyclicality in the event of a crisis, even if rules can offer policy space for a response to shocks (Klomp, 2010; Romer and Romer, 2017). Tying the hands of policymakers may make the crisis more costly. To test the global impact of fiscal rules on the cost of banking crises, we use the database provided by Schaechter et al. (2012).¹⁴ We focus specifically on budget balance rules, for three main reasons. First, budget balance rules have gained growing support and are now the most popular type of fiscal rule around the world. Second, budget balance rules are usually expressed as a share of GDP, unlike expenditure and revenue rules, and according

13. See, e.g., Agnello et al. (2013); Bergman et al. (2016); Burret and Feld (2018) for the most recent contributions. Interestingly, Eyraud et al. (2018) show that fiscal rules can reduce the deficit bias even when they are not complied with.

14. Details and updates are provided by Budina et al. (2012); Bova et al. (2015); Lledó et al. (2017).

TABLE 1.1 – Determinants of the real cost of banking crises : Preliminary results with control variables

| | loss_5years | loss_all | trend_loss | cycle_loss |
|---------------------------|----------------------|----------------------|----------------------|----------------------|
| GDP per capita | 1.837*** (0.206) | 0.875*** (0.143) | 2.757*** (0.238) | -0.169 (0.144) |
| Inflation | 1.629*** (0.226) | 1.196*** (0.186) | 2.173*** (0.269) | 1.011*** (0.295) |
| Bank credit / GDP | 0.033*** (0.001) | 0.031*** (0.001) | 0.030*** (0.001) | 0.031*** (0.002) |
| Credit-to-GDP gap | 0.913*** (0.134) | 0.823*** (0.118) | 0.800*** (0.130) | 0.792*** (0.261) |
| Public debt / GDP | 0.023*** (0.001) | 0.017*** (0.001) | 0.024*** (0.001) | 0.015*** (0.001) |
| Financial openness | -0.814*** (0.153) | -0.840*** (0.136) | -0.793*** (0.165) | -0.186 (0.226) |
| Trade openness | -0.011*** (0.002) | -0.008*** (0.002) | -0.010*** (0.002) | -0.016*** (0.003) |
| Currency crisis | 0.396*** (0.060) | 0.326*** (0.056) | 0.292*** (0.064) | 0.871*** (0.102) |
| Discret. gov. consumption | -1.240*** (0.173) | -1.396*** (0.163) | -0.581*** (0.186) | -2.239*** (0.306) |
| CB assets | -0.030*** (0.004) | -0.009*** (0.003) | -0.037*** (0.005) | 0.000 (0.004) |
| Constant | -6.380*** (0.537) | -4.112*** (0.453) | -8.215*** (0.588) | -1.748*** (0.651) |
| Observations | 4,043 | 4,043 | 4,043 | 4,043 |
| Number of countries | 146 | 146 | 146 | 146 |
| Crisis obs. | 330 | 330 | 330 | 330 |
| Year FE | YES | YES | YES | YES |

Note : Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

to Schaechter et al. (2012), this makes them easier to monitor. As a result, budget balance rules are an effective constraint for the conduct of fiscal policy. Third, they have been shown by the empirical literature to be associated with a greater probability of debt being stabilised, and they imply a strong political commitment to fiscal discipline and long-term fiscal sustainability (see, e.g., Molnár, 2012). We consider the impact of budget balance rules through a dummy variable that is equal to 1 when the national or supranational legislation includes such a rule, and 0 otherwise.

The corresponding results are reported in the left-hand side of Table 1.2. As we already discussed the results for the control variables in the previous section, now we focus on the coefficients associated with the dummy for the budget balance rule. It can be seen that having a budget balance rule tends to reduce the real cost of banking crises, which suggests that the discipline and enhanced credibility it brings overcome its potential adverse effects. However, the design of rules may also matter. Indeed in some countries, the budget balance rule is combined with a “cycle-friendly” clause, which usually allows the deficit ceiling to be changed to suit the position of the economy in the business cycle. It could be expected that the existence of such a clause is more effective in dampening fiscal procyclicality.

To test the impact of such a flexibility clause, we consider the existence of a budget balance rule with this clause as a reference. To this end, we define two dummy variables. The first dummy variable takes the value of 1 when no budget balance rule is implemented and 0 otherwise. The second dummy variable takes the value of 1 when the rule is set without a clause and 0 otherwise. The two dummies are included together in the regressions. Then they must be interpreted with reference to a case where there is a rule with the friendly clause.

TABLE 1.2 – The impact of a budget balance rule on the real cost of banking crises

| | Budget balance rule | | | Budget balance rule with a flexibility clause | | |
|---------------------------------------|-----------------------------|-----------------------------|-----------------------------|---|----------------------------|----------------------------|
| | loss_5years | trend_all | cycle_loss | loss_5years | trend_all | cycle_loss |
| Budget balance rule | -0.458*** (0.132) | -0.530*** (0.122) | -0.808*** (0.154) | 1.602*** (0.216) | 1.927*** (0.259) | 1.702*** (0.517) |
| No budg. bal. rule | | | | 1.294*** (0.193) | 1.263*** (0.223) | 1.614*** (0.506) |
| Budg. bal. rule without clause | | | | 3.110*** (0.342) | 4.185*** (0.406) | -0.153 (0.191) |
| GDP per capita | 3.067*** (0.346) | 2.479*** (0.296) | 4.136*** (0.408) | 0.293 (0.406) | 1.365*** (0.367) | 0.367 (0.388) |
| Inflation | 0.133 (0.292) | -0.013 (0.255) | 1.257*** (0.369) | 0.164 (0.292) | 0.037*** (0.368) | 0.037*** (0.388) |
| Bank credit / GDP | 0.037*** (0.002) | 0.036*** (0.001) | 0.035*** (0.002) | 0.037*** (0.002) | 0.037*** (0.002) | 0.037*** (0.003) |
| Credit-to-GDP gap | 0.942*** (0.135) | 0.867*** (0.120) | 0.772*** (0.131) | 0.912*** (0.135) | 0.836*** (0.120) | 0.784*** (0.266) |
| Public debt / GDP | 0.022*** (0.002) | 0.023*** (0.002) | 0.023*** (0.002) | 0.021*** (0.002) | 0.022*** (0.002) | 0.019*** (0.002) |
| Financial openness | -0.340 (0.229) | -0.976*** (0.213) | -0.127 (0.250) | -0.312 (0.229) | -0.985*** (0.214) | -0.175 (0.355) |
| Trade openness | 0.008*** (0.003) | 0.007*** (0.002) | 0.013*** (0.003) | 0.008*** (0.003) | 0.007*** (0.002) | -0.007* (0.004) |
| Currency crisis | 0.510*** (0.094) | 0.347*** (0.089) | 0.197* (0.103) | 0.489*** (0.094) | 0.327*** (0.089) | 1.164*** (0.151) |
| Discret. gov. consumption | -1.050*** (0.236) | -1.388*** (0.230) | -0.522* (0.275) | -1.057*** (0.236) | -1.409*** (0.231) | -2.170*** (0.394) |
| CB assets | 0.019** (0.008) | 0.004 (0.008) | 0.005 (0.009) | 0.025*** (0.008) | 0.011 (0.009) | 0.038*** (0.013) |
| Constant | -9.653*** (0.909) | -8.310*** (0.797) | -12.242*** (1.060) | -11.285*** (0.931) | -10.090*** (0.818) | -4.163*** (1.056) |
| Observations | 1,713 | 1,713 | 1,713 | 1,713 | 1,713 | 1,713 |
| Number of countries | 77 | 77 | 77 | 77 | 77 | 77 |
| Crisis obs. | 208 | 208 | 208 | 208 | 208 | 208 |
| Year FE | YES | YES | YES | YES | YES | YES |

Note : Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

The results are reported in the right-hand side of Table 1.2. We can see that both dummies are positively and significantly linked to the real cost of banking crises. This means that having budget balance rules with flexibility clauses is the best way to contain the cost of a banking crisis. More precisely, Table 1.12 in the Appendix reports that the expected cost of crises is around five times higher in countries with no budget balance rule, and more than three times higher in countries with a budget balance rule without a flexibility clause. In other words, the most suitable approach in terms of the costs of banking crises is a budget balance rule with a flexibility clause, which is an intermediate solution between a strict rule and the absence of a rule.

1.5 The impact of exchange rate regimes

The bipolar view posits that fixed and pure floating exchange rate regimes are opportune restrictive frameworks that make policymakers more responsible. By tying the hands of policymakers, pegged regimes imply more discipline and, as a rule, more credibility (Canzoneri et al., 2001; Ghosh et al., 2010; Davis et al., 2018). In emerging countries, fixed exchange rates also protect local markets from imported inflation and financial instability (see, e.g., Calvo and Reinhart, 2002). Similarly, a pure floating exchange rate regime enhances discipline because any bad political behaviour leads to immediate punishment through movements in the exchange rate (Tornell and Velasco, 2000). It follows from all this that intermediate exchange rate regimes are believed to be more prone to banking and financial crises (Eichengreen et al., 1994; Bubula and Ötker-Robe, 2003). However, this point of view has recently been challenged and Ambrosius (2017) for example reject any robust impact from the exchange rate regime on the speed of recovery after a banking crisis. Combes et al. (2016) find that intermediate exchange rate regimes are not more vulnerable to banking crises than corner regimes, whether fixed or floating.

With this debate on the bipolar view in mind, we test how the exchange rate regime affects the losses related to banking crises by defining a dummy variable, labelled “corner ERR”, which is equal to 1 if the exchange rate regime of country i at time t corresponds to a corner regime, and

0 otherwise. Information on the exchange rate regimes comes from the classification proposed by Ghosh et al. (2010), which uses entries running from 1 for the more fixed regimes to 14 for the more floating ones.

Following the recommendations of the authors, corner regimes correspond to the entries 1 to 5 for fixed exchange rate regimes and 14 for a pure floating regime, while modalities 6 to 13 represent intermediate exchange rate regimes. Then we include the corner ERR dummy in the regressions, with intermediate exchange rate regimes as an implicit reference. The results are reported in the left-hand side of Table 1.3. The corner ERR dummy appears significantly positive. Thus, in contrast to the bipolar view, we find that an intermediate exchange rate regime provides a better outcome in terms of the cost of banking crises. As shown in Table 1.12 in the Appendix, the expected cost of banking crises is around twice as high in countries operating under a corner exchange rate regime as in those operating under an intermediate exchange rate regime.

TABLE 1.3 – The impact of the exchange rate regime on the real cost of banking crises

| | Corner exchange rate regime dummy | | | Exchange rate regime (squared) | | |
|----------------------------|-----------------------------------|----------------------------|----------------------------|--------------------------------|-----------------------------|-----------------------------|
| | loss_5years | loss_all | trend_loss | loss_5years | loss_all | trend_loss |
| Corner ERR dummy | 0.745*** (0.073) | 0.952*** (0.068) | 0.896*** (0.085) | 0.377*** (0.108) | | |
| ER regime | | | | | | |
| ER regime (squared) | | | | | | |
| GDP per capita | 2.239*** (0.223) | 1.268*** (0.163) | 3.243*** (0.256) | -0.086 (0.148) | -1.089*** (0.052) | -1.052*** (0.065) |
| Inflation | 1.288*** (0.217) | 0.995*** (0.178) | 2.022*** (0.262) | 0.542* (0.292) | 0.054*** (0.003) | 0.031*** (0.005) |
| Bank credit / GDP | 0.032*** (0.001) | 0.030*** (0.001) | 0.029*** (0.001) | 0.031*** (0.002) | 1.105*** (0.147) | -0.018 (0.153) |
| Credit-to-GDP gap | 0.923*** (0.134) | 0.826*** (0.118) | 0.796*** (0.130) | 0.800*** (0.261) | 0.749*** (0.119) | 0.522* (0.268) |
| Public debt / GDP | 0.023*** (0.001) | 0.017*** (0.001) | 0.024*** (0.001) | 0.014*** (0.001) | 0.017*** (0.001) | 0.029*** (0.002) |
| Financial openness | -0.933*** (0.163) | -1.072*** (0.147) | -0.784*** (0.176) | -0.451* (0.234) | 0.747*** (0.153) | 0.792*** (0.261) |
| Trade openness | -0.014*** (0.002) | -0.011*** (0.002) | -0.014*** (0.002) | -0.016*** (0.003) | 0.022*** (0.002) | 0.013*** (0.003) |
| Currency crisis | 0.367*** (0.061) | 0.289*** (0.056) | 0.233*** (0.065) | 0.867*** (0.102) | 0.357*** (0.058) | 0.882*** (0.103) |
| Discret. gov. consumption | -1.313*** (0.176) | -1.410*** (0.165) | -0.710*** (0.189) | -2.134*** (0.303) | -1.292*** (0.164) | -1.984*** (0.304) |
| CB assets | -0.034*** (0.004) | -0.013*** (0.003) | -0.040*** (0.005) | -0.003 (0.004) | -0.017*** (0.003) | -0.003 (0.004) |
| Constant | -7.344*** (0.551) | -5.318*** (0.463) | -9.168*** (0.609) | -2.160*** (0.669) | -0.826 (0.510) | -0.106 (0.736) |
| Observations | 3,472 | 3,472 | 3,472 | 3,472 | 3,472 | 3,472 |
| Number of countries | 146 | 146 | 146 | 146 | 146 | 146 |
| Crisis obs. | 322 | 322 | 322 | 322 | 322 | 322 |
| Year FE | YES | YES | YES | YES | YES | YES |

Note : Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

To go a step further in investigating the non-linear relationship between exchange rate regimes and the costs of banking crises, we consider the granular classification of Ghosh et al. (2010) from 1 to 14 and test whether the exchange rate regimes have a significant quadratic influence. The results are reported in the right-hand side of Table 1.3 and they confirm the existence of a U-shaped relationship between the exchange rate regime and the cost of banking crises, with a turning point between 8 and 9, which indicates exactly an intermediate exchange rate regime.

So in contrast to the dominant view, our results indicate that an intermediate regime tends to lower the expected cost of banking crises. This finding is in line with Eichengreen and Hausmann (1999, p. 3), according to whom “*both fixed and flexible exchange rates are problematic*”. Fixed exchange rate regimes do not necessarily encourage discipline, as bad behaviour today leads to an insidious build-up of vulnerabilities that will make the peg collapse, but only in the medium or long run (Schuknecht, 1998; Tornell and Velasco, 2000). Even worse, pegged regimes may increase financial and banking vulnerabilities by providing an implicit guarantee against currency risk, thus creating moral hazard (see, e.g., Eichengreen and Hausmann, 1999). Burnside et al. (2001, 2004) show that fixed exchange rate regimes are more vulnerable to speculative attacks and more sensitive to banking and currency crises. According to Haile and Pozo (2006), announced pegged exchange rate regimes increase the risk of a currency crisis even if, in reality, the exchange rate system that is used is not pegged. Finally, a central bank that is defending its parity under a pegged regime may not be able to fulfil its role of lender of last resort, and so may not protect the economy from bank runs (Chang and Velasco, 2000). As a result, Domaç and Martinez Peria (2003) find that a fixed exchange rate regime implies a higher real cost once a crisis occurs. In the same vein, Lane and Milesi-Ferretti (2011) find that countries with pegged exchange regimes experienced weaker output growth during the recent global financial crisis. At the other end of the scale, where the exchange rate regime is pure floating, agents indebted in foreign currency are threatened by an increase in their real debt burden if the domestic currency collapses (Eichengreen and Hausmann, 1999).

In contrast, intermediate exchange rate regimes present many advantages. They are not less discipline-enhancing than fixed exchange rate regimes, because punishment for bad behaviour

would be quite immediate, like in a flexible regime. Moreover, countries under an intermediate exchange rate regime can use the exchange rate policy as a stabilising tool, and an intermediate exchange rate regime should imply less volatility than a pure floating regime does. This is why such an intermediate solution better contains the real costs of banking crises.

1.6 The impact of monetary policy features

We look at monetary policy arrangements by first addressing two features that are likely to affect the flexibility of monetary policy, these being independence and conservatism. Second, we focus on the inflation targeting framework, which is interesting in terms of restrictiveness as it is supposed to combine pre-commitment and flexibility.

1.6.1 Central bank independence and conservatism

The degree of central bank independence is a monetary policy feature that may impact the cost of banking crises. As it strengthens the responsibility of the policymakers and protects them from lobbying pressures, central bank independence should be discipline-enhancing, and by extension, it may imply fiscal discipline and be conducive to a sound macroeconomic environment (see, e.g., Bodea and Higashijima, 2017). Equally however, the “paradox of credibility view” suggests that central bank independence may encourage risk-taking by making monetary policy more effective (Borio and Zhu, 2012). Taking this even further, an independent central bank is less likely to clean up afterwards by supporting the recovery policies of the government after a crisis (Rosas, 2006) unless inflation is substantially affected. Independent central bankers may even refrain from leaning against the wind because this might lead to an undesirable undershooting of the inflation target (Berger and Kießmer, 2013).

To assess the global impact of central bank independence on the output costs of banking crises, we use the well-known CWN index initially developed by Cukierman et al. (1992) and recently updated by Garriga (2016).¹⁵ This *de jure* measure is based on analysis of the statutes

15. Note that empirical findings on the central bank independence-financial stability nexus are very rare

of central banks. It is constructed as a weighted average of four subcomponents, which are executive independence, monetary policy formulation, monetary policy objectives, and limitations on lending to the government. This last subcomponent, whose weighting represents a significant proportion of the index at 50%, is particularly interesting in our case, as it can partly capture whether a central bank can legally provide financial support for the recovery policies of the government or not.

The results are reported in the left-hand side of Table 1.4. We find a significant positive relationship between central bank independence and the cost of a banking crisis. The higher central bank independence is, the higher the unconditional losses are. If we consider “*loss_5years*” as the dependent variable for example, we can see in Table 1.12 in the Appendix that a 1% increase in the degree of central bank independence leads on average to an increase of 2% in the expected cost of banking crises.

While more factual than institutional, the degree of central bank conservatism is another important monetary policy feature, which is related to the degree of flexibility of the monetary policy. In essence, the degree of central bank conservatism shows the preference given by the monetary authorities to the objective of price stability relative to the objective of output stabilisation. Certainly a high degree of central bank conservatism implies more monetary discipline, which may strengthen macroeconomic stability. Nevertheless, some recent papers show that financial stability is likely to be neglected when monetary policy is primarily focused on price stabilisation.¹⁶ The induced worsening of financial imbalances may increase vulnerabilities and the loss of output in a crisis. Moreover, a conservative central banker may be reluctant to deviate from the top priority objective of inflation¹⁷, which may affect the pace of economic recovery in the aftermath of a banking crisis. At the other extreme, a dovish central banker is believed to respond more quickly to a crisis, so a high degree of central bank conservatism can render a banking crisis more costly because of a lack of leaning before the crisis and a lack of cleaning up afterwards.

and not conclusive. Klomp and De Haan (2009) empirically find a positive relationship between central bank independence and financial stability, whereas Klomp (2010) finds central bank independence has not significant effects on the probability of a banking crisis.

16. See Bernanke (2013); Mishkin (2017a); Leveuge et al. (2019).

17. Such a view is supported by Whelan (2013) for example. See Tillmann (2008) for a more general assessment of the welfare cost related to an overly conservative central banker.

To assess the global impact of central bank conservatism on the unconditional cost of banking crises, we use two alternative measures of central bank preferences. We first consider a *de jure* proxy for central bank conservatism, which is a subcomponent of the full CWN index of central bank independence previously mentioned. This subcomponent, called CWN_OBJ, captures the importance given to the pursuit of price stability relative to the other objectives in central bank statutes. CWN_OBJ lies between 0 and 1, with 1 corresponding to price stability as the sole or main objective of monetary policy. We also gauge the level of central bank conservatism through the CONS index suggested by Leveuge and Lucotte (2014). This *de facto* index is based on the Taylor curve, which precisely represents the trade-off between price and output volatility. It consists in measuring the relative importance assigned to the objective of inflation stabilisation through the empirical variances of inflation and output gap over a five-year rolling window. We use the shock-adjusted version of the CONS index, called CONS_W, which lies between 0 for no conservatism and 1 for the highest level of conservatism.

The results are reported in the second and third parts of Table 1.4. They indicate that the higher the central bank conservatism, the higher the cost of banking crises is. More precisely, as we can see in Table 1.12 in the Appendix, the marginal effect of a 1% increase in the degree of conservatism on the expected cost of banking crises lies between 0.31% and 2.10%.

These findings are coherent with how the costs of banking crises are computed, which is in terms of output losses. Indeed, priority given to inflation stabilisation at the expense of higher output instability, in the case of high central bank conservatism, or the low propensity of the monetary authorities to stimulate output, in the case of high central bank independence, are naturally conducive to higher output losses in times of banking crisis. At the opposite end of the scale, a dovish stance would help to contain the losses by allowing a stimulus to output in the short run. Nonetheless, these results do not mean that low levels of central bank independence or conservatism are globally desirable. Indeed, all our regressions so far show that inflation tends to increase the cost of banking crises. Furthermore, if high levels of central bank independence and conservatism are detrimental in terms of the cost of banking crises, the existing literature widely documents the harmful impact that weak central bank independence and conservatism have on macroeconomic stability as a whole.

TABLE 1.4 – The impact of central bank independence and conservatism on the real cost of banking crises

| | Central bank independence (CWN) | | | | Central bank conservatism (CWN_OBj) | | | | Central bank conservatism (CONS_W) | | | |
|---------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-------------------------------------|-----------------------------------|--------------------------------|-----------------------------------|------------------------------------|--------------------------------|--------------------------------|-----------------------------------|
| | loss_5years | loss_all | trend_loss | cycle_loss | loss_5years | loss_all | trend_loss | cycle_loss | loss_5years | loss_all | trend_loss | cycle_loss |
| Index of CBI/CBC | 1.835*** (0.237) | 1.939*** (0.213) | 0.766*** (0.263) | 0.946*** (0.358) | 1.302*** (0.174) | 1.083*** (0.154) | 0.233 (0.194) | 2.080*** (0.276) | 0.309*** (0.108) | 0.067 (0.099) | 0.181 (0.119) | 0.432*** (0.178) |
| GDP per capita | 1.442*** (0.221) | 0.724*** (0.144) | 2.832*** (0.265) | -0.178 (0.148) | 1.661*** (0.228) | 0.868*** (0.163) | 3.038*** (0.252) | -0.202 (0.136) | 0.876*** (0.175) | 0.350*** (0.122) | 1.238*** (0.227) | -0.281* (0.153) |
| Inflation | 1.166*** (0.235) | 0.736*** (0.192) | 1.252*** (0.292) | 0.897*** (0.304) | 1.369*** (0.243) | 0.873*** (0.197) | 1.224*** (0.297) | 1.552*** (0.320) | 2.731*** (0.254) | 2.048*** (0.204) | 3.234*** (0.297) | 1.418*** (0.319) |
| Bank credit / GDP | 0.035*** (0.001) | 0.033*** (0.001) | 0.031*** (0.001) | 0.033*** (0.002) | 0.037*** (0.001) | 0.035*** (0.001) | 0.032*** (0.001) | 0.035*** (0.002) | 0.028*** (0.001) | 0.026*** (0.001) | 0.026*** (0.001) | 0.027*** (0.002) |
| Credit-to-GDP gap | 0.941*** (0.134) | 0.865*** (0.119) | 0.844*** (0.130) | 0.789*** (0.261) | 0.961*** (0.134) | 0.885*** (0.119) | 0.849*** (0.130) | 0.804*** (0.261) | 0.791*** (0.135) | 0.750*** (0.119) | 0.689*** (0.131) | 0.677** (0.263) |
| Public debt / GDP | 0.020*** (0.001) | 0.016*** (0.001) | 0.021*** (0.001) | 0.015*** (0.001) | 0.020*** (0.001) | 0.016*** (0.001) | 0.022*** (0.001) | 0.015*** (0.001) | 0.022*** (0.001) | 0.017*** (0.001) | 0.021*** (0.001) | 0.014*** (0.001) |
| Financial openness | -0.921*** (0.162) | -1.136*** (0.145) | -0.830*** (0.181) | -0.271 (0.232) | -0.651*** (0.161) | -0.892*** (0.143) | -0.744*** (0.179) | -0.074 (0.234) | -0.717*** (0.166) | -0.754*** (0.147) | -0.653*** (0.181) | -0.347 (0.259) |
| Trade openness | -0.011*** (0.002) | -0.010*** (0.002) | -0.008*** (0.002) | -0.016*** (0.003) | -0.009*** (0.002) | -0.008*** (0.002) | -0.008*** (0.002) | -0.015*** (0.003) | -0.005*** (0.002) | -0.003 (0.002) | -0.003 (0.002) | -0.010*** (0.003) |
| Currency crisis | 0.512*** (0.067) | 0.447*** (0.063) | 0.345*** (0.073) | 0.922*** (0.109) | 0.500*** (0.067) | 0.418*** (0.063) | 0.335*** (0.072) | 0.940*** (0.107) | 0.579*** (0.067) | 0.517*** (0.062) | 0.490*** (0.071) | 0.948*** (0.120) |
| Discret. gov. consumption | -1.428*** (0.191) | -1.716*** (0.185) | -0.698*** (0.215) | -2.346*** (0.315) | -1.417*** (0.192) | -1.711*** (0.185) | -0.685*** (0.216) | -2.287*** (0.314) | -1.230*** (0.195) | -1.532*** (0.181) | -0.501** (0.207) | -2.843*** (0.381) |
| CB assets | -0.015*** (0.005) | 0.000 (0.003) | -0.014*** (0.005) | 0.001 (0.004) | -0.012*** (0.004) | 0.001 (0.003) | -0.012** (0.005) | -0.001 (0.004) | -0.023*** (0.004) | -0.006* (0.003) | -0.030*** (0.005) | 0.003 (0.004) |
| Constant | -6.722*** (0.535) | -4.906*** (0.453) | -8.408*** (0.593) | -2.379*** (0.713) | -6.500*** (0.519) | -4.593*** (0.437) | -8.246*** (0.595) | -3.381*** (0.663) | -5.093*** (0.599) | -3.052*** (0.525) | -6.127*** (0.638) | -1.492* (0.763) |
| Observations | 3,682 | 3,682 | 3,682 | 3,682 | 3,682 | 3,682 | 3,682 | 3,682 | 2,437 | 2,437 | 2,437 | 2,437 |
| Number of countries | 142 | 142 | 142 | 142 | 142 | 142 | 142 | 142 | 97 | 97 | 97 | 97 |
| Crisis obs. | 307 | 307 | 307 | 307 | 307 | 307 | 307 | 307 | 272 | 272 | 272 | 272 |
| Year FE | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |

Note : Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

1.6.2 Inflation targeting

By implying a precommitment to a certain level of inflation at a given horizon, inflation targeting constitutes a restrictive monetary policy framework for central bankers. In a seminal paper, Bernanke and Mishkin (1997) asserted that inflation targeting improves the transparency of monetary policy, the accountability of the central bank and, by extension, its credibility. Woodford (2012) theoretically demonstrates that an inflation targeting regime can achieve long-term price stability while ensuring activity and financial stabilisation in the short run.

However, the influence of inflation targeting on financial stability is discussed a great deal in the literature. Some studies indicate that this monetary policy framework can have adverse effects on asset prices (Frappa and Mésonnier, 2010; Lin, 2010), while others studies show that inflation targeting allows for leaning against financial vulnerabilities. Fazio et al. (2015) for example show that inflation targeting countries have relatively sounder and more capitalised banking systems. Some studies looking at the conditional costs indicate that inflation targeting countries are less affected than their peers in a financial crisis (Walsh, 2009; Andersen et al., 2015). One reason is that they have more room for manoeuvring in terms of interest rate cuts (De Carvalho Filho, 2011). Moreover, inflation expectations are likely to be better anchored under an inflation targeting regime. This implies that inflation targeting should reduce the risk of an economy falling into deflation and a liquidity trap. Nonetheless, in the aftermath of the global financial crisis, a number of economists called for a reconsideration of the desirability of inflation targeting.

In this section, we assess the global performance of inflation targeting in terms of the real costs of banking crises. To this end, we use a binary variable that takes the value of 1 once a country has fully adopted inflation targeting as a monetary policy regime and 0 otherwise.¹⁸ Our empirical results, reported in Table 1.5, show that this monetary policy framework tends to lower the real losses associated with banking crises. More precisely, as shown in Table 1.12 in the Appendix, pursuing an inflation targeting strategy halves the expected cost of banking crises.

18. Fully fledged adoption occurs when all the pre-conditions of an inflation targeting framework have been met. See Mishkin and Schmidt-Hebbel (2007).

These results are very interesting in the light of the trade-off between restrictiveness and flexibility which has already been put forward with the policy frameworks investigated in the previous sections. As a rule, inflation targeting should imply more discipline and responsibility. At the same time, inflation targeting is a flexible framework, in that the pre-commitment to the inflation target prevails for a medium-term horizon. Meanwhile, the central bank can respond to real shocks (Svensson, 1997), and also to financial shocks that influence credit conditions (Choi and Cook, 2018).

At this stage, it is important to remember the following arguments of Bernanke and Mishkin (1997) : “*Some useful policy strategies are ‘rule-like’, in that by their forward-looking nature they constrain central banks from systematically engaging in policies with undesirable long-run consequences ; but which also allow some discretion for dealing with unforeseen or unusual circumstances. These hybrid or intermediate approaches may be said to subject the central bank to ‘constrained discretion’.*” Specifically, they assert that inflation targeting must be viewed as a constrained discretion framework¹⁹, which implies discipline but allows for discretion in dealing with unusual circumstances, and this constitutes a desirable compromise for reaching macroeconomic stability.

As such, “constrained discretion” was put forward as an oxymoric concept without any formal evidence of its superiority. Since then, some empirical investigations have concluded that inflation targeting enhances macroeconomic performance. Improvements can be attributed to constrained discretion, but this is never tested *per se*. By focusing on the degree of restrictiveness of alternative policy frameworks in this paper, we can and do provide evidence that constrained discretion is suitable for containing the real costs of banking crises. Indeed inflation targeting is an intermediate solution between a very lax framework and a very restrictive one, like a budget balance rule with a flexibility clause and like intermediate exchange rate regimes. Hence, all the previous results can be viewed as benefits of constrained discretion.

19. See Kim (2011) for a theoretical demonstration.

TABLE 1.5 – The impact of inflation targeting on the real cost of banking crises

| | Inflation targeting | | | |
|----------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| | loss_5years | loss_all | trend_loss | cycle_loss |
| Inflation targeting | -0.858*** (0.143) | -0.845*** (0.131) | -0.931*** (0.152) | -0.628*** (0.243) |
| GDP per capita | 1.918*** (0.206) | 0.985*** (0.146) | 2.845*** (0.236) | -0.136 (0.143) |
| Inflation | 1.579*** (0.223) | 1.127*** (0.186) | 2.077*** (0.267) | 0.999*** (0.294) |
| Bank credit / GDP | 0.032*** (0.001) | 0.029*** (0.001) | 0.029*** (0.001) | 0.031*** (0.002) |
| Credit-to-GDP gap | 0.879*** (0.134) | 0.788*** (0.118) | 0.771*** (0.130) | 0.770*** (0.261) |
| Public debt / GDP | 0.023*** (0.001) | 0.018*** (0.001) | 0.024*** (0.001) | 0.015*** (0.001) |
| Financial openness | -0.783*** (0.153) | -0.815*** (0.137) | -0.785*** (0.165) | -0.127 (0.228) |
| Trade openness | -0.010*** (0.002) | -0.007*** (0.002) | -0.009*** (0.002) | -0.015*** (0.003) |
| Currency crisis | 0.410*** (0.060) | 0.335*** (0.056) | 0.316*** (0.064) | 0.875*** (0.102) |
| Discret. gov. consumption | -1.275*** (0.174) | -1.430*** (0.163) | -0.609*** (0.186) | -2.272*** (0.307) |
| CB assets | -0.035*** (0.004) | -0.013*** (0.003) | -0.042*** (0.005) | -0.000 (0.004) |
| Constant | -6.488*** (0.532) | -4.300*** (0.450) | -8.296*** (0.586) | -1.848*** (0.646) |
| Observations | 4,043 | 4,043 | 4,043 | 4,043 |
| Number of countries | 146 | 146 | 146 | 146 |
| Crisis obs. | 330 | 330 | 330 | 330 |
| Year FE | YES | YES | YES | YES |

Note : Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

1.7 Robustness checks

We check the robustness of our previous findings in four ways. First, we consider an alternative set of control variables to take account of the possible relation between the policy framework and the policy responses or the currency crisis dummy. More precisely, we alternatively drop the currency crisis dummy, the variables measuring discretionary government spending and the level of central bank assets according to the policy framework under review. The results are reported in Table 1.6. To save space, we only report the sign of the coefficients associated with the policy frameworks. As can be seen, the findings for the budget balance rule dummies remain similar when we drop the discretionary government spending variable, and indeed we still find that having a budget balance rule with a flexibility clause helps contain the real expected output losses associated with banking crises. Similarly, dropping the currency crisis dummy from the set of control variables does not change our previous conclusion about exchange rate regimes. The findings still suggest that the unconditional cost of banking crises is lower when a country operates under an intermediate exchange rate regime. The results for the monetary policy framework are also robust when we exclude the level of central bank assets from the set of control variables.

TABLE 1.6 – Robustness checks when the policy responses and the currency crisis dummy are dropped

| Dropping discretionary government consumption as a control variable | | | | |
|---|-------------|----------|------------|------------|
| | loss_5years | loss_all | trend_loss | cycle_loss |
| Budget balance rule | – | – | – | N.S. |
| No. budg. bal. rule | + | + | + | + |
| Budg. bal. rule without clause | + | + | + | + |
| Dropping currency crisis as a control variable | | | | |
| | loss_5years | loss_all | trend_loss | cycle_loss |
| Corner ERR dummy | + | + | + | + |
| ER regime | – | – | – | – |
| ER regime (squared) | + | + | + | + |
| Dropping central bank assets as a control variable | | | | |
| | loss_5years | loss_all | trend_loss | cycle_loss |
| CWN | + | + | + | + |
| CWN_OBJ | + | + | N.S. | + |
| CONS_W | + | N.S. | + | + |
| Inflation targeting | – | – | – | – |

Note : +/- means that the variable noted has a significant positive/negative impact on the unconditional cost of banking crises. N.S. means that the estimated coefficient is not statistically significant at the conventional levels.

Second, we control for cross-country differences in terms of banking regulation. Such regulation means (i) measures aimed at controlling banking sector vulnerabilities and (ii) measures defining the scope for actions by policymakers to solve crises. Papers that investigate this issue empirically usually find that banking regulation and supervision are negatively linked to the real cost of banking crises (see, e.g., Hoggarth et al., 2005; Angkinand, 2009; Fernández et al., 2013). While banking regulation may be an important determinant of the cost of banking crises, it has been neglected thus far for sample size reasons. Indeed, information on national banking regulation is less extensive than the usual macroeconomic data are. We collected information from the Database of Regulation and Supervision of Banks around the World, detailed in Barth et al. (2013), which is a survey that was first published in 1999.²⁰ This means it excludes the banking crises that occurred from 1970 to the early 1990s. Nonetheless, considering a smaller sample can also serve as an additional robustness check.

More precisely, we consider three alternative measures of banking regulation and supervision : “Prompt corrective action”, which captures the level of automatic intervention set in the authorities’ statutes for resolving banking sector vulnerabilities ; “Activity regulation”, which measures the restrictions on bank activities regarding securities offerings, insurance and real estate services ; and “Supervision power”, which refers to the supervision power that authorities have to impose regulatory constraints on banks to correct financial imbalances. Each measure is a polynomial variable. The higher the value, the higher the level of regulation and supervision. We expect banking regulation to be associated with a smaller expected cost for banking crises.

All the previous regressions are replicated by alternatively including these three indicators of banking regulation as additional control variables. The results are reported in Table 1.7. As we can see, the findings are very similar to those obtained before. We still find that a budget balance rule with an easing clause and an inflation targeting framework tend to reduce the real costs of banking crises, while the opposite effect is found for corner exchange rate regimes and for the independence and conservatism of the central bank.

Then, we consider the existence of a deposit insurance scheme as an additional control

20. The database contains four surveys (1999, 2003, 2007, and 2011). To conserve the panel structure of our data, we consider the results of the first survey for the years 1990-2002, of the second survey for the years 2003-2006, of the third survey for the years 2007-2010, and of the fourth survey for years 2011 and 2013.

TABLE 1.7 – Robustness checks when banking regulation is controlled for

| Adding prompt corrective action as an additional control variable | | | | |
|--|-------------|----------|------------|------------|
| | loss_5years | loss_all | trend_loss | cycle_loss |
| Budget balance rule | N.S. | – | N.S. | – |
| No. budg. bal. rule | + | + | + | + |
| Budg. bal. rule without clause | + | + | + | + |
| Corner ERR dummy | + | + | + | + |
| ER regime | – | – | – | – |
| ER regime (squared) | + | + | + | + |
| CWN | + | + | + | + |
| CWN_OBJ | + | + | + | + |
| CONS_W | + | N.S. | + | N.S. |
| Inflation targeting | – | – | – | – |
| Adding banking activities restriction as an additional control variable | | | | |
| | loss_5years | loss_all | trend_loss | cycle_loss |
| Budget balance rule | N.S. | – | N.S. | – |
| No. budg. bal. rule | + | + | + | + |
| Budg. bal. rule without clause | + | + | + | + |
| Corner ERR dummy | + | + | + | + |
| ER regime | – | – | – | – |
| ER regime (squared) | + | + | + | + |
| CWN | + | + | + | + |
| CWN_OBJ | + | + | + | + |
| CONS_W | + | N.S. | + | + |
| Inflation targeting | – | – | – | – |
| Adding supervisory power index as an additional control variable | | | | |
| | loss_5years | loss_all | trend_loss | cycle_loss |
| Budget balance rule | – | – | – | N.S. |
| No. budg. bal. rule | + | + | + | + |
| Budg. bal. rule without clause | + | + | + | + |
| Corner ERR dummy | + | + | + | + |
| ER regime | – | – | – | – |
| ER regime (squared) | + | + | + | + |
| CWN | + | + | + | + |
| CWN_OBJ | + | + | + | + |
| CONS_W | + | N.S. | + | + |
| Inflation targeting | – | – | – | – |
| Adding the existence of a deposit insurance scheme as an additional control variable | | | | |
| | loss_5years | loss_all | trend_loss | cycle_loss |
| Budget balance rule | – | – | – | – |
| No. budg. bal. rule | + | + | + | + |
| Budg. bal. rule without clause | + | + | + | + |
| Corner ERR dummy | + | + | + | + |
| ER regime | – | – | – | – |
| ER regime (squared) | + | + | + | + |
| CWN | + | + | N.S. | N.S. |
| CWN_OBJ | + | + | N.S. | + |
| CONS_W | + | N.S. | + | N.S. |
| Inflation targeting | – | – | – | – |

Note : +/- means that the variable noted has a significant positive/negative impact on the unconditional cost of banking crises. N.S. means that the estimated coefficient is not statistically significant at the conventional levels.

variable. Theoretically, a deposit insurance scheme can affect the severity of banking crises in contradictory ways. It is intended to prevent bank runs and to reduce the likelihood of distress at one bank causing a fully-fledged banking crisis, but such a scheme can also be a source of moral hazard that may increase the incentives for banks to take excessive risks. This may increase the likelihood and the conditional cost of banking crises. Overall, empirical findings generally suggest that the first effect dominates, and as a safety net preventing bank runs, deposit insurance coverage is negatively related to the real costs of banking crises (see, e.g., Hoggarth et al., 2005; Angkinand, 2009; Fernández et al., 2013). To check the robustness of our results once the existence of a deposit insurance is considered, we define a dummy variable equal to 1 if there is such a scheme in country i at time t and 0 otherwise. The information comes from the WDI database, and the results are reported in Table 1.7. As can be seen, our previous results are robust to the inclusion of this additional control variable.

TABLE 1.8 – Robustness checks when the quality of domestic institutions is controlled for

| Adding government stability as an additional control variable | | | | |
|--|-------------|----------|------------|------------|
| | loss_5years | loss_all | trend_loss | cycle_loss |
| Budget balance rule | – | – | – | – |
| No. budg. bal. rule | + | + | + | + |
| Budg. bal. rule without clause | + | + | + | + |
| Corner ERR dummy | + | + | + | + |
| ER regime | – | – | – | – |
| ER regime (squared) | + | + | + | + |
| CWN | + | + | + | N.S. |
| CWN_OBJ | + | + | + | + |
| CONS_W | + | + | + | + |
| Inflation targeting | – | – | – | – |
| Adding democratic accountability as an additional control variable | | | | |
| | loss_5years | loss_all | trend_loss | cycle_loss |
| Budget balance rule | – | – | – | N.S. |
| No. budg. bal. rule | + | + | + | + |
| Budg. bal. rule without clause | + | + | + | + |
| Corner ERR dummy | + | + | + | + |
| ER regime | – | – | – | – |
| ER regime (squared) | + | + | + | + |
| CWN | + | + | + | + |
| CWN_OBJ | + | + | + | + |
| CONS_W | + | + | + | + |
| Inflation targeting | – | – | – | – |

Note : +/- means that the variable noted has a significant positive/negative impact on the unconditional cost of banking crises. N.S. means that the estimated coefficient is not statistically significant at the conventional levels.

Thirdly we check the possibility that each policy framework only reflects one broader feature, which is institutional quality. As argued by Demirgüç-Kunt and Detragiache (1998), the quality of domestic institutions is highly related to the ability of the government to implement effective prudential regulation. Furthermore, a weak institutional environment is expected to exacerbate financial fragility, as it provides limited judicial protection to creditors and shareholders (Shimpalee and Breuer, 2006). Claessens et al. (2005) find that better domestic institutions, less corruption and greater judicial efficiency contribute to lower output losses and fiscal costs in the aftermath of a banking crisis. They explain this result by noting that a well-functioning legal system can help to restructure corporations in crisis, and also by noting the ability of supervisory authorities to enforce regulation and to intervene in incipient crisis situations. Consequently, it may be expected that banking crises would be less costly if there are good domestic institutions. In our study, we proxy the quality of domestic institutions by considering

two variables commonly used in the literature, which are government stability and democratic accountability. These variables are taken from the International Country Risk Guide (ICRG) database and are available from 1984. In line with Claessens et al. (2005), we consider these two variables alternatively in each of our specifications. The results for the coefficients of interest are reported in Table 1.8. As can be seen, our results are robust to the inclusion of these two variables, and we still find that the policy framework is the key driver of the unconditional cost of banking crises. Of particular note, this finding confirms that the impact of the policy framework is distinct from the influence of institutional quality.

Finally, it may be possible that each variable related to a given policy framework accounts for common, and possibly unobserved, characteristics. To check this, we simultaneously include the variables capturing the frameworks for monetary policy, fiscal policy and the exchange rate in the same regression. This means that four alternative sets of variables are considered. All of them include the budget balance rule dummies, with and without a flexibility clause, and the dummy for corner exchange rate regimes. Then we successively include the variables for the monetary policy framework, which are *CWN*, *CWN_OBJ*, *CONS_W* index, and the inflation targeting dummy. The results are reported in Table 1.11 in the Appendix. Once again, we observe that our variables of interest remain statistically significant, and so our findings are largely robust.

1.8 Conclusion

Many efforts have been made so far, and in particular in the wake of the global financial crisis, to explain the real costs of banking crises empirically. This paper contributes to this literature by assessing whether the macroeconomic policy frameworks, which are monetary policy features, fiscal policy rules and exchange rate regimes, matter. More specifically, following the rule versus discretion debate, we focus on how restrictive these policy frameworks are, as stringency may have ambivalent effects on the costs of banking crises. In one way, a stringent policy framework is supposed to enhance discipline, improve credibility and enforce greater accountability, and it may give financial room to policymakers. This is conducive to greater economic and banking

sector stability. Equally however, restrictive policy frameworks can be counterproductive and procyclical, and while they are not sufficient to prevent banking crises, stringent frameworks lack the flexibility to respond to unforeseeable shocks. This means that tying the hands of policymakers may render banking crises more costly. Focusing on the degree of restrictiveness of the macroeconomic policy frameworks is the first originality of our contribution.

The second innovation consists of focusing on the unconditional real output losses related to banking crises. We argue that, like in a cost-benefit perspective, it is instructive to gauge the global effect of any policy framework, instead of only considering losses conditional to the occurrence of banking crises. Policy framework may explain why crises do not occur. To this viewpoint, the unconditional cost of banking crisis is the relevant loss measure.

Our answer to whether the degree of restrictiveness of macroeconomic policy frameworks matters is yes, even when the usual determinants of the costs of banking crises are considered. A graphical representation of our results is presented in Figure 1.5 in the Appendix. We find that the absence of restriction, for example the absence of a fiscal rule, is associated with higher expected losses. Moreover, extremely restrictive policy features such as corner exchange rate regimes, budget balance rules without friendly clauses and a high degree of monetary policy conservatism and independence are conducive to a higher real cost for crises. In contrast, fiscal rules with easing clauses, intermediate exchange rate regimes and an inflation targeting framework combine discipline and flexibility and so can significantly contain the expected cost of banking crises. These results are consistent to many robustness checks, including tests that take banking regulation and institutional quality into account.

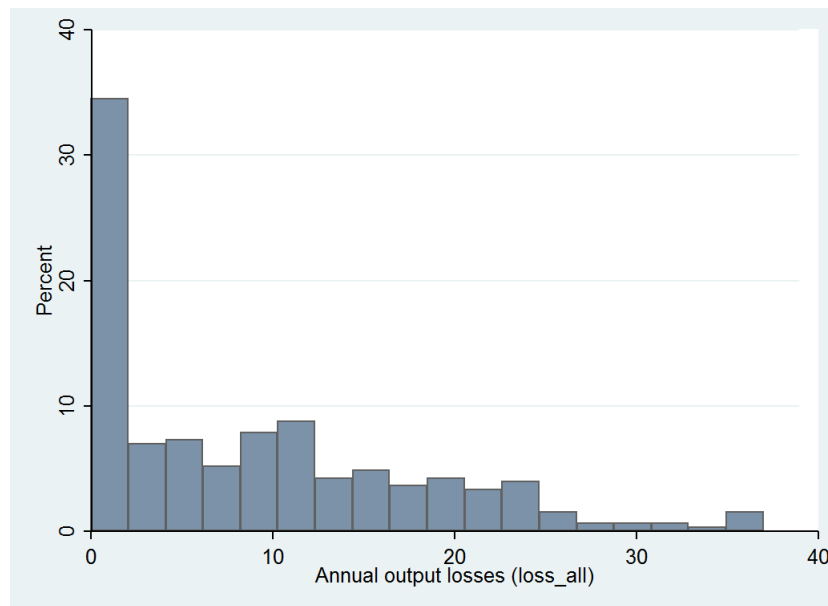
In this way, we provide evidence for the benefits of policy frameworks based on “constrained discretion”. Two decades ago, a seminal paper by Bernanke and Mishkin (1997) asserted that constrained discretion is a desirable compromise for macroeconomic stability, in particular through inflation targeting. In this paper we provide evidence that constrained discretion is also suitable for minimising the real costs of banking crises.

Further research should aim to determine what the optimal mix between fiscal, monetary and exchange rate regimes should be. Some policy arrangements that are suitable individually

are mutually incompatible. For instance, inflation targeters are not supposed to have an intermediate exchange rate regime. This suggests that there are some trade-offs beyond the degree of restrictiveness related to each individual policy feature. Some complementarities are also possible. Assessing the impact of policy transparency and credibility would constitute another interesting extension. Indeed, as theoretically demonstrated by Bianchi and Melosi (2018), we would expect the unconditional costs of crises to be lower whenever transparency and credibility are high, as policymakers could more easily deviate from their usual mandate without losing control over agents' expectations.

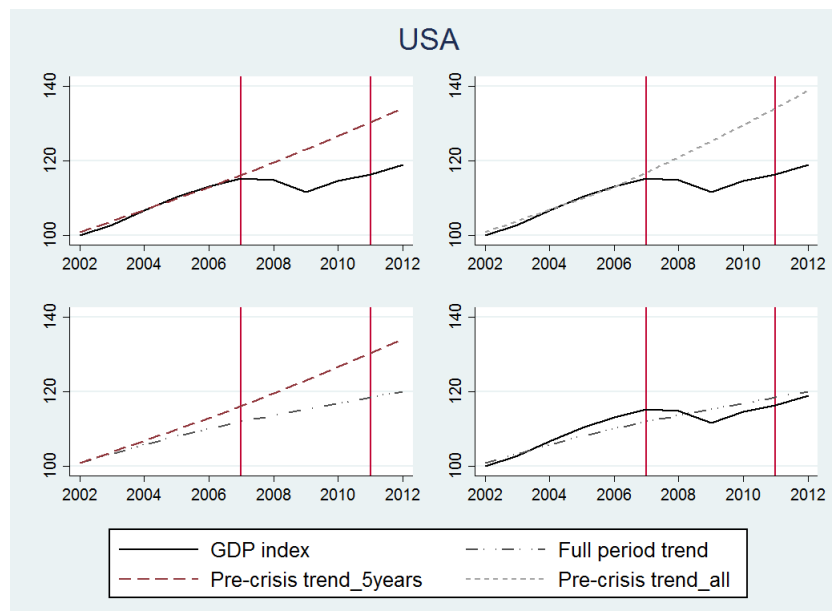
1.9 Appendix

FIGURE 1.3 – Distribution of annual output losses due to banking crises



Source: Laeven and Valencia (2018) and authors' calculations (see definition of *loss_all* in section 1.3.1).

FIGURE 1.4 – Measuring the real output costs associated with banking crises : the case of the United States



Source: Authors' calculations.

TABLE 1.9 – Sample of countries and banking crisis episodes

| Country | No. of banking crisis episode(s) | Starting date(s) | No. of yearly crisis observations | Country | No. of banking crisis episode(s) | Starting date(s) | No. of yearly crisis observations |
|----------------------|----------------------------------|------------------------|-----------------------------------|----------------|----------------------------------|------------------|-----------------------------------|
| Algeria | 1 | 1990 | 5 | Mexico | 2 | 1981, 1994 | 7 |
| Argentina | 4 | 1980, 1989, 1995, 2001 | 7 | Mongolia | 1 | 2008 | 2 |
| Austria | 1 | 2008 | 5 | Morocco | 1 | 1980 | 5 |
| Belgium | 1 | 2008 | 5 | Nepal | 1 | 1988 | 1 |
| Bolivia | 2 | 1986, 1994 | 2 | Netherlands | 1 | 2008 | 2 |
| Brazil | 2 | 1990, 1994 | 9 | Nicaragua | 2 | 1990, 2000 | 5 |
| Bulgaria | 1 | 1996 | 2 | Niger | 1 | 1983 | 3 |
| Burkina Faso | 1 | 1990 | 5 | Nigeria | 2 | 1991, 2009 | 9 |
| Burundi | 1 | 1994 | 5 | Norway | 1 | 1991 | 3 |
| Cameroon | 2 | 1987, 1995 | 8 | Panama | 1 | 1988 | 2 |
| Central African Rep. | 1 | 1995 | 2 | Paraguay | 1 | 1995 | 1 |
| Chad | 1 | 1992 | 5 | Peru | 1 | 1983 | 1 |
| Chile | 2 | 1976, 1981 | 6 | Philippines | 2 | 1983, 1997 | 9 |
| China | 1 | 1998 | 1 | Portugal | 1 | 2008 | 5 |
| Colombia | 2 | 1982, 1998 | 4 | Romania | 1 | 1998 | 2 |
| Congo, Dem. Rep. | 2 | 1991, 1994 | 5 | Russia | 2 | 1998, 2008 | 3 |
| Congo, Rep. | 1 | 1992 | 3 | Senegal | 1 | 1988 | 4 |
| Costa Rica | 2 | 1987, 1994 | 7 | Serra Leone | 1 | 1990 | 5 |
| Cote d'Ivoire | 1 | 1988 | 5 | Slovak Rep. | 1 | 1998 | 5 |
| Cyprus | 1 | 2011 | 3 | Slovenia | 1 | 2008 | 5 |
| Czech Republic | 1 | 1996 | 4 | Spain | 2 | 1977, 2008 | 10 |
| Denmark | 1 | 2008 | 2 | Sri Lanka | 1 | 1989 | 3 |
| Dominican Rep. | 1 | 2003 | 2 | Swaziland | 1 | 1995 | 5 |
| Egypt | 1 | 1980 | 1 | Sweden | 2 | 1991, 2008 | 6 |
| El Salvador | 1 | 1989 | 2 | Switzerland | 1 | 2008 | 2 |
| Finland | 1 | 1991 | 5 | Thailand | 2 | 1983, 1997 | 5 |
| France | 1 | 2008 | 2 | Togo | 1 | 1993 | 2 |
| Germany | 1 | 2008 | 2 | Tunisia | 1 | 1991 | 1 |
| Ghana | 1 | 1982 | 2 | Turkey | 2 | 1982, 2000 | 5 |
| Greece | 1 | 2008 | 5 | Uganda | 1 | 1994 | 1 |
| Guinea-Bissau | 1 | 1995 | 4 | Ukraine | 2 | 1998, 2008 | 5 |
| Hungary | 1 | 2008 | 5 | United Kingdom | 1 | 2007 | 5 |
| Iceland | 1 | 2008 | 5 | United States | 2 | 1988, 2007 | 6 |
| Indonesia | 1 | 1997 | 5 | Uruguay | 2 | 1981, 2002 | 9 |
| Ireland | 1 | 2008 | 5 | Vietnam | 1 | 1997 | 1 |
| Israel | 1 | 1983 | 3 | Yemen | 1 | 1996 | 1 |
| Italy | 1 | 2008 | 2 | Zimbabwe | 1 | 1995 | 5 |
| Jamaica | 1 | 1996 | 2 | | | | |
| Japan | 1 | 1997 | 5 | | | | |
| Jordan | 1 | 1989 | 1 | | | | |
| Kazakhstan | 1 | 2008 | 1 | | | | |
| Kenya | 2 | 1985, 1992 | 4 | | | | |
| Korea | 1 | 1997 | 2 | | | | |
| Kyrgyz Rep. | 1 | 1995 | 2 | | | | |
| Madagascar | 1 | 1988 | 1 | | | | |
| Malaysia | 1 | 1997 | 3 | | | | |
| Mali | 1 | 1987 | 2 | | | | |

Countries with no banking crisis episode :
Albania*, Angola, Armenia*, Australia, Azerbaijan*, Bangladesh*, Barbados, Belarus*, Belize, Benin*, Bhutan, Botswana, Cabo Verde*, Cambodia, Canada, Comoros, Croatia*, Djibouti*, Dominica, Equatorial Guinea*, Estonia*, Fiji, Gabon, The Gambia, Georgia*, Grenada, Guatemala, Guinea*, Guyana*, Haiti*, Honduras, India*, Iran Islamic Rep., Kuwait*, Lao P.D.R..., Latvia*, Lebanon*, Lesotho, Liberia*, Libya, Lithuania*, Macedonia*, Malawi, Maldives, Mauritania*, Mauritius, Moldova*, Mozambique*, Namibia, New Zealand, Pakistan, Papua New Guinea, Poland*, Rwanda, Singapore, South Africa, Sudan, Suriname, Tajikistan, Tanzania*, Trinidad and Tobago, Venezuela*.

Note : * means that, according to Laeven and Valencia (2018), these countries have experienced one or more banking crisis episodes. However, due to data availability, these banking crisis episodes are not covered by our sample.

Definition and source of variables

- **Real GDP per capita** : Logarithm of the GDP in constant 2005 U.S. dollars divided by midyear population (source : WDI, World Bank).
- **Inflation** : Normalised measure of inflation calculated as $\pi/(1+\pi)$, where π is the annual percentage change in the consumer price index (source : WDI, World Bank and authors' calculations).
- **Bank credit to GDP** : Financial resources provided to the private sector by domestic money banks as a share of GDP (source : WDI, World Bank).
- **Credit-to-GDP gap** : Difference in % between the annual domestic credit to the private sector as a share of GDP and its long-term trend, obtained using the Hodrick-Prescott filter (source : WDI, World Bank and authors' calculations).
- **Public debt** : Gross general government debt as a share of GDP (source : Abbas et al., 2010).
- **Financial openness** : Normalised KAOPEN index. This index is based on information regarding restrictions in the International Monetary Fund's Annual Report on Exchange Rate Arrangements and Exchange Restrictions (AREAER). The KAOPEN index is the first principal component of the variables that indicate the presence of multiple exchange rates, restrictions on current account transactions and on capital account transactions, and the requirement of the surrender of export proceeds (source : Chinn and Ito, 2006).
- **Trade openness** : Sum of exports and imports of goods and services measured as a share of GDP (source : WDI, World Bank).
- **Currency crisis** : Dummy variable equal to 1 if the domestic currency is subject to an annual depreciation higher than 15% against the U.S. dollar (source : authors' calculations following Reinhart and Rogoff, 2009).
- **Discretionary government spending** : Government expenditures not driven by automatic stabilisers as a % of GDP (source : WDI and authors' calculations following Ambrosius, 2017).
- **Central bank assets** : Ratio of central bank assets to GDP. Central bank assets are claims on the domestic real non-financial sector (source : Global Financial Development Database, World Bank).

-
- **Budget balance rule** : Dummy variable based on country-specific information on fiscal rules collected by the IMF, equal to 1 if fiscal policy operates under a budget balance rule (source : Bova et al., 2014 and Lledó et al., 2017).
 - **Exchange rate regime** : *De facto* classification of country-specific exchange rate regimes based on the IMF country team analysis and consultations with the central banks. The classification goes from 1 to 14. The higher the value, the more flexible the exchange rate regime (source : Ghosh et al., 2010).
 - **Corner exchange rate regime dummy** : Dummy variable based on the IMF *de facto* classification of exchange rate regimes, equal to 1 if a country operates under a fixed or pure floating exchange rate regime and 0 otherwise (source : Ghosh et al., 2010).
 - **Inflation targeting** : Dummy variable equal to 1 if a country has adopted a full-fledged inflation targeting framework and 0 otherwise (source : Roger, 2009 and central banks' website).
 - **CONS_W** : *De facto* measure of central bank conservatism based on the Taylor curve. It is computed as a shock-adjusted ratio of the variance in the output gap relative to the variance of inflation (source : authors' calculations following Levieuge and Lucotte, 2014).
 - **CWN_OBJ** : *De jure* measure of central bank conservatism based on the importance given to price stability relative to other objectives, according to the central banks' legal statutes (source : Cukierman et al., 1992 and Garriga, 2016).
 - **CWN index** : *De jure* index of central bank independence. It is computed as a weighted average of four subcomponents corresponding to organic independence, monetary policy objectives, monetary policy formulation and limitations of lending to the government. The index lies between 0 and 1, with 0 as the smallest level of independence and 1 as the highest (source : Cukierman et al., 1992 and Garriga, 2016).
 - **Prompt corrective action** : A polynomial variable measuring whether a law establishes predetermined levels of bank solvency deterioration that force automatic actions, such as government intervention. It ranges from 0 to 6, with a higher value indicating more promptness in responding to problems (source : Barth et al., 2013).
 - **Banking activities restriction** : A polynomial variable ranging between 0 and 12 and capturing the level of restrictions on banks regarding securities, insurance and real estate

activities. A higher value indicates more restrictions on banking activities (source : Barth et al., 2013).

- **Supervisory power index** : Polynomial variable ranging between 0 and 16, measuring the extent to which official supervisory institutions have the authority to take specific actions to prevent and resolve banks' problems. A higher value indicates greater supervisory power (source : Barth et al., 2013).
- **Deposit insurance scheme** : Dummy variable equal to 1 if a country has implemented a deposit insurance scheme and 0 otherwise (source : WDI, World Bank).
- **Government stability** : Index of a government's ability to carry out its declared programme(s) and its ability to stay in office. The index ranges between 0 and 12, with a higher score meaning higher stability (source : International Country Risk Guide).
- **Democratic accountability** : Index of how responsive government is to its people, on the basis that the less responsive it is, the more likely it is that the government will fall, peacefully in a democratic society, but possibly violently in a non-democratic one. The index lies between 0 and 6, with a higher score indicating lower risk (source : International Country Risk Guide).

TABLE 1.10 – Descriptive statistics

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|--------------------------------|-------|--------|-----------|--------|--------|
| Loss_5years | 4,043 | 0.615 | 3.195 | 0 | 41.755 |
| Loss_all | 4,043 | 0.717 | 3.502 | 0 | 37.003 |
| Trend_loss | 4,043 | 0.542 | 2.740 | 0 | 39.408 |
| Cycle_loss | 4,043 | 0.201 | 1.169 | 0 | 19.083 |
| GDP per capita (ln) | 4,043 | 3.636 | 1.501 | 0.718 | 6.801 |
| Inflation (normalised) | 4,043 | 0.095 | 0.125 | -0.559 | 0.996 |
| Bank credit / GDP | 4,043 | 38.66 | 34.98 | 0.186 | 312.15 |
| Credit-to-GDP gap | 4,043 | 0.092 | 3.291 | -6.580 | 6.796 |
| Public debt / GDP | 4,043 | 58.82 | 47.45 | 0 | 629.18 |
| Financial openness | 4,043 | 0.440 | 0.347 | 0 | 1 |
| Trade openness | 4,043 | 72.65 | 43.67 | 6.320 | 531.73 |
| Currency crisis | 4,043 | 0.183 | 0.386 | 0 | 1 |
| Discret. gov. consumption | 4,043 | -0.004 | 0.123 | -0.736 | 1.724 |
| CB assets | 4,043 | 7.410 | 11.32 | 0 | 197.59 |
| Budget balance rule | 1,713 | 0.458 | 0.498 | 0 | 1 |
| No budg. bal. rule | 1,713 | 0.542 | 0.498 | 0 | 1 |
| Budg. bal. rule without clause | 1,713 | 0.375 | 0.484 | 0 | 1 |
| Corner ERR dummy | 3,472 | 0.525 | 0.499 | 0 | 1 |
| ER regime | 3,472 | 8.123 | 4.399 | 1 | 14 |
| CWN | 3,682 | 0.513 | 0.208 | 0.017 | 0.904 |
| CWN_OBJ | 3,682 | 0.531 | 0.267 | 0 | 1 |
| CONS_W | 2,437 | 0.448 | 0.365 | 0 | 1 |
| Inflation targeting | 4,043 | 0.075 | 0.263 | 0 | 1 |

TABLE 1.11 – Results obtained by simultaneously considering the different policy frameworks

| | Central bank independence (CWN) | | | | Central bank conservatism (CWN_OBJ) | | | |
|---------------------------------------|------------------------------------|----------------------------|----------------------------|----------------------------|-------------------------------------|----------------------------|-----------------------------|----------------------------|
| | loss_5years | loss_all | trend_loss | cycle_loss | loss_5years | loss_all | trend_loss | cycle_loss |
| No budg. bal. rule | 1.700*** (0.243) | 1.825*** (0.230) | 2.148*** (0.275) | 1.910*** (0.514) | 1.347*** (0.249) | 1.297*** (0.227) | 1.684*** (0.274) | 1.927*** (0.589) |
| Budg. bal. rule without clause | 1.408*** (0.211) | 1.342*** (0.197) | 1.309*** (0.229) | 1.779*** (0.494) | 1.387*** (0.230) | 1.204*** (0.209) | 1.192*** (0.241) | 1.988*** (0.581) |
| Corner ERRR dummy | 0.684*** (0.111) | 0.949*** (0.106) | 1.004*** (0.129) | 0.154 (0.168) | 0.853*** (0.113) | 1.124*** (0.108) | 1.156*** (0.130) | 0.307* (0.171) |
| CWN | 2.457*** (0.307) | 3.032*** (0.294) | 2.340*** (0.329) | 2.658*** (0.504) | | | | |
| CWN_OBJ | | | | | 3.411*** (0.303) | 3.028*** (0.262) | 2.911*** (0.320) | 3.029*** (0.462) |
| Observations | 1,672 | 1,672 | 1,672 | 1,672 | 1,672 | 1,672 | 1,672 | 1,672 |
| Number of countries | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 |
| Crisis obs. | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 |
| Year FE | YES | YES | YES | YES | YES | YES | YES | YES |
| | Inflation targeting | | | | | | | |
| | Central bank conservatism (CONS_W) | | | | Inflation targeting | | | |
| | loss_5years | loss_all | trend_loss | cycle_loss | loss_5years | loss_all | trend_loss | cycle_loss |
| No budg. bal. rule | 1.346*** (0.230) | 1.530*** (0.217) | 1.802*** (0.260) | 1.334*** (0.493) | 1.497*** (0.238) | 1.525*** (0.224) | 1.884*** (0.271) | 1.712*** (0.516) |
| Budg. bal. rule without clause | 1.454*** (0.206) | 1.296*** (0.193) | 1.481*** (0.221) | 1.717*** (0.481) | 1.369*** (0.212) | 1.348*** (0.199) | 1.360*** (0.233) | 1.659*** (0.503) |
| Corner ERRR dummy | 0.342*** (0.114) | 0.508*** (0.105) | 0.476*** (0.132) | 0.394** (0.182) | 0.750*** (0.111) | 0.992*** (0.105) | 1.035*** (0.129) | 0.200 (0.165) |
| CONS_W | 1.319*** (0.177) | 0.811*** (0.158) | 0.971*** (0.192) | 1.625*** (0.315) | | | | |
| Inflation targeting | | | | | -0.167 (0.171) | -0.421** (0.166) | -0.537*** (0.186) | 0.217 (0.306) |
| Observations | 1,118 | 1,118 | 1,118 | 1,118 | 1,713 | 1,713 | 1,713 | 1,713 |
| Number of countries | 59 | 59 | 59 | 59 | 77 | 77 | 77 | 77 |
| Crisis obs. | 161 | 161 | 161 | 161 | 208 | 208 | 208 | 208 |
| Year FE | YES | YES | YES | YES | YES | YES | YES | YES |

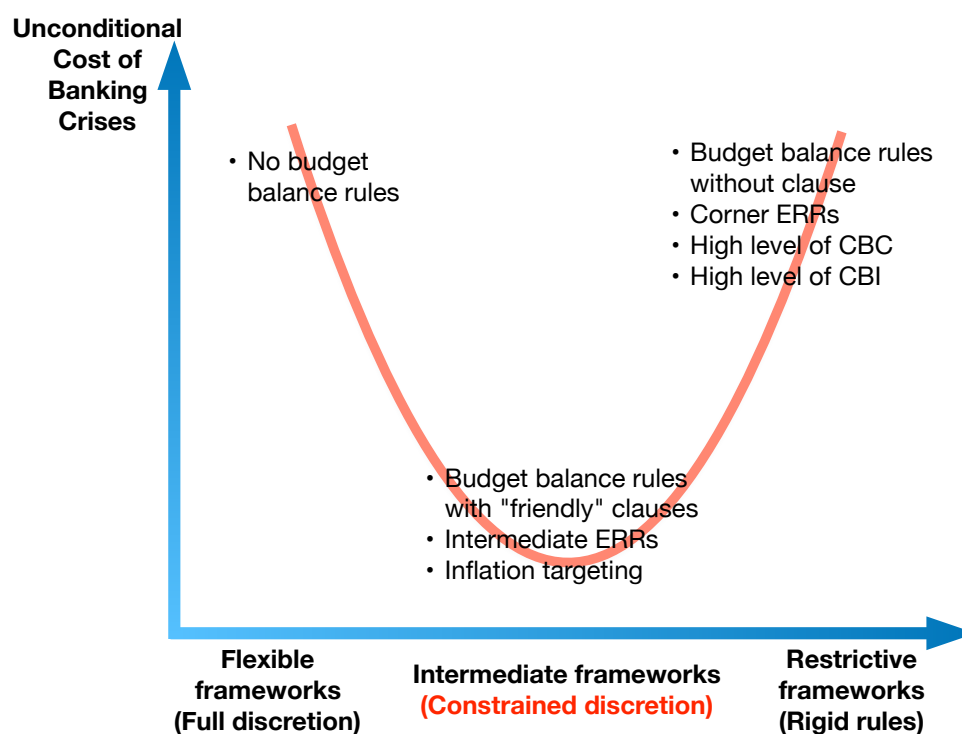
Note : Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. To save space, control variables and the constant are included but not reported.

TABLE 1.12 – Marginal effects of policy framework variables on the expected cost of banking crises

| | | Policy framework | loss_5years | loss_all | trend_loss | cycle_loss |
|------------------|--|--------------------------------|-------------|----------|------------|------------|
| Policy change | | No budg. bal. rule | 382.11% | 396.29% | 586.89% | 448.49% |
| | | Budg. bal. rule without clause | 264.73% | 241.78% | 253.60% | 402.29% |
| | | Corner ERR dummy | 110.64% | 159.09% | 144.98% | 45.79% |
| | | Inflation targeting | -57.60% | -57.04% | -60.58% | -46.63% |
| 1% increase | | CWN | 1.85% | 1.96% | 0.77% | 0.95% |
| | | CWN_OBJ | 1.31% | 1.09% | N.S. | 2.10% |
| | | CONS_W | 0.31% | N.S. | N.S. | 0.43% |

Note : N.S. means that the estimated coefficient is not statistically significant at the conventional levels. Marginal effects are calculated using an exponential transformation of the estimated coefficients.

FIGURE 1.5 – Graphical representation of the results



Chapitre 2

Central banks' preferences and banking sector vulnerability

2.1 Introduction

Since the public authorities in industrialized countries entrusted newly independent central banks with disinflation policies in the 1980s, price stability has become the main objective of monetary policy.¹ The advent of the inflation targeting framework and the considerable support it has received among central bankers and academics can be viewed as the culmination of this orientation (King, 1997).

This top priority assigned to the control of inflation stems from the adherence of numerous economists and central bankers to Schwartz's "conventional wisdom" (Schwartz, 1995), according to which price stability implies macroeconomic and financial stability. It was widely accepted as a "divine coincidence" that having a monetary policy focused primarily on price stability would ensure output stability and maximum welfare, provided that distortions are composed solely of price rigidities (Woodford, 2003). The idea that price stability is a sufficient condition for guaranteeing financial stability was a leitmotiv in the 2000s. The conclusion of Bernanke and Gertler (2000, p.46) is representative of this perspective : "*Given a strong*

1. This chapter gave rise to an article co-written with G. Leveuge and Y. Lucotte.

commitment to stabilizing expected inflation, it is neither necessary nor desirable for monetary policy to respond to changes in asset prices, except to the extent that they help to forecast inflationary or deflationary pressures". The second part of this quote refers to the "Jackson Hole Consensus", which says that central banks should respond to financial developments only if they threaten price stability. In practice, this led most central banks to adopt a strategy of "cleaning up (the bust) afterwards", rather than a strategy of "leaning against the wind".

Certainly, a high level of inflation is not conducive to macroeconomic and financial stability. By showing that high-inflation countries are more subject to financial crises, some empirical studies such as Bordo and Wheelock (1998), Demirgüç-Kunt and Detragiache (1998) and Bordo et al. (2001) are in some ways in accordance with the Schwartz's conventional wisdom.

However, many recent financial crises were not preceded by periods of price instability (White, 2006), and typically, the recent financial crisis occurred in the context of the Great Moderation. This has shed some doubt on Schwartz's hypothesis. Many upstanding authors and institutions now argue that with monetary policies focused primarily on inflation, financial stability was largely ignored.² In turn, financial instability has undermined macroeconomic stability, despite a low and stable inflation rate. In this alternative view, the belief in the divine coincidence has, in retrospect, been revealed to be benign neglect. The following quotation of Mishkin (2017b, p.256) is representative of this reversal : "*central banks' success in stabilising inflation and the decreased volatility of business cycle fluctuations, which became known as the Great Moderation, made policy-makers complacent about the risks from financial disruptions. The benign economic environment leading up to 2007, however, did surely not protect the economy from financial instability. Indeed, it may have promoted it. Although price and output stability are surely beneficial, the recent crisis indicates that a policy focused solely on these objectives may not be enough to produce good economic outcomes*".

This alternative view benefits from theoretical support. In particular, it can be demonstrated that the "divine coincidence" does not hold when real rigidities are present (Blanchard and Galí, 2007), as well as in the presence of financial imperfections (Woodford, 2012; Lambertini et al., 2013; Reis, 2013). Christiano et al. (2010) show that as inflation is stable during periods of

2. See for instance Bernanke (2013), Whelan (2013), Bayoumi et al. (2014) and Borio (2014b).

stock market booms while credit increases sharply, a central bank that focuses excessively on inflation overlooks the financial imbalances that such a policy exacerbates. Overall, because of its impact on welfare - beyond its effects on inflation and output forecasts - financial stability deserves to be a goal in itself. The problem is that monetary policy and financial stability policy may sometimes be conflicting and both may have negative externalities on each other.³ This suggests the existence of a trade-off between those two objectives in certain circumstances. Given the legal mandates of central banks, priority is often given to the inflation goal to the detriment of financial stability.

On empirical grounds, to the best of our knowledge, only Blot et al. (2015) have recently addressed the issue of the Schwartz's hypothesis frontally. Using various methods, they reject the hypothesis that price stability is positively correlated with financial stability. Nevertheless, it is a policymakers' decision, namely their relative preferences and objectives, and not the inflation rate *per se*, which defines whether they turn away from the financial stability objective. As inflation is potentially subject to shocks and exogenous trends, beyond the will of policymakers, it only constitutes a rough proxy of what fundamentally underlies the Schwartz's hypothesis and the benign neglect hypothesis (i.e. policymakers' decision).

Against this background, the objective of the present paper is to extend this very scarce literature by testing the Schwartz hypothesis against the benign neglect hypothesis : Does assigning a higher priority to inflation stabilization reduces or increases the vulnerability of the banking sector ? To this end, we go further than the existing evidence by directly addressing the link between policymakers' preferences and financial stability, with different methodologies, with a genuine measure of the preferences of central banks, and over a period that includes the global financial crisis years.

The preference of central banks for price stability is proxied by the *CONS* index of central banks' conservatism (CBC), suggested by Levieuge and Lucotte (2014) and based on the Taylor curve (Taylor, 1979). We consider six alternative measures for banking sector vulnerability that are widely used in the literature on early warning systems as determinants of financial crises⁴ :

3. See Ioannidou (2005) and Laséen et al. (2017).

4. See, e.g., Schularick and Taylor (2012).

credit volatility, the credit-to-GDP gap, the credit-to-deposit ratio, nonperforming loans, the Z-score, and the capital-to-asset ratio. In essence, these factors primarily concern the credit cycle and the structure of the banks' balance sheets. Our results, from a sample of 73 countries over the period 1980-2012, indicate that the degree of CBC robustly explains banking sector vulnerability, which is in line with the benign neglect hypothesis. On this respect, if the inflation targeting (IT) framework implies a narrower focus on the inflation stabilization objective, our results are in line with papers concluding that IT has some adverse financial and real effects (Frappa and Mésonnier, 2010; Lin, 2010; Petreski, 2014).

The remainder of this paper is organized as follows. Section 2.2 reviews the Schwartz's and the benign neglect hypotheses. Section 2.3 is dedicated to the way we measure central banks' preferences, using the *CONS* index of CBC, which we extend to a broader set than that initially proposed by Leveuge and Lucotte (2014). Data for the dependent and control variables are also detailed in Section 2.3. Section 2.4 describes the methodology we implement and presents the results. Robustness checks are performed in Section 2.5. Section 2.6 concludes and discusses the implications and extensions of our results.

2.2 The Schwartz's and benign neglect hypotheses : A review

According to the Schwartz's conventional wisdom, by focusing on the objective of price stability, policymakers contribute not only to achieving high levels of economic activity and employment, but also foster financial stability. The main reason is that inflation creates uncertainty and disturbs the information contained in prices. Future real returns of asset prices and investment are thus incorrectly valued. As a consequence, asset accumulation and lending decisions are imperfect. Finally, the banking sector stability is threatened by increasing non-performing loans and default risks. Conversely, price stability promotes a sound and appropriate intertemporal allocation of resources, and thus sound lending operations. This view has found a more formal theoretical underpinning through the so-called "divine coincidence" :

in the absence of real imperfections, stabilizing inflation in standard new Keynesian models is found equivalent to stabilizing the welfare-relevant output gap (Woodford, 2003; Blanchard and Galí, 2007).

However, real imperfections matter in practice, implying a trade-off between inflation and output. Furthermore, it has been proven that financial imperfections may reduce welfare by themselves and not only through their impact on output and inflation (Woodford, 2012; Lambertini et al., 2013; Reis, 2013). To this view, as reducing the effects of financial distortions makes the economy operate more efficiently, financial stability should be an objective on its own. A single inflation goal is not enough. Similarly, many authors and institutions have expressed their doubts about the conventional view in the wake of the global financial crisis.

In practice, institutional and legal arrangements governing monetary policy in every country assign an overriding priority to the inflation stabilization objective. According to the comprehensive survey led by Oosterloo and De Haan (2004) and the exhaustive report published by the BIS (2009), the objectives and powers of the financial stability function are not clearly and explicitly stated in legal texts. Even when legal statutes mention a financial stability objective, the understanding of what it entails is quite diffuse. For instance, central banks are supposed to act in favour of “promoting” or “contributing to” financial stability.⁵ Such extra-statutory statements assign little commitment and responsibility (see details in BIS, 2009, tab.2 p.30).

Certainly, the objectives of central banks change over time (Toniolo and White, 2015) and policymakers have realized that they should pay more attention to financial instability since 2008. However, this aspiration is still informal and superficial. In the most recent literature, it is still presented as an “ongoing” debate, with few practical changes up until now (Koetter et al., 2014; Lombardi and Siklos, 2016; Khan, 2017).⁶ Finally, from the survey of Smaga (2013), we can learn that central banks that have an objective of financial stability do not even have an official definition for “financial stability”. This contrasts with the clarity and accountability surrounding the quantitative objective of price stability.

5. Preserving financial stability is often considered to be a concern for central banks, or even one of their main functions, but only because they are responsible for the functioning of the payment system.

6. There are very few exceptions. For example, the Financial Services Act (2012) gives to the Bank of England a clear set of statutory objectives for the supervision of the financial system. Switzerland and India have also reformed the mandates of their central banks.

Complementary - *de facto* - arguments explain why central bankers may neglect financial developments. First, monetary policy is not the most efficient tool to ensure financial stability, as it does not only affect the specific financial sector where distortions have to be corrected but also many macroeconomic variables. Moreover, its impact on asset prices is uncertain. More generally, knowledge on financial stability is largely incomplete in terms of definition, measures, and adequate policies. Thus, responding to financial developments may harm the credibility of the monetary authorities, with the fear of financial dominance. Even an explicit dual mandate makes the credibility of the central bank vulnerable to a new time-inconsistency problem (Ueda and Valencia, 2014) and may compromise the independence of the central bank (Cukierman, 2011). Furthermore, such uncertainty may lead policymakers to be conservative - as expressed by Brainard (1967) - namely to neglect the financial stability issue⁷ (Lombardi and Siklos, 2016) and to give priority to the inflation goal instead.

In such a context, four arguments explain how and why strong preferences for price stability can lead to benign neglect and adversely affect financial stability.

Financial stability may be neglected because of desynchronization between consumer prices and the financial cycle. The business cycle and the financial cycle are not perfectly aligned (Borio, 2014a). Thus, while tighter monetary policy may be required to burst an asset price bubble, it may not necessarily be justified in terms of inflation, as it was the case in 2002-2007. Given the legal arrangements mentioned earlier, desynchronization leads central banks to give priority to the price stability objective and neglect financial imbalances.

Financial instability is exacerbated by the risk-taking channel of monetary policy if inflation is low. The vast literature on the risk-taking channel argues that monetary policy can be responsible for an increase in systemic risk, if conducted regardless of any objective other than the inflation goal in the context of the Great Moderation.⁸ Indeed, prioritizing the inflation stabilization objective when the inflation rate is very low leads central banks to conduct loose monetary policies over a prolonged period. Such policies have been blamed for lowering risk perceptions and increasing risk tolerance.

7. Here, “financial” and “banking” are considered as synonyms when discussing vulnerability, stability, and so forth.

8. See, among others, Borio and Zhu (2012) and Jiménez et al. (2014).

Financial stability suffers from the consequences of a conflict of objectives. Side effects and conflicts between monetary policy and financial-stability policy can occur.⁹ Ioannidou (2005) for example highlights the conflict between monetary policy, which usually requires high real interest rates in order to fight inflation, and regulatory or supervisory policy, which is concerned about the adverse effects of higher interest rate on the solvency of the banking sector. The risk-taking channel of monetary policy is another example of side effects. Similarly, macroprudential tools impact credit growth and external imbalances with consequences for aggregate demand and ultimately for inflation. Examining the policy architecture of 35 countries, Chortareas et al. (2016) find that central banks serving both monetary and banking supervision functions are less conservative than those with a single price stability mandate. In this vein, Heller (1991), Goodhart and Schoenmaker (1995), Di Noia and Di Giorgio (1999) and Hasan and Mester (2008) unanimously find that countries whose central banks do not have supervisory duties have overall lower inflation rates. Similarly, Ioannidou (2005) finds that the Federal Reserve becomes less strict in bank supervision when it tightens monetary policy. One explanation is that the Federal Reserve compensates banks for the extra pressure it puts on them. When monetary and prudential policies are conducted by two distinct agencies, the conflict of objectives raises the risk of “push-me, pull-you” behaviour between policymakers.¹⁰ While the literature is far from being clear-cut on the optimal policy-mix to be implemented, it is at least obvious that the optimal equilibrium depends on policymakers’ preferences. Through a contract theory model, Franck and Krausz (2008) demonstrate that under a sound banking system, conservative parties with low inflation objectives find it appropriate to separate banking supervision from the conduct of monetary policy. A way to interpret their conclusion is to admit that conflicts of objectives are less likely to occur under a sound banking system. In contrast, when there is banking instability, a single agent is needed to internalize the external effects of both banking supervision and monetary policy.

More focus on output stabilization would imply more focus on the objective of financial stability. Asset price changes and financial shocks have an impact on economic activity through well-known channels : wealth effects, Tobin’s Q channel, the financial accelerator

9. Discussions on the trade-off between these two objectives are provided for example by Issing (2003), Gadanecz et al. (2015) and Laséen et al. (2017).

10. See Smets (2014). For a discussion on the “single entity” *vs* “coordinated” approach, see Lombardi and Siklos (2016).

mechanism, the bank capital channel and the exchange rate channel. Thus, if central banks were more concerned with output stabilization, they would focus more on the financial stability objective, following the “leaning against the wind” strategy.

While the previous points explain a benign neglect attitude, a few recent papers consider that there is no trade-off between monetary and financial stability, and support the Schwartz’s hypothesis. Investigating the interactions between monetary and macroprudential instruments, De Paoli and Paustian (2017) find that increased conservatism improves welfare. On empirical grounds, Fazio et al. (2015) find that countries with inflation targeting (IT) frameworks have more stable banking systems. They interpret this result as a validation of the conventional wisdom : by reducing the degree of inflation uncertainty, IT countries are able to grow more. Then, in line with Lucas (2000), this should contribute to the development of credit markets and consequently to the improvement of financial stability.

This calls for a more general empirical assessment about the impact of the priority assigned to the inflation goal on the banking sector vulnerability. Focusing on policymakers’ preferences is required to shed a light on this issue.

2.3 Data

This section describes in detail characteristics of the variables we use in our empirical analysis and presents the theoretical justifications for them.

Measuring central banks’ preferences. Attempts to measure CBC are very scarce in the literature. They are inconvenient to expand in time and space, often time-invariant and model-dependent. These caveats are circumvented by the recent CONS indicator proposed by Levieuge and Lucotte (2014), which we expand in this paper. This indicator is based on the Taylor curve (Taylor, 1979), which precisely represents the trade-off between price and output volatility. It consists in measuring the relative importance assigned to the objective of inflation stabilization through the empirical variances of inflation and output gap, as detailed in the

Appendix.

As Leveuge and Lucotte (2014) argue, the CONS indicator has at least two main advantages. It is time-varying and model-independent. It does not impose any assumption about the monetary policy rule or strategy that a central bank follows. So it can assess the relative preferences of a central bank whatever monetary regime in place. These features are particularly important for our study, as we consider countries that have heterogeneous monetary policy practices, and monetary policy strategies have changed substantially around the world in recent decades. For example, a growing number of industrialized and emerging economies have abandoned monetary targeting and have instead adopted an inflation targeting framework. As shown in Leveuge and Lucotte (2013), these changes affect the degree of CBC. Finally, while Leveuge and Lucotte (2014) focus solely on the OECD countries from 1980 to 1998, we extend their index to a broader set of 73 countries, on an annual basis from 1980 to 2012, using the empirical variances of inflation and output gap computed over five-year rolling windows. Note that the CONS index lies between 0 and 1. The higher CONS is, the more conservative the central bank is considered to be in the sense of Rogoff (1985), and the lower it is, the less conservative the central bank. An immediate way to assess the relevance of this extension is to examine the correlation between CONS and the average inflation rate. Figure 2.3 in the Appendix indicates that except for in the 1980s, the correlation is clearly negative.

Note that a movement in the CONS index might not always reflect a conscious desire by the central bank to change its behaviour through changes in preferences. In particular, such a shift may partly result from a combination of supply and demand shocks. These shocks are supposed to be addressed over the five-year rolling windows that we consider to compute CONS. Indeed, the main task of the central bank is to respond to shocks so as to meet its objectives. Nevertheless, to be as rigorous as possible, supply and demand shocks will be taken into account as control variables (for details see *infra*). Moreover, we will use an alternative measure of CBC, labelled CONS_W, which is the CONS index adjusted for demand and supply shocks. Details are provided in the Appendix. While supply and demand shocks were expected to be particularly important in some emerging countries in our sample, CONS and CONS_W are highly correlated, as we can see in Figure 2.4 in the Appendix.

The average values of CONS and CONS_W by decades, for all the countries in our sample, are reported in Tables 2.11 and 2.12 in the Appendix. Overall, we observe that central banks became more conservative from the 1980s to the 2000s. This is particularly striking for the OECD countries, for at least two reasons. First, over this period, a significant number of them had joined the European Monetary Union (EMU) with the prospect of adopting the euro. This involved reforms in central bank legislation by the euro candidates and their rallying to the leadership of the reputedly conservative Bundesbank (Siklos, 2002). Second, more than one-third of the OECD countries have adopted an inflation targeting regime since the early 1990s. This has increased their inflation aversion, as shown by Leveuge and Lucotte (2013). In contrast, no clear trend emerges for non-OECD countries, in which preferences are heterogeneous.

Measures of banking sector vulnerability. As there is no universally accepted empirical measure of banking sector vulnerability, we employ six alternative variables commonly used in the literature.

First, a simple way of measuring the potential effect of benign neglect on financing conditions and financial instability more generally is to focus on credit volatility. In essence, the higher the credit volatility, the more unstable financing is for households and firms. This variable is calculated as a five-year moving variance on quarterly credit data, which come from the International Monetary Fund's International Financial Statistics (IFS) database.

Our second measure is the credit-to-GDP gap. This is one of the most widely accepted proxies for banking and financial imbalances among policymakers and academics. It is designed to measure the size of the credit cycle, as the deviations of credit from the "normal" range of historical experience - and then to capture excess credit growth. As argued by Minsky (1972) and Kindleberger (1978), credit booms tend to sow the seeds of crises. A number of empirical papers show that indicators of excess credit growth are efficient at providing a leading signal of banking distress (see, e.g., Borio and Lowe, 2004; Schularick and Taylor, 2012; Giese et al., 2014). A case in point is Dell'Ariccia et al. (2014), who find that one third of credit booms are followed by crises and three-fifths are followed by a period of economic underperformance in the six years following the end of the boom. This empirical evidence certainly explains why the Basel Committee on Banking Supervision (BCBS) recommends using the credit-to-GDP gap

as a benchmark for the activation and release of the countercyclical capital buffer. We compute the credit-to-GDP gap as the difference between the credit-to-GDP ratio and its Hodrick-Prescott (HP) filter trend. Credit refers to domestic loans provided by financial corporations to the household and private non-financial corporate sector. Data come from the World Bank's Global Financial Development (GFD) database.

The next four variables that we consider as proxies for banking sector vulnerability concern the structure of banks' balance sheets. They are taken from the GFD database. The first is the credit-to-deposit ratio, which measures the banking sector's funding stability. This ratio increases if credit creation is higher than deposit growth and decreases in the opposite case. Thus a higher ratio indicates there is more wholesale funding in the capital structure and is a signal of excessive bank leverage. As shown by Stremmel and Zsámboki (2015), an increasing credit-to-deposit ratio positively contributes to the amplitude of the financial cycle. Several recent papers about the global financial crisis indicate that the credit-to-deposit ratio is a good predictor of financial distress. For example, Caprio et al. (2014) show that the probability of suffering from the crisis in 2008 was larger for countries where the credit-to-deposit ratio was at higher levels. Ratnovski and Huang (2009) find that a large share of wholesale funding was the most robust predictor of distress for financial institutions during the subprime crisis.

Next, we consider the ratio of nonperforming loans to total gross loans. This variable is used as a proxy for the quality of banks' assets and, more generally, as a proxy for banking system stability. A higher value of this ratio indicates a degradation of the quality of the assets held by the banks in a given country. According to Čihák and Schaeck (2010), the proportion of nonperforming loans is also a good predictor of systemic banking vulnerabilities.

Then we consider the Z-score, a measure that is widely used in the literature to capture the solvency of the banking system (see, e.g., Demirgüç-Kunt et al., 2008; Laeven and Levine, 2009; Beck et al., 2010). It is based on a comparison between banks' buffers in the form of their capitalization and returns and their risks in the volatility of returns. Formally, the Z-score is defined as $Z = (k + \mu)/\sigma$, where k is equity capital as a percentage of assets, μ is return as a percentage of assets, and σ is the standard deviation of return on assets as a proxy for return volatility. Because a bank becomes insolvent when the value of its assets drops below the value

of its debt, the Z-score can be interpreted as the number of standard deviations that a bank's return must fall below its expected value to wipe out all the equity in the bank and render it insolvent. The Z-score is inversely related to the probability of a bank becoming insolvent. As our empirical analysis is conducted at the country level, the Z-score can then be interpreted as the banking system's distance to default.

Our last measure of banking sector vulnerability is the bank capital-to-asset ratio, which measures the banking system's capitalization. A higher ratio indicates a better capitalized banking system. As a bank with higher capital provides a cushion against insolvency and better resilience to adverse shocks, this ratio can be viewed as an inverse proxy for banking system vulnerability.

Note that the credit-to-deposit ratio, the capital-to-asset ratio and the share of nonperforming loans to total gross loans are variables that belong to the "financial soundness indicators" of the International Monetary Fund. Ultimately, using these six different indicators allows us to consider all aspects of banking sector vulnerabilities.

Control variables. We also need to control for factors other than CBC that may impact banking sector vulnerabilities. There is no consensus in the empirical literature on the determinants of financial and banking imbalances. Following the literature on early warning indicators (see, e.g., Frankel and Saravelos, 2012), we therefore consider a large range of structural, cyclical and regulatory control variables.

The first set of these variables is intended to control for the economic conditions and shocks that the banking sector faces. To this end, we identify demand and supply shocks by applying the decomposition scheme suggested by Blanchard and Quah (1989) and consider the variance of these shocks as control variables. Like with the inflation and output gap volatilities used to compute the CONS index, the variance of shocks is calculated over five-year rolling windows. As argued by Leveuge and Lucotte (2014), it is also important to control for demand and supply shocks because they can impact the output gap and inflation variabilities, and thus the value of the CONS index. Thus, by considering the variance of demand and supply shocks, we control for inflation and output gap volatilities not necessarily reflecting a conscious willingness

by the central bank to prioritize inflation stabilization. We then take the heterogeneity of the country sample into account by considering real GDP per capita as an indicator of the level of development. This variable is taken from the World Bank's World Development Indicators (WDI) database.

The second set of control variables is intended to capture the degree of banking competition because this can affect the risk-taking behaviour of financial intermediaries and, in turn, banking sector vulnerability. We measure the level of banking competition using two proxies commonly employed in the banking literature. The first is the Lerner index, which measures the degree of market power of the banks and is thus an inverse proxy for bank competition. A low value (the minimum is 0) indicates a high degree of competition, while a high value (the maximum is 1) indicates a low competitive environment. The second proxy we consider is a measure of bank concentration. This corresponds to the assets of the three largest commercial banks as a share of total commercial banking assets. As with the Lerner index, bank concentration is an inverse proxy for competition because a concentrated market structure is expected to be associated with higher prices and profits, reflecting an uncompetitive context. These two variables are obtained from the GFD database. Despite the large number of studies devoted to the competition-stability nexus, the relationship between competition and bank risk-taking remains ambiguous. Under the "competition-fragility" view, bank competition is seen as detrimental to financial stability. Conversely, the "competition-stability" view rejects the competition-stability trade-off hypothesis and argues that market power increases bank portfolio risks.

Finally, we control for the regulation of the banking system. To this end, we consider the banking sector supervision index developed by Abiad et al. (2010). This index comprises four sub-components and takes values from 0 to 6. A higher value indicates greater supervision and regulation of the banking system, then we expect that this variable is negatively related to the fragility of the banking sector. To have a complete picture of the degree of financial liberalization, we also consider a measure of financial openness using the Chinn-Ito index (Chinn and Ito, 2008). This index is a *de jure* measure of financial openness that assesses the extent of openness in capital account transactions. It is normalized between 0 and 1, with the highest degree of financial openness corresponding to a value of 1 and the lowest to a value of 0. The

expected impact of this variable on the vulnerability of the banking sector is uncertain. On the one hand, according to Abiad et al. (2007), greater financial openness allows investors to diversify their portfolios : this implies a longer investment horizon and reduces the risk of sudden stops, which may in itself reduce banking vulnerability.¹¹ On the other hand, globally integrated financial systems are more exposed to international financial shocks and may experience more pronounced financial vulnerability (Giannone et al., 2011).

Figure 2.1 reports the mean value of our six measures of vulnerability for each quartile of the CBC indexes. We observe a positive correlation between the CBC indexes and the mean values of credit volatility, the credit-to-GDP gap, and the credit-to-deposit ratio, in accordance with the benign neglect hypothesis. Analogously, we see that higher degrees of conservatism are related to lower capital-to-asset ratios. The plots are less clear for the nonperforming loans ratio and the Z-score variable. We formally investigate this issue in the next section.

2.4 Methodology and results

This section presents the methodology and the results of our empirical analysis. Driven by data availability, the sample covers 73 countries, from 1980 to 2012.¹² To test the impact of central banks' preferences on banking sector vulnerability, so testing benign neglect against Schwartz's hypothesis, we run the following estimation :

$$Y_{i,t} = \alpha + \beta CBP_{i,t} + \gamma_1 \sigma_{i,t} + \gamma_2 X_{i,t-1} + \delta_i + \delta_t + \epsilon_{i,t} \quad (2.1)$$

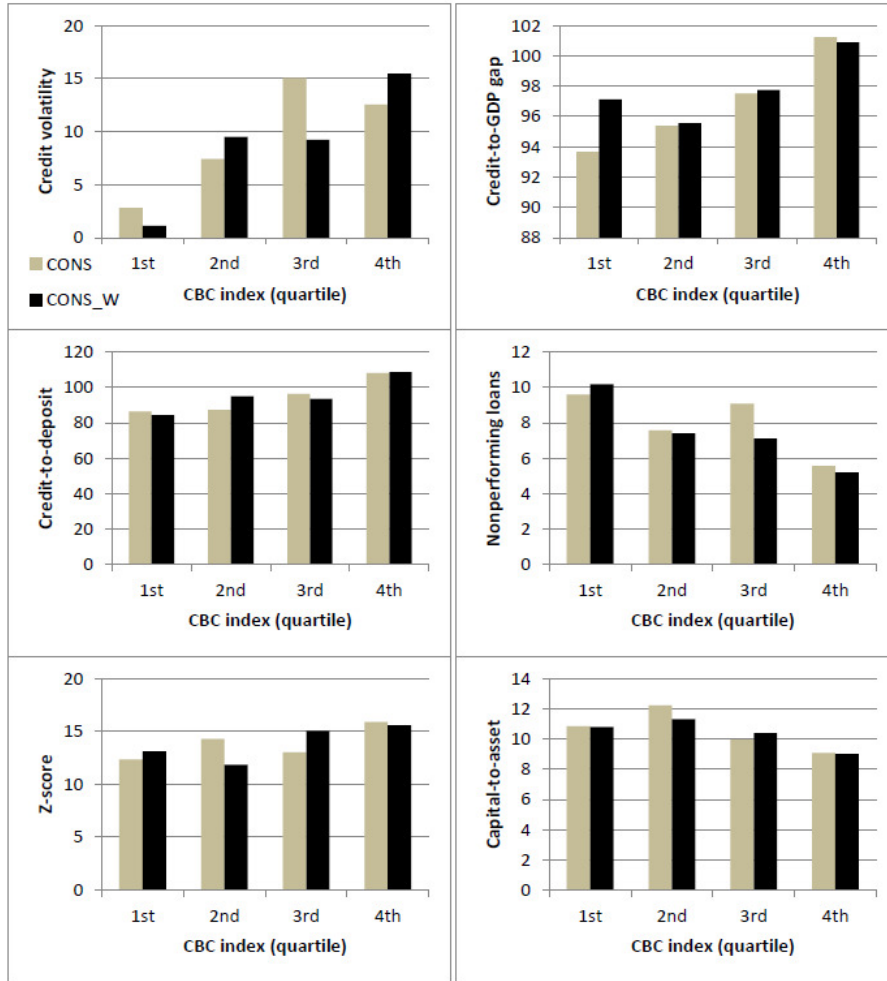
where $Y_{i,t}$ alternatively represents one of our six measures of banking sector vulnerability for country i at time t . $CBP_{i,t}$ is the indicator of central banks' preferences (CONS or CONS_W)¹³, $\sigma_{i,t}$ is a vector containing the variances of supply and demand shocks, and $X_{i,t-1}$ is a vector that includes the other control variables, which are lagged to address potential endogeneity.

11. See also Calvo et al. (2008) and Abiad et al. (2009) for empirical evidence.

12. See the Appendix for further details on the composition of our sample. Countries are excluded from the sample once they join a monetary union. This is the case for the members of the EMU, CEMAC, WAEMU and ECCU.

13. As mentioned above, CONS and CONS_W are calculated using inflation and output gap volatilities computed over five-year rolling windows.

FIGURE 2.1 – Central banks' preferences and banking sector vulnerability



Source: Authors' calculation

Moreover, country fixed effects (δ_i) are included in equation (2.1) and are intended to eliminate unobserved time-invariant heterogeneity at the country level. We also introduce time fixed effects (δ_t) to absorb the impact of global shocks that may affect all the countries in the sample, such as the subprime crisis. $\epsilon_{i,t}$ is the error term.

Throughout the study, we will be particularly interested in the sign and significance of β . For Y , measuring banking sector vulnerabilities, a positive β would validate the benign neglect hypothesis, while a negative one would support Schwartz's hypothesis. As the Z-score and capital-to-asset ratio are inverse proxies for banking vulnerabilities, the signs related to the alternative hypotheses are reversed.

Table 2.1 presents the results with credit volatility and the credit-to-GDP gap as endo-

genous variables. Table 2.2 reports results obtained with the credit-to-deposit ratio and the nonperforming loans to total gross loans ratio. Finally, Table 2.3 gives the results obtained with the Z-score and the capital-to-assets ratio as proxies for banking sector vulnerability. In each table, specification (1) includes *CONS*, the variances of macroeconomic shocks and real GDP per capita as explanatory variables. Specifications (2) and (3) then successively include variables intended to control for banking competition or concentration in (2), and for the financial environment in (3). Banking competition and banking concentration are included simultaneously because many studies find no evidence that bank competitiveness measures are related to banking system concentration (see, e.g., Claessens and Laeven, 2004).

TABLE 2.1 – Central banks' preferences and banking sector vulnerability : Results obtained with the credit volatility and the credit-to-GDP gap

| Dependent variable | Credit volatility | | | Credit-to-GDP gap | | |
|---------------------------|----------------------|-----------------------|-----------------------|----------------------|-----------------------|------------------------|
| | (1) | (2) | (3) | (1) | (2) | (3) |
| CONS | 21.876** (11.009) | 62.121*** (20.210) | 45.351*** (13.176) | 15.300*** (2.715) | 17.241*** (3.534) | 14.845*** (5.590) |
| Variance of supply shocks | -2.497 (4.396) | -1.610 (8.524) | -1.404 (5.138) | 0.845 (1.083) | -1.983 (1.478) | -1.829 (2.181) |
| Variance of demand shocks | 6.219 (4.200) | 5.836 (7.436) | 6.038 (5.355) | -2.995*** (1.033) | -1.601 (1.290) | -4.482** (2.267) |
| GDP per capita | -0.051 (0.097) | -0.220 (0.236) | -0.136 (0.184) | 0.018 (0.025) | 0.224*** (0.044) | 0.489*** (0.078) |
| Lerner index | | -71.759** (32.971) | -47.322** (20.100) | | 16.776*** (5.980) | 8.992 (8.535) |
| Bank concentration | | 0.001 (0.269) | -0.097 (0.168) | | 0.025 (0.050) | -0.016 (0.071) |
| Financial openness | | | -7.794 (19.617) | | | 15.387* (8.319) |
| Banking supervision | | | -6.483 (7.647) | | | 0.798 (3.247) |
| Constant | 3.171 (50.881) | 3.588 (37.540) | 21.713 (39.302) | 20.089 (13.857) | -34.071*** (6.782) | -82.981*** (16.826) |
| Observations | 874 | 520 | 339 | 998 | 628 | 343 |
| R-squared | 0.047 | 0.071 | 0.089 | 0.144 | 0.230 | 0.275 |
| Number of countries | 73 | 65 | 53 | 73 | 66 | 53 |
| CONS_W | 27.396** (10.764) | 65.735*** (20.449) | 45.038*** (13.012) | 12.634*** (2.682) | 15.400*** (3.589) | 15.426*** (5.507) |
| Variance of supply shocks | 1.098 (4.672) | 7.248 (8.974) | 4.803 (5.506) | 2.444** (1.153) | 0.127 (1.553) | 0.313 (2.336) |
| Variance of demand shocks | 2.797 (4.350) | -3.392 (7.807) | -1.101 (5.422) | -4.763*** (1.064) | -3.878*** (1.333) | -6.886*** (2.294) |
| GDP per capita | -0.056 (0.096) | -0.205 (0.235) | -0.117 (0.183) | 0.026 (0.025) | 0.235*** (0.044) | 0.493*** (0.078) |
| Lerner index | | -64.512* (32.924) | -43.986** (20.013) | | 18.534*** (6.045) | 10.009 (8.488) |
| Bank concentration | | 0.020 (0.269) | -0.112 (0.168) | | 0.027 (0.051) | -0.019 (0.071) |
| Financial openness | | | -7.844 (19.612) | | | 15.369* (8.307) |
| Banking supervision | | | -5.719 (7.632) | | | 1.032 (3.237) |
| Constant | 2.200 (50.694) | -0.826 (37.796) | 20.474 (39.342) | 22.115 (13.914) | -33.681*** (6.918) | -83.725*** (16.824) |
| Observations | 874 | 520 | 339 | 998 | 628 | 343 |
| R-squared | 0.050 | 0.073 | 0.089 | 0.135 | 0.223 | 0.277 |
| Number of countries | 73 | 65 | 53 | 73 | 66 | 53 |

Note : Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

TABLE 2.2 – Central banks' preferences and banking sector vulnerability : Results obtained with the credit-to-deposit ratio and the nonperforming loans ratio

| Dependent variable | Credit-to-deposit ratio | | | Nonperforming loans ratio | | |
|---------------------------|-------------------------|-----------------------|-----------------------|---------------------------|-----------------------|----------------------|
| | (1) | (2) | (3) | (1) | (2) | (3) |
| CONS | 18.919*** (5.451) | 31.487*** (6.617) | 23.641** (10.693) | 6.539*** (1.378) | 6.692*** (1.414) | 4.875*** (1.866) |
| Variance of supply shocks | -10.270*** (2.179) | -3.088 (2.692) | -3.732 (4.102) | 0.705 (0.499) | 0.592 (0.558) | 0.309 (0.689) |
| Variance of demand shocks | -3.470* (2.097) | -4.756* (2.443) | -13.156*** (4.248) | 2.354*** (0.479) | 2.242*** (0.493) | 2.237*** (0.716) |
| GDP per capita | 0.317*** (0.050) | 0.462*** (0.085) | 0.993*** (0.163) | 0.082*** (0.017) | 0.074*** (0.017) | 0.035 (0.026) |
| Lerner index | | 8.420 (10.943) | -20.553 (16.185) | | -10.156*** (2.266) | -7.782*** (2.722) |
| Bank concentration | | -0.197** (0.093) | -0.309** (0.144) | | -0.022 (0.019) | 0.025 (0.023) |
| Financial openness | | | -21.987 (15.634) | | | -1.623 (2.753) |
| Banking supervision | | | -2.668 (6.188) | | | -0.655 (1.046) |
| Constant | 23.120 (26.760) | 51.461*** (12.834) | 11.704 (31.951) | -11.083*** (2.634) | -7.613** (2.976) | -3.424 (5.399) |
| Observations | 940 | 581 | 325 | 607 | 574 | 316 |
| R-squared | 0.150 | 0.192 | 0.235 | 0.303 | 0.331 | 0.396 |
| Number of countries | 72 | 65 | 52 | 65 | 63 | 50 |
| CONS_W | 13.406** (5.359) | 25.630*** (6.694) | 25.961** (10.501) | 6.328*** (1.409) | 5.961*** (1.460) | 4.951*** (1.882) |
| Variance of supply shocks | -8.614*** (2.302) | 0.426 (2.818) | -0.172 (4.360) | 1.575*** (0.525) | 1.404** (0.584) | 0.972 (0.732) |
| Variance of demand shocks | -5.529** (2.159) | -8.945*** (2.534) | -17.119*** (4.310) | 1.412*** (0.486) | 1.364*** (0.508) | 1.435* (0.737) |
| GDP per capita | 0.327*** (0.050) | 0.474*** (0.086) | 0.996*** (0.162) | 0.084*** (0.017) | 0.077*** (0.017) | 0.038 (0.026) |
| Lerner index | | 11.092 (11.111) | -19.245 (16.100) | | -9.510*** (2.290) | -7.493*** (2.706) |
| Bank concentration | | -0.198** (0.094) | -0.316** (0.143) | | -0.020 (0.019) | 0.025 (0.023) |
| Financial openness | | | -21.980 (15.598) | | | -1.749 (2.752) |
| Banking supervision | | | -2.243 (6.165) | | | -0.577 (1.044) |
| Constant | 27.201 (26.802) | 55.650*** (13.049) | 10.082 (31.869) | -10.884*** (2.642) | -7.350** (3.026) | -3.621 (5.410) |
| Observations | 940 | 581 | 325 | 607 | 574 | 316 |
| R-squared | 0.144 | 0.179 | 0.239 | 0.300 | 0.323 | 0.396 |
| Number of countries | 72 | 65 | 52 | 65 | 63 | 50 |

Note : Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

TABLE 2.3 – Central banks' preferences and banking sector vulnerability : Results obtained with the Z-score and the capital-to-asset ratio

| Dependent variable | Z-score | | | Capital-to-asset ratio | | |
|---------------------------|----------------------|----------------------|----------------------|------------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (1) | (2) | (3) |
| CONS | -2.273** (1.105) | -2.062* (1.200) | -4.421* (2.298) | -2.936*** (0.598) | -1.994*** (0.580) | -1.158 (1.051) |
| Variance of supply shocks | 0.691 (0.438) | 0.374 (0.495) | -0.210 (0.897) | 0.409* (0.211) | 0.199 (0.227) | -0.574 (0.396) |
| Variance of demand shocks | -1.604*** (0.408) | -1.630*** (0.433) | -2.754*** (0.932) | -0.588*** (0.204) | -0.715*** (0.194) | -0.752* (0.386) |
| GDP per capita | -0.015 (0.013) | -0.023 (0.015) | -0.013 (0.032) | -0.013 (0.008) | -0.016** (0.008) | -0.026 (0.018) |
| Lerner index | | 2.911 (2.036) | -1.724 (3.509) | | 4.067*** (0.948) | 2.762* (1.513) |
| Bank concentration | | 0.017 (0.017) | -0.010 (0.029) | | 0.025*** (0.008) | 0.043*** (0.015) |
| Financial openness | | | -2.938 (3.420) | | | -1.258 (1.934) |
| Banking supervision | | | -0.539 (1.335) | | | -0.153 (0.605) |
| Constant | 15.238*** (1.840) | 13.703*** (2.325) | 21.073*** (6.918) | 12.779*** (1.155) | 10.493*** (1.280) | 11.969*** (3.222) |
| Observations | 738 | 641 | 343 | 457 | 429 | 187 |
| R-squared | 0.041 | 0.053 | 0.058 | 0.115 | 0.167 | 0.161 |
| Number of countries | 70 | 66 | 53 | 54 | 52 | 40 |
| CONS_W | -3.230*** (1.082) | -3.383*** (1.208) | -4.662** (2.265) | -3.096*** (0.614) | -2.014*** (0.608) | -1.043 (1.157) |
| Variance of supply shocks | 0.244 (0.465) | -0.063 (0.516) | -0.858 (0.961) | -0.008 (0.218) | -0.073 (0.231) | -0.719* (0.398) |
| Variance of demand shocks | -1.181*** (0.416) | -1.217*** (0.444) | -2.031** (0.944) | -0.151 (0.209) | -0.429** (0.202) | -0.576 (0.410) |
| GDP per capita | -0.015 (0.013) | -0.024 (0.015) | -0.014 (0.032) | -0.014* (0.008) | -0.017** (0.008) | -0.027 (0.018) |
| Lerner index | | 2.383 (2.040) | -2.020 (3.491) | | 3.776*** (0.962) | 2.664* (1.511) |
| Bank concentration | | 0.014 (0.017) | -0.009 (0.029) | | 0.025*** (0.008) | 0.043*** (0.015) |
| Financial openness | | | -2.934 (3.417) | | | -1.329 (1.958) |
| Banking supervision | | | -0.607 (1.332) | | | -0.183 (0.606) |
| Constant | 15.833*** (1.824) | 14.907*** (2.348) | 21.327*** (6.920) | 12.909*** (1.159) | 10.636*** (1.307) | 12.066*** (3.318) |
| Observations | 738 | 641 | 343 | 457 | 429 | 187 |
| R-squared | 0.048 | 0.061 | 0.060 | 0.117 | 0.165 | 0.159 |
| Number of countries | 70 | 66 | 53 | 54 | 52 | 40 |

Note : Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Due to data availability, it is important to note that the three specifications that we consider cover different time periods. The specification (1) covers the period from 1980 to 2012. The specification (2) covers the period from 1996 to 2012, as the competition and concentration measures provided by GFD database are available since 1996. Finally, the specification (3), which includes all control variables, covers the period from 1996 to 2005, because the measure of banking sector supervision provided by Abiad et al. (2010) are only available until 2005.¹⁴

For all the specifications reported from Tables 2.1 to 2.3, we find a robust relationship between the measure of inflation aversion of the central bank and the level of banking sector vulnerability. Except specification (3), with the capital-to-asset ratio as the endogenous variable, the coefficients associated with the CONS index are significant at the conventional levels, with a sign that validates the benign neglect hypothesis. This also applies to the CONS_W index. The link between the central banks' inflation aversion and the vulnerability of the banking sector is even stronger with CONS_W, in particular with the Z-score as dependent variable. Thus, the more the central banks focus on the inflation goal, the more this increases fragility of the banking sector. Credit cycles are amplified, with more excessive and volatile amounts of credit (Table 2.1) and banks' balance sheets are deteriorated (Tables 2.2 and 2.3). A higher degree of CBC clearly entails higher banking sector vulnerability. Importantly, this result holds despite changes in the sample size and the period covered due to data availability, in particular once variables capturing the banking market structure and financial regulation are included. This is a first evidence of robustness.

The non-significance of the coefficient for the central banks' preferences when the capital-to-asset ratio is used as the dependent variable in specification (3) can easily be explained. Since the late 1980s, the Basel Committee on Banking Supervision (BCBS) has made recommendations on regulations on bank capital and leverage. The most striking example is the implementation in 1992 of the Cook ratio as an international norm for banks' capital. Such requirements were followed by many countries whatever the preferences of their central banks.

14. Unfortunately, there does not yet exist in the literature a database on banking sector supervision and regulation that covers a longer time span. Due to data availability, please also note that, for each specification, the time period depends on the endogenous variable considered. The credit volatility, the credit-to-GDP gap, and the credit-to-deposit ratio cover the period from 1980 to 2012, while the other measures of banking sector vulnerability cover the period 1998 to 2012.

In our sample, no country has an average capital-to-asset ratio below the reference value of 3%¹⁵ (the norm recommended by the Basel III agreement, see BIS, 2014). This is the case for the 40 countries that remain once financial openness and regulation data are considered in specification (3). In consequence, this variable does not act as a discriminant indicator of banking sector vulnerability for these countries.

Moreover, the significance of the control variables depends on both the sample size and the choice of the dependent variable, particularly for macroeconomic shocks. As highlighted above, the expected sign of banking competition is unclear. When the Lerner coefficient is significant, competition between banks tends to weaken the banking sector in most cases. Our result highlights the “competition-fragility” view mentioned above. This explanation is particularly relevant when we consider the nonperforming loans ratio, the capital-to-asset ratio, and the credit volatility as endogenous variables. The coefficients associated with the concentration index lead to the same conclusion with the credit-to-deposit ratio and the capital-to-asset ratio as left-hand side variables. A more concentrated banking market seems to lead to a more stable financial sector. Next, the coefficient estimates associated with the banking sector supervision appear not statistically significant at the conventional levels. Finally, financial openness is only significant when we consider the credit-to-GDP gap as an endogenous variable. Overall, the signs associated with the control variables are consistent with the theoretical arguments raised in the literature.

2.5 Robustness checks

To enhance the credibility and plausibility of our earlier findings, we check the robustness of our baseline results in five ways. First, we address the fact that the global shocks that emerging and industrialised countries face are not necessarily symmetric, and we also control for the potential break induced by the subprime crisis. Second, we check whether our baseline results are sensitive to the set of control variables by considering some alternative control variables. Third,

15. In the measure we use, the definition of banks’ capital is broader than those adopted by the Basel Committee; however, the measure also underestimates banks’ assets because, unlike the Basel III agreement, it does not consider off-balance-sheet assets. Therefore, the 3% threshold can be considered more restrictive for our measure.

we perform the same exercise by considering additional right-hand side variables capturing some features of the monetary policy framework and characteristics of the banking sector. Fourth, we propose an alternative measure of central banks' preferences which explicitly takes into account some other factors that could impact the inflation and output gap volatility. Finally, we address the potential reverse causality issue between central banks' preferences and the vulnerability of the banking sector by re-estimating our baseline model using a two-stage least squares (2SLS) estimator.

Sample heterogeneity and subprime crisis. The recent evidence suggests that industrialised, emerging, and developing countries have not been impacted in a similar way by the subprime crisis. Indeed, a number of developing economies were protected from the immediate consequences of the financial crisis by relatively underdeveloped financial markets and limited international linkages. Instead, they were impacted by the crisis more gradually and through somewhat different channels than developed and emerging countries, such as the decline of global trade, the decline of remittances, and reduced capital flows.

Given potential heterogeneity, we check the robustness of our results in two ways. First, we replace time fixed effects by time-group fixed effects, by considering two groups of countries, OECD and non-OECD. By this way, we take explicitly into account the fact that common shocks are not the same for OECD and non-OECD countries. Results that we obtain concerning the CONS and CONS_W indexes are not impacted by this change.

Second, we include a dummy variable capturing the subprime crisis. However, since the banking sectors of economies around the world have not been impacted in the same way by the subprime crisis, we do not consider the same dummy variable for all countries of our sample. As our main research question concerns the fragility of the banking sector, we prefer to consider a subprime crisis dummy variable equal to 1 for countries which have known at the same period a systemic banking crisis, and 0 otherwise. To this end, we refer to the comprehensive database on systemic banking crises compiled by Laeven and Valencia (2018). Results that we obtain are reported in Table 2.4. To save space, we only report the coefficient estimates associated with the CONS and CONS_W indexes, and those associated with the subprime crisis dummy

variable.¹⁶

As expected, for both specifications, we find a robust and significant positive relationship between the crisis dummy and the credit volatility. This result is closely linked to the slowdown in credit growth in the aftermath of the crisis, which exacerbates the volatility of credit.¹⁷ This decline in bank lending probably also explains the negative relationship that we observe between the crisis dummy and the credit-to-deposit ratio, even if this relationship is only statistically significant for the specification (1). Similar results are obtained for the nonperforming loans ratio and the Z-score. More importantly, we still observe a significant relationship between the CONS (or CONS_W) index and our alternative measures of banking sector vulnerability. This confirms our initial findings that central banks' preferences are an important driver of the fragility of the banking sector.

Alternative control variables. We assess whether our baseline results are sensitive to the set of control variables by considering some alternative control variables. First, following Demirgüç-Kunt and Detragiache (1998), we replace demand and supply shocks with the annual growth rate of real GDP and the annual inflation rate. These two variables are taken from the WDI database and constitute an alternative approach to capturing macroeconomic shocks that may adversely affect the economy and the banking system and, in turn, drive financial imbalances.

Second, we consider two alternative proxies for banking competition. We replace the Lerner index with the Boone index. As the Lerner index, the Boone index is a non-structural competition measure and is taken from the GFD database. Despite the intensive academic debate between the proponents of the Lerner index and those of the Boone index, some recent empirical papers in the banking literature use the Boone index as a measure of bank competition (see, e.g., Van Leuvensteijn et al., 2011; Schaeck and Čihák, 2014). In the same way, we consider an alternative measure of bank concentration, defined as the assets of the five largest commercial banks, rather than the three largest, as a share of total assets of the banking sector.¹⁸

16. The specification (3) is not considered because, as explained above, it only covers the period from 1996 to 2005.

17. Indeed, this variable is calculated as a five-year moving variance on quarterly credit data.

18. Please also note that our main empirical findings are not affected when we re-estimate our model by considering individually each of the four bank competition proxies considered in this paper.

TABLE 2.4 – Robustness checks - Results obtained with a subprime crisis dummy as additional control variable

| Results obtained with CONS index | | | | | | |
|------------------------------------|---------------------------|-----------|-------------------|-----------|-------------------------|-----------|
| Dependent variable | Credit volatility | | Credit-to-GDP gap | | Credit-to-deposit ratio | |
| | (1) | (2) | (1) | (2) | (1) | (2) |
| CONS | 19.890* | 59.062*** | 15.753*** | 17.320*** | 20.107*** | 31.832*** |
| | (11.009) | (20.246) | (2.727) | (3.580) | (5.442) | (6.668) |
| Subprime crisis dummy | 33.374** | 32.207* | -4.525 | -0.411 | -18.938*** | -2.784 |
| | (14.102) | (18.949) | (2.778) | (2.874) | (6.484) | (6.326) |
| | Nonperforming loans ratio | | Z-score | | Capital-to-asset ratio | |
| | (1) | (2) | (1) | (2) | (1) | (2) |
| CONS | 6.234*** | 6.552*** | -1.998* | -1.840 | -3.033*** | -2.019*** |
| | (1.385) | (1.430) | (1.115) | (1.215) | (0.603) | (0.587) |
| Subprime crisis dummy | 1.824* | 0.727 | -1.609* | -1.096 | 0.507 | 0.116 |
| | (1.020) | (1.056) | (0.931) | (0.971) | (0.415) | (0.409) |
| Results obtained with CONS_W index | | | | | | |
| Dependent variable | Credit volatility | | Credit-to-GDP gap | | Credit-to-deposit ratio | |
| | (1) | (2) | (1) | (2) | (1) | (2) |
| CONS_W | 25.967** | 63.839*** | 12.946*** | 15.357*** | 14.576*** | 25.867*** |
| | (10.748) | (20.423) | (2.690) | (3.618) | (5.353) | (6.743) |
| Subprime crisis dummy | 33.418** | 34.090* | -3.977 | 0.293 | -18.510*** | -1.991 |
| | (14.060) | (18.872) | (2.788) | (2.873) | (6.509) | (6.373) |
| | Nonperforming loans ratio | | Z-score | | Capital-to-asset ratio | |
| | (1) | (2) | (1) | (2) | (1) | (2) |
| CONS_W | 6.055*** | 5.819*** | -3.009*** | -3.223*** | -3.163*** | -2.020*** |
| | (1.412) | (1.469) | (1.088) | (1.217) | (0.617) | (0.612) |
| Subprime crisis dummy | 1.948* | 0.977 | -1.535* | -1.015 | 0.446 | 0.037 |
| | (1.019) | (1.056) | (0.925) | (0.962) | (0.413) | (0.407) |

Note : Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Third, we re-estimate our baseline model by replacing the banking supervision index with a measure of *de jure* supervisory power to give a more complete picture of prudential regulation. This index has been developed by Barth et al. (2013) and lies between 0 and 16. The expected sign of the variable is negative, as a higher value implies greater supervisory power.

Finally, we consider a proxy for the quality of domestic institutions as an alternative to the banking supervision index. This choice is driven by several considerations. As argued by Demirgüç-Kunt and Detragiache (1998), the quality of domestic institutions is highly related to the ability of the government to implement effective prudential supervision. Moreover, a weak institutional framework is expected to exacerbate financial fragility, as it provides limited judicial protection to creditors and shareholders (Shimpalee and Breuer, 2006). Given this, we use the “law and order” index compiled by the International Country Risk Guide (ICRG). This

index lies between 0 and 6, with a higher value indicating better institutional quality. It has been widely used in the empirical literature devoted to financial fragility (see, e.g., Demirgüç-Kunt and Detragiache, 1998; Kaminsky and Schmukler, 2003).

Results that we obtain suggest that considering alternative control variables does not affect our main results. Indeed, we still find a statistically significant relationship between central banks' preferences and our different variables proxying the vulnerability of the banking sector. As for our baseline estimates, we find a positive and significant relationship between the CONS (or CONS_W) index and the credit volatility, the credit-to-GDP gap, the credit-to-deposit ratio, and the nonperforming loans ratio, and a negative and significant relationship between the CONS (or CONS_W) index and the Z-score, and the capital-to-asset ratio. Then, our findings confirm that strong preferences of the central bank for price stability exacerbate the vulnerability of the banking sector, and then financial instability.

Controlling for the features of the monetary policy framework. We extend the set of control variables by considering three different features of the monetary policy framework : the degree of central bank independence, the type of exchange rate regime and, whether a central bank pursues or not an inflation targeting strategy.

According to Čihák (2007), the independence of a central bank could enhance financial stability. Indeed, independence from the political authorities reduces monetary policy constraint and allows central bankers to react quicker and stronger to financial distress. On the contrary, dependent central banks delay their response to financial imbalances, as electoral purposes lead policymakers to maintain the status quo in order to transfer the problem to their successor. The empirical analysis conducted by Klomp and De Haan (2009) supports this view. Using bank-level data, Doumpos et al. (2015) reach the same conclusion. They show that the independence of the central bank and other supervisory agencies exercises a positive impact on the soundness of banking institutions. Nevertheless, some other papers support the opposite view (see, e.g., Berger and Kießmer, 2013; Aklin and Kern, 2019). Furthermore, other studies focus on the role of inflation targeting framework on financial stability (see, e.g., Frappa and Mésonnier, 2010; Fazio et al., 2015). However, these papers reach opposite conclusions. The last important feature of the monetary policy framework that we consider is the exchange rate regime. Indeed, a number

of empirical studies investigate the linkages between exchange rate regimes and banking crises (see, e.g., Domaç and Martinez Peria, 2003).

The degree of central bank independence is measured using two well-known proxies introduced by Cukierman et al. (1992) : the CWN index and the turnover rate of central bank governors (TOR index). The former is a *de jure* index of central bank independence. The CWN index has been recently updated by Garriga (2016) for a large sample of countries. The TOR index is commonly used in the literature as an inverse proxy for central bank independence. It is viewed as more reliable when the rule of law is not strongly embedded in the political culture, as is sometimes the case in some developing and emerging countries. The index is computed over five-year rolling windows, and information on the term in office of central bank governors comes from Dreher et al. (2008). Consequently, as our sample contains advanced and emerging countries, we include simultaneously these two proxies for central bank independence as additional control variables.

As usual in the literature, we consider two alternative binary variables for controlling for the adoption of an inflation targeting framework. The first takes the value of 1 when a country in a given year has at least partially adopted inflation targeting as a monetary policy strategy, and 0 otherwise. The second measures the fully-fledged adoption of an inflation targeting framework. It takes the value of 1 only when an inflation targeting country satisfies all prerequisites for inflation targeting, and 0 otherwise.

Finally, to control for the exchange rate regime, we use a *de jure* and a *de facto* classification. Both classifications are polynomial variables and come from the classification taxonomy introduced by the International Monetary Fund (IMF) and Ghosh et al. (2010). Exchange rate regimes are classified into eight categories, from the less flexible regime (1) to the most flexible (8).

We re-estimate our three baseline specifications by including individually each of the additional control variables discussed above. Results that we obtain are reported in Tables 2.5 to 2.7. To save space, we only report the coefficient estimates for the CONS and CONS_W indexes. As we can see, results are quite similar to our initial findings and thus confirm the robustness

of the link between central banks' preferences and banking sector vulnerability. Concerning the additional control variables, in line with the existing empirical literature, results that we obtain are more mixed.¹⁹

Controlling for other characteristics of the banking sector. We extend the set of control variables by considering different features of the banking industry. First, following the recent empirical literature having investigated the competition-efficiency-stability nexus, we consider additional control variables proxying the efficiency of the banking sector. Indeed, as shown by Schaeck and Čihák (2014), efficiency is the transmission mechanism through which competition contributes to stability. The proxies for banking sector efficiency that we consider are the bank cost to income ratio and the bank overhead costs to total assets ratio. They are taken from the GFD database. The bank cost to income ratio is defined as the operating expenses of a bank as a share of sum of net-interest revenue and other operating income, while the bank overhead costs to total assets ratio represents the operating expenses of a bank as a share of the value of all assets held. These two variables are expressed in percentage terms. The World Bank computes them by considering for each country the median of the bank-level ratios.

Second, we control for the diversification of income sources in the banking industry, i.e. interest *vs* non-interest income.²⁰ Indeed, the link between the income diversification and bank risk has attracted increasing attention in academic research.²¹ Our measure of income diversification is taken from the GFD database, and is defined as the ratio of bank non-interest income to total income. As for the measures of banking sector efficiency, the World Bank considers for each country the median of the bank-level ratios.

Third, we control for the relative importance of the foreign bank presence in domestic banking systems. As well-documented by Claessens and Van Horen (2014), there is an extensive debate in the academic literature concerning the potential costs and benefits of foreign bank

19. We have also tested the potential indirect effects of these features of the monetary policy framework through interaction terms with our two measures of central banks' preferences, namely the CONS and CONS_W indexes. Results that we obtain suggest that interaction terms are generally not statistically significant at the conventional levels.

20. Non-interest income includes in particular income from trading and securitization, investment banking and advisory fees, brokerage commissions, venture capital, fiduciary income, and gains on non-hedging derivatives.

21. See, e.g., DeYoung and Roland (2001) and Köhler (2015).

ownership, particularly in terms of financial stability. The variable that we consider to measure the relative importance of the foreign bank presence is taken from the GFD database, and corresponds to the percentage of the number of foreign owned banks to the number of the total banks in the host economy. A bank is defined as foreign-owned if 50 % or more of its shares are owned by foreigners.²²

Fourth, we take into account the fact that risk may be different for government-owned banks and privately-owned banks, and then, the fact that the ownership structure of the banking sector may impact its vulnerability (see, e.g., La Porta et al., 2002; Barth et al., 2013). Following the existing macro literature, we measure the relative importance of government ownership in the banking industry as the share of state-owned or state controlled bank assets on the total banking sector assets. A bank is classified as state-owned when the government's equity ownership exceeds 50%. This variable is taken from Barth et al. (2013), and covers the period 1999-2012.²³

Finally, we test the robustness of our results by including the capital flows as an additional control variable in the specification (3). Following Calvo et al. (2008), the measure of capital flows is calculated as the sum of foreign direct and portfolio investments, using data constructed by Lane and Milesi-Ferretti (2007). While we used the Chinn-Ito index as a proxy for legal financial openness in our baseline estimates, this test accounts simultaneously for both the legal and the actual dimensions of financial openness.

Results that we obtain when we consider these additional control variables are reported Tables 2.5 to 2.7. To save space, we only report the coefficient estimates for the CONS and CONS_W indexes. We can see that our findings still support a strong relationship between central banks' preferences for inflation stabilization and the fragility of the banking sector.

Alternative measure of central banks' preferences. We develop an alternative measure of central banks' preferences which control for the fact that the monetary policy dependence

22. The Global Financial Development Database (GFDD) also provides as a measure of foreign bank presence the foreign bank assets to total bank assets ratio. Unfortunately, this variable is only available since 2005.

23. More precisely, Barth et al. (2013) conducted four surveys on bank regulation (1999, 2003, 2007, and 2011). To conserve the panel structure of our data, we consider the results of the 1st survey for the years 1999-2002, of the 2nd survey for the years 2003-2006, of the 3rd for the years 2007-2010 and, years 2011 and 2012 correspond to the results of the 4th survey.

vis-à-vis the rest of the world and the government's preferences could impact the output gap and inflation volatility, and then the CONS and CONS_W indexes. From a broader perspective, the monetary policy dependence vis-à-vis the rest of the world relies to the well-known monetary policy "trilemma" (Mundell, 1963), according to which a country cannot have simultaneously free capital mobility, exchange rate management and monetary autonomy. Countries may choose only two of the three policy goals. Consequently, such a framework implies that the behavior of the central bank is constrained by at least one side of the "impossible trinity". For instance, in the most extreme case, the literature on the open-economy trilemma suggests that a country facing a completely open capital account and a fixed exchange rate regime must align its interest rate policy to exactly match that of its base country (Frankel et al., 2004). This means that the output gap and inflation volatility in small open economies could be partly explained by interest rate fluctuations in large influential economies, i.e. countries to which currencies are typically pegged.

Consequently, we compute two alternative measures of central banks' preferences, respectively called "cleansed CONS" and "cleansed CONS_W", in order to consider these potential interferences. Indeed, these two measures can be viewed as the part of the original indexes that cannot be explained by the trilemma configuration and the government's preferences. The details concerning the methodology used to compute these alternative measures of central banks' preferences are provided in the Appendix. Results obtained with the cleansed CONS (or cleansed CONS_W) as right-hand side variable are reported in table 2.8. They are similar to those obtained with the original measures of central banks' preferences.

Endogeneity issue. Finally, it can be argued that there might be a potential reverse causality from banking sector vulnerability to the preferences of central banks. To address this potential endogeneity issue, we further consider an instrumental variable approach using the two-stage least squares (2SLS) estimator. Three instrumental variables are considered : the first lag of the CONS (or CONS_W) index, and two complementary proxies for central bank independence, namely the CWN index and the turnover rate of central bank governors.

Instrumental variables estimates for each measure of banking sector vulnerability and each specification are reported in Tables 2.9 and 2.10. As above, to save space we only report the

coefficients for CONS and CONS_W. As we can see, the results after correcting for potential endogeneity are very similar to our previous findings as we still find a significant relationship between the preferences of central banks and banking sector vulnerability. The effect of the preferences of central banks appears to be even stronger than with the fixed-effects estimator. Note that the Hansen test p-values and the Cragg-Donald statistics indicate that our instruments are valid and not weak.²⁴

Overall, these additional results reinforce the finding that a high degree of central bank conservatism exacerbates the vulnerability of the banking sector, which is in line with the benign neglect hypothesis.

24. Please note that we obtain similar results when we consider the “cleansed” CONS and CONS_W indexes as measures of central banks' preferences, with the first lag of the cleansed CONS (or CONS_W) index, the CWN index and the turnover rate of central bank governors as instrumental variables.

TABLE 2.5 – Robustness checks - Additional control variables : Results obtained with the credit volatility and the credit-to-GDP gap

| Measure of central banks' preferences | CONS | | | | | |
|---|----------------------|------------------------|-----------------------|----------------------|----------------------|----------------------|
| Dependent variable | Credit volatility | | | Credit-to-GDP gap | | |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| Additional control variable | | | | | | |
| Central bank independence | 21.049* (11.716) | 71.885*** (21.918) | 51.727*** (13.840) | 16.310*** (2.809) | 16.886*** (3.627) | 13.121** (5.719) |
| Partial adoption of inflation targeting | 21.913** (11.020) | 62.473*** (20.372) | 46.323*** (13.287) | 15.371*** (2.710) | 17.443*** (3.556) | 14.602** (5.639) |
| Fully-fledged inflation targeting | 22.209** (11.013) | 61.855*** (20.311) | 45.320*** (13.203) | 15.366*** (2.710) | 17.132*** (3.552) | 14.694*** (5.583) |
| <i>De jure</i> exchange rate regime | 21.983** (11.001) | 73.149*** (21.602) | 49.130*** (13.659) | 13.115*** (3.258) | 14.917*** (4.909) | 15.415*** (5.804) |
| <i>De facto</i> exchange rate regime | 20.250* (10.824) | 68.075*** (20.763) | 46.375*** (13.206) | 13.781*** (3.215) | 15.441*** (4.773) | 14.489** (5.607) |
| Bank cost-to-income ratio | | 62.033*** (20.260) | 46.134*** (13.269) | | 17.198*** (3.539) | 14.780*** (5.623) |
| Bank overhead costs | | 60.336*** (20.557) | 42.607*** (13.339) | | 17.602*** (3.527) | 13.158** (5.640) |
| Income diversification | | 56.790*** (20.245) | 44.228*** (13.250) | | 17.114*** (3.569) | 15.913*** (5.588) |
| Foreign bank presence | | 64.359*** (20.392) | 48.602*** (13.305) | | 15.814*** (3.515) | 13.785** (5.655) |
| State-owned bank presence | | 103.431*** (30.228) | 86.452*** (21.866) | | 13.848*** (3.738) | 15.849*** (6.020) |
| <i>De facto</i> financial openness | | | 46.349*** (13.326) | | | 15.279*** (5.620) |
| Measure of central banks' preferences | CONS_W | | | | | |
| Dependent variable | Credit volatility | | | Credit-to-GDP gap | | |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| Additional control variable | | | | | | |
| Central banks independence | 27.261** (11.419) | 78.734*** (22.441) | 52.386*** (13.754) | 13.468*** (2.761) | 15.332*** (3.713) | 13.831** (5.677) |
| Partial adoption of inflation targeting | 27.451** (10.776) | 65.905*** (20.563) | 45.779*** (13.098) | 12.816*** (2.678) | 15.495*** (3.603) | 15.204*** (5.544) |
| Fully-fledged inflation targeting | 27.782** (10.768) | 65.480*** (20.492) | 45.102*** (13.037) | 12.800*** (2.677) | 15.298*** (3.596) | 15.581*** (5.497) |
| <i>De jure</i> exchange rate regime | 26.444** (10.677) | 72.358*** (21.525) | 48.291*** (13.426) | 11.270*** (3.186) | 14.541*** (4.888) | 15.925*** (5.690) |
| <i>De facto</i> exchange rate regime | 24.894** (10.494) | 68.350*** (20.781) | 45.712*** (13.028) | 12.037*** (3.141) | 15.117*** (4.776) | 15.161*** (5.515) |
| Bank cost-to-income ratio | | 65.544*** (20.506) | 45.535*** (13.095) | | 15.297*** (3.594) | 15.226*** (5.535) |
| Bank overhead costs | | 64.009*** (20.772) | 42.236*** (13.199) | | 15.867*** (3.584) | 13.704** (5.567) |
| Income diversification | | 62.358*** (20.394) | 43.987*** (13.056) | | 15.162*** (3.604) | 16.097*** (5.498) |
| Foreign bank presence | | 67.627*** (20.592) | 47.258*** (13.080) | | 14.456*** (3.551) | 14.583*** (5.540) |
| State-owned bank presence | | 111.780*** (31.291) | 89.860*** (22.360) | | 14.278*** (3.844) | 18.650*** (6.124) |
| <i>De facto</i> financial openness | | | 46.335*** (13.209) | | | 15.692*** (5.560) |

Note : Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

TABLE 2.6 – Robustness checks - Additional control variables : Results obtained with the credit-to-deposit ratio and the nonperforming loans ratio

| Measure of central banks' preferences | CONS | | | | | |
|---|-------------------------|----------------------|----------------------|---------------------------|---------------------|---------------------|
| | Credit-to-deposit ratio | | | Nonperforming loans ratio | | |
| Dependent variable | (1) | (2) | (3) | (1) | (2) | (3) |
| Additional control variable | | | | | | |
| Central bank independence | 19.753*** (5.685) | 31.555*** (6.813) | 21.648* (11.116) | 5.755*** (1.224) | 6.273*** (1.252) | 4.729** (1.978) |
| Partial adoption of inflation targeting | 19.424*** (5.443) | 31.536*** (6.649) | 23.129** (10.764) | 6.278*** (1.378) | 6.423*** (1.419) | 4.618** (1.879) |
| Fully-fledged inflation targeting | 19.585*** (5.440) | 31.347*** (6.638) | 23.651** (10.691) | 6.355*** (1.374) | 6.468*** (1.417) | 4.855*** (1.865) |
| <i>De jure</i> exchange rate regime | 7.220 (5.844) | 26.917*** (8.632) | 23.309** (11.139) | 2.218 (1.462) | 3.105** (1.515) | 3.946** (1.891) |
| <i>De facto</i> exchange rate regime | 8.889 (5.778) | 27.651*** (8.363) | 23.645** (10.742) | 2.784* (1.442) | 3.724** (1.502) | 4.892*** (1.870) |
| Bank cost-to-income ratio | | 31.088*** (6.588) | 24.737** (10.729) | | 6.735*** (1.413) | 4.810** (1.881) |
| Bank overhead costs | | 32.479*** (6.608) | 17.681* (10.667) | | 6.912*** (1.422) | 4.625** (1.896) |
| Income diversification | | 31.614*** (6.658) | 25.367** (10.728) | | 6.850*** (1.435) | 5.138*** (1.859) |
| Foreign bank presence | | 26.670*** (6.467) | 19.666* (10.803) | | 6.524*** (1.426) | 4.777** (1.900) |
| State-owned bank presence | | 25.870*** (4.997) | 20.825*** (5.878) | | 7.244*** (1.409) | 6.291*** (1.934) |
| <i>De facto</i> financial openness | | | 22.978** (10.800) | | | 4.841** (1.883) |
| Measure of central banks' preferences | CONS_W | | | | | |
| Dependent variable | Credit-to-deposit ratio | | | Nonperforming loans ratio | | |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| Additional control variable | | | | | | |
| Central bank independence | 13.005** (5.561) | 25.637*** (6.953) | 23.526** (10.994) | 5.589*** (1.265) | 5.619*** (1.304) | 4.851** (2.016) |
| Partial adoption of inflation targeting | 14.084*** (5.356) | 25.589*** (6.713) | 25.529** (10.554) | 6.173*** (1.404) | 5.783*** (1.458) | 4.735** (1.889) |
| Fully-fledged inflation targeting | 14.216*** (5.352) | 25.526*** (6.702) | 26.413** (10.502) | 6.255*** (1.402) | 5.873*** (1.456) | 5.052*** (1.881) |
| <i>De jure</i> exchange rate regime | 5.003 (5.709) | 26.172*** (8.568) | 25.730** (10.882) | 2.539* (1.501) | 3.211** (1.554) | 4.051** (1.904) |
| <i>De facto</i> exchange rate regime | 6.841 (5.638) | 27.043*** (8.347) | 25.946** (10.536) | 3.096** (1.482) | 3.856** (1.542) | 4.955*** (1.886) |
| Bank cost-to-income ratio | | 25.393*** (6.665) | 26.680** (10.529) | | 6.075*** (1.459) | 4.928*** (1.894) |
| Bank overhead costs | | 26.673*** (6.690) | 19.742* (10.512) | | 6.228*** (1.471) | 4.699** (1.912) |
| Income diversification | | 25.568*** (6.720) | 27.305** (10.527) | | 6.005*** (1.469) | 5.123*** (1.871) |
| Foreign bank presence | | 22.193*** (6.497) | 22.833** (10.540) | | 5.806*** (1.466) | 4.848** (1.904) |
| State-owned bank presence | | 19.211*** (5.213) | 21.111*** (5.951) | | 6.092*** (1.470) | 6.066*** (1.991) |
| <i>De facto</i> financial openness | | | 24.852** (10.657) | | | 5.006*** (1.905) |

Note : Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

TABLE 2.7 – Robustness checks - Additional control variables : Results obtained with the Z-score and the capital-to-asset ratio

| Measure of central banks' preferences | CONS | | | | | |
|---|---------------------|---------------------|---------------------|------------------------|----------------------|-------------------|
| Dependent variable | Z-score | | | Capital-to-asset ratio | | |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| Additional control variable | | | | | | |
| Central bank independence | -2.286** (1.160) | -2.231* (1.266) | -4.274* (2.366) | -2.973*** (0.626) | -2.048*** (0.607) | -1.227 (1.055) |
| Partial adoption of inflation targeting | -2.541** (1.104) | -2.625** (1.189) | -5.159** (2.288) | -2.902*** (0.599) | -1.977*** (0.581) | -0.948 (1.055) |
| Fully-fledged inflation targeting | -2.495** (1.100) | -2.586** (1.185) | -4.540** (2.275) | -3.000*** (0.601) | -2.104*** (0.584) | -1.231 (1.061) |
| <i>De jure</i> exchange rate regime | -2.655 (1.637) | -2.561 (1.783) | -4.930** (2.384) | -2.224*** (0.841) | -1.933** (0.821) | -1.781 (1.081) |
| <i>De facto</i> exchange rate regime | -2.355 (1.593) | -2.267 (1.737) | -4.429* (2.308) | -1.889** (0.835) | -1.550* (0.822) | -1.171 (1.051) |
| Bank cost-to-income ratio | | -2.157* (1.192) | -4.054* (2.300) | | -1.948*** (0.583) | -1.152 (1.054) |
| Bank overhead costs | | -1.991* (1.200) | -4.983** (2.324) | | -2.049*** (0.584) | -0.743 (1.095) |
| Income diversification | | -2.425** (1.206) | -4.735** (2.297) | | -1.930*** (0.593) | -1.087 (1.058) |
| Foreign bank presence | | -2.376** (1.201) | -4.875** (2.325) | | -1.926*** (0.587) | -0.449 (1.086) |
| State-owned bank presence | | -2.075** (1.000) | -1.996 (1.985) | | -1.581** (0.645) | 0.938 (1.174) |
| <i>De facto</i> financial openness | | | -4.319* (2.313) | | | -1.059 (1.054) |

| Measure of central banks' preferences | CONS_W | | | | | |
|---|----------------------|----------------------|---------------------|------------------------|----------------------|-------------------|
| Dependent variable | Z-score | | | Capital-to-asset ratio | | |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| Additional control variable | | | | | | |
| Central bank independence | -3.309*** (1.143) | -3.625*** (1.284) | -4.677** (2.348) | -3.065*** (0.647) | -2.016*** (0.640) | -1.037 (1.168) |
| Partial adoption of inflation targeting | -3.401*** (1.078) | -3.775*** (1.193) | -5.277** (2.252) | -3.070*** (0.615) | -2.003*** (0.608) | -0.789 (1.163) |
| Fully-fledged inflation targeting | -3.361*** (1.075) | -3.656*** (1.189) | -4.553** (2.244) | -3.135*** (0.616) | -2.064*** (0.609) | -1.070 (1.161) |
| <i>De jure</i> exchange rate regime | -3.006* (1.580) | -3.231* (1.774) | -5.125** (2.338) | -2.464*** (0.907) | -1.818** (0.897) | -1.673 (1.187) |
| <i>De facto</i> exchange rate regime | -2.724* (1.545) | -2.945* (1.736) | -4.665** (2.272) | -2.122** (0.904) | -1.418 (0.900) | -1.065 (1.157) |
| Bank cost-to-income ratio | | -3.464*** (1.199) | -4.408* (2.264) | | -1.966*** (0.611) | -1.027 (1.160) |
| Bank overhead costs | | -3.300*** (1.209) | -5.269** (2.294) | | -2.079*** (0.613) | -0.483 (1.226) |
| Income diversification | | -3.609*** (1.206) | -4.962** (2.259) | | -1.948*** (0.614) | -0.987 (1.161) |
| Foreign bank presence | | -3.588*** (1.205) | -4.985** (2.280) | | -1.948*** (0.613) | -0.323 (1.183) |
| State-owned bank presence | | -2.824*** (1.022) | -0.825 (2.038) | | -1.805*** (0.673) | 0.728 (1.294) |
| <i>De facto</i> financial openness | | | -4.701** (2.287) | | | -0.962 (1.163) |

Note : Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

TABLE 2.8 – Robustness checks - Alternative measures of central banks' preferences : Results obtained with “cleansed” CONS and “cleansed” CONS_W

| Dependent variable | Credit volatility | | | Credit-to-GDP gap | | |
|--------------------|-------------------------|------------------------|-----------------------|---------------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (1) | (2) | (3) |
| Cleansed CONS | 46.648** (23.220) | 124.362*** (40.592) | 87.187*** (26.830) | 25.341*** (5.715) | 30.040*** (7.234) | 25.476** (11.358) |
| Cleansed CONS_W | 57.189** (22.682) | 130.622*** (40.761) | 86.455*** (26.357) | 19.893*** (5.609) | 26.762*** (7.237) | 27.327** (11.129) |
| | Credit-to-deposit ratio | | | Nonperforming loans ratio | | |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| Cleansed CONS | 36.161*** (11.439) | 62.040*** (13.390) | 43.936** (21.555) | 12.214*** (2.847) | 12.356*** (2.909) | 9.628** (3.769) |
| Cleansed CONS_W | 25.177** (11.202) | 49.631*** (13.392) | 48.005** (21.059) | 11.606*** (2.872) | 10.711*** (2.956) | 9.830*** (3.780) |
| | Z-score | | | Capital-to-asset ratio | | |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| Cleansed CONS | -4.147* (2.246) | -3.552 (2.436) | -7.392 (4.669) | -5.051*** (1.258) | -3.860*** (1.197) | -1.882 (2.150) |
| Cleansed CONS_W | -6.199*** (2.178) | -6.312*** (2.422) | -8.100* (4.577) | -5.386*** (1.270) | -3.907*** (1.226) | -1.493 (2.320) |

Note : Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

TABLE 2.9 – 2SLS results for credit volatility, credit-to-GDP gap and credit-to-deposit ratio

| Dependent variable | Credit volatility | | | | | |
|-----------------------------------|-------------------------|------------------------|-----------------------|-----------------------|------------------------|-----------------------|
| | (1) | (2) | (3) | (1) | (2) | (3) |
| CONS | 40.181*** (13.473) | 110.949*** (26.289) | 55.870*** (16.824) | | | |
| CONS_W | | | | 49.668*** (14.777) | 123.588*** (29.544) | 57.499*** (17.444) |
| Observations | 835 | 485 | 321 | 769 | 454 | 298 |
| Number of countries | 67 | 56 | 46 | 65 | 54 | 44 |
| R-squared | 0.046 | 0.068 | 0.117 | 0.048 | 0.061 | 0.112 |
| Hansen J-OverID test [p-value] | 0.729 | 0.336 | 0.0981 | 0.884 | 0.399 | 0.160 |
| Cragg-Donald Wald F Stat. | 563.4 | 242.8 | 126.4 | 342.2 | 161.9 | 105.3 |
| Stock & Yogo critical value (10%) | 22.30 | 22.30 | 22.30 | 22.30 | 22.30 | 22.30 |
| Dependent variable | Credit-to-GDP gap | | | | | |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| CONS | 13.312*** (3.197) | 16.256*** (4.267) | 14.307** (7.066) | | | |
| CONS_W | | | | 9.328*** (3.620) | 11.727** (4.784) | 14.986** (7.631) |
| Observations | 946 | 588 | 329 | 881 | 558 | 306 |
| Number of countries | 68 | 61 | 50 | 67 | 60 | 48 |
| R-squared | 0.143 | 0.228 | 0.280 | 0.119 | 0.214 | 0.268 |
| Hansen J-OverID test [p-value] | 0.208 | 0.590 | 0.0649 | 0.208 | 0.469 | 0.0742 |
| Cragg-Donald Wald F Stat. | 730.3 | 364.1 | 128.3 | 441.5 | 243.4 | 106.5 |
| Stock & Yogo critical value (10%) | 22.30 | 22.30 | 22.30 | 22.30 | 22.30 | 22.30 |
| Dependent variable | Credit-to-deposit ratio | | | | | |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| CONS | 16.175** (6.549) | 34.659*** (8.104) | 28.435** (13.471) | | | |
| CONS_W | | | | 10.367 (7.377) | 24.469*** (9.297) | 29.426** (14.961) |
| Observations | 892 | 540 | 307 | 828 | 510 | 284 |
| Number of countries | 67 | 56 | 45 | 66 | 55 | 43 |
| R-squared | 0.157 | 0.215 | 0.241 | 0.148 | 0.185 | 0.227 |
| Hansen J-OverID test [p-value] | 0.0497 | 0.474 | 0.822 | 0.0546 | 0.744 | 0.745 |
| Cragg-Donald Wald F Stat. | 648.2 | 306 | 125.2 | 391 | 199.3 | 100.3 |
| Stock & Yogo critical value (10%) | 22.30 | 22.30 | 22.30 | 22.30 | 22.30 | 22.30 |

Note : Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

TABLE 2.10 – 2SLS results for nonperforming loans ratio, Z-score and capital-to-asset ratio

| Dependent variable | Nonperforming loans ratio | | | | | |
|-----------------------------------|---------------------------|----------------------|----------------------|---------------------|---------------------|----------------------|
| | (1) | (2) | (3) | (1) | (2) | (3) |
| CONS | 10.459*** (1.500) | 11.015*** (1.531) | 12.108*** (2.500) | | | |
| CONS_W | | | | 9.636*** (1.713) | 9.837*** (1.758) | 10.075*** (2.701) |
| Observations | 558 | 526 | 298 | 532 | 502 | 281 |
| Number of countries | 54 | 52 | 42 | 54 | 52 | 42 |
| R-squared | 0.366 | 0.396 | 0.355 | 0.360 | 0.380 | 0.353 |
| Hansen J-OverID test [p-value] | 0.0469 | 0.0375 | 0.104 | 0.108 | 0.105 | 0.273 |
| Cragg-Donald Wald F Stat. | 318.1 | 289.4 | 109.9 | 189.1 | 179.9 | 83.79 |
| Stock & Yogo critical value (10%) | 22.30 | 22.30 | 22.30 | 22.30 | 22.30 | 22.30 |
| | Z-score | | | | | |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| CONS | -2.398* (1.381) | -2.301 (1.489) | -4.708 (2.901) | | | |
| CONS_W | | | | -3.070** (1.545) | -3.243* (1.684) | -3.252 (3.192) |
| Observations | 692 | 597 | 329 | 656 | 567 | 306 |
| Number of countries | 65 | 61 | 50 | 64 | 60 | 48 |
| R-squared | 0.039 | 0.056 | 0.060 | 0.055 | 0.069 | 0.067 |
| Hansen J-OverID test [p-value] | 0.207 | 0.475 | 0.637 | 0.192 | 0.470 | 0.583 |
| Cragg-Donald Wald F Stat. | 430.4 | 371.9 | 128.3 | 274.1 | 247.7 | 106.5 |
| Stock & Yogo critical value (10%) | 22.30 | 22.30 | 22.30 | 22.30 | 22.30 | 22.30 |
| | Capital-to-asset ratio | | | | | |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| CONS | -2.258*** (0.745) | -1.302* (0.714) | -0.768 (1.227) | | | |
| CONS_W | | | | -1.723** (0.830) | -0.947 (0.795) | -0.784 (1.425) |
| Observations | 421 | 394 | 178 | 402 | 376 | 168 |
| Number of countries | 50 | 48 | 36 | 50 | 48 | 36 |
| R-squared | 0.126 | 0.177 | 0.203 | 0.121 | 0.177 | 0.263 |
| Hansen J-OverID test [p-value] | 0.283 | 0.584 | 0.396 | 0.878 | 0.624 | 0.138 |
| Cragg-Donald Wald F Stat. | 256.4 | 239.5 | 63.51 | 169.1 | 164.6 | 48.99 |
| Stock & Yogo critical value (10%) | 22.30 | 22.30 | 22.30 | 22.30 | 22.30 | 22.30 |

Note : Standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

2.6 Conclusion

The global financial crisis occurred in the context of the Great Moderation. This has shed doubt on the Schwartz's conventional wisdom according to which price stability should guarantee macroeconomic and financial stability. An alternative growing view contends that with monetary policies focused primarily on price stability, financial risks were left largely unaddressed. The belief in the "divine coincidence" has, in retrospect, been revealed to be benign neglect. As a consequence, financial instability has undermined macroeconomic stability despite inflation being low and stable. Nonetheless, a few recent papers consider that there is no trade-off between monetary and financial stability, and support the Schwartz's hypothesis.

In this context, our paper is the first to address directly the link between the relative preferences of central banks for the inflation stabilization objective and banking sector vulnerability. This leads us to test the Schwartz's hypothesis against the benign neglect hypothesis. Our results, from a sample of 73 industrialized and emerging countries, indicate that differences in central banks' conservatism (CBC) robustly explain cross-country differences in banking sector vulnerability and unambiguously validate the benign neglect hypothesis.

On normative grounds, this result suggests two alternative perspectives for recommendations. One is that central bankers now know that it could be very costly to neglect financial and banking vulnerabilities. In particular, once a dramatic crisis occurs, the usual monetary policy orthodoxy must be renounced in favour of unconventional measures. This should instead preemptively lead central bankers to tolerate a dilution of their primary price stability objective in order to devote greater attention to output and financial stability. Ideally, this could be stated in law. Central banks would then officially be responsible for this goal.

The other perspective²⁵ is that if single mandates remain the rule, the implementation of an efficient macroprudential policy framework may reduce the adverse effects of high CBC. Some efforts have been made in this direction since 2008. However, such a framework is certainly not a panacea in itself because it may interfere with monetary policy. Indeed, monetary and macroprudential policies can be complementary, but they can also compete with one another,

25. See for instance Svensson (2012) and Woodford (2012) for two different viewpoints on this issue.

so they need to be coordinated. While the literature on this topic remains scarce, it is clear that the terms of the optimal coordination will depend on the preferences of the single or various authorities responsible for the two goals. In particular, the degree of conservatism of the central bank would influence the terms of the coordination and the corresponding macroeconomic equilibrium. In this respect, our results call for an analysis of the occurrence of trade-offs, with reference to the preferences of the authorities, given different types of shocks and given the underlying structural features of the economies.

While a higher level of CBC implies a more vulnerable banking sector, it is widely recognized that a highly inflationary context is not conducive to sound financial conditions. This suggests that an immediate extension of our results would be to examine the existence of non-linearities in the link between CBC and banking sector vulnerability. Furthermore, our results suggest more fundamental extensions. While this paper documents the *ex ante* effect of CBC (i.e. on financial vulnerabilities), it can be expected that the degree of CBC also impacts the pace of economic recovery in the aftermath of a crisis. Indeed, a conservative central banker may be reluctant to deviate from the sacred inflation objective to support the economy and the financial system once a financial crisis has occurred. At best, conservative monetary authorities would react too late.²⁶

It is all the more important to assess whether CBC matters for the costs of crises, as the inflation targeting (IT) strategy has become very popular. While such a strategy can be followed in a flexible way, it firmly places the inflation objective at the heart of the monetary policy arrangements (King, 1997; Leveuge and Lucotte, 2013). Thus far, there is some debate on the performance of IT with respect to financial instability and the costs of crises. One reason may be that beyond the focus on inflation, the IT strategy is accompanied by institutional, political, legal and practical reforms that are globally beneficial to macroeconomic and financial stability. In emerging countries in particular, these reforms could overcome the negative effect of greater conservatism, at least in the first years following the adoption of IT. This is less obvious for industrialized countries, in which the aversion of central banks to inflation is already high and inflation has been under control for almost 30 years. While it is difficult to control for the effects

26. Such a view is supported, for example, by Whelan (2013, pp.107-108).

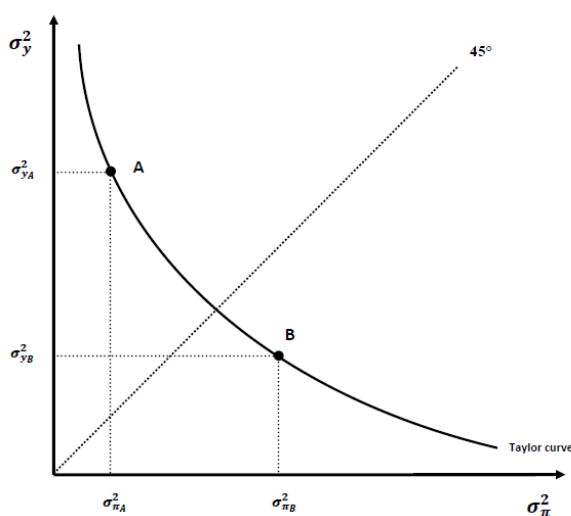
of institutional improvement, it would be interesting to re-examine the empirical literature on the performance of IT by considering the relationship between IT, CBC and financial instability separately for developed and emerging countries.

2.7 Appendix

Details on the CONS index

Our measure of CBC uses the method suggested by Leveuge and Lucotte (2014) on the theoretical basis of the Taylor curve (Taylor, 1979). This curve, shown in Figure 2.2 below, represents the standard trade-off between the variability of the inflation rate (σ_π^2) and the variability of the output gap (σ_y^2). Theoretically, any point on this curve is the result of an optimal monetary policy, given the structural model of the economy and the weight assigned to the objective of inflation stabilization. Then, the position where an economy is observed on this curve reveals the central bank's preferences for inflation stabilization relative to output stabilization. The 45° line corresponds to the case in which monetary authorities assign an equal weight to inflation and output variability in their loss function. A central bank is then considered increasingly conservative as its corresponding point moves along the Taylor curve from the right to the left. It suggests that inflation receives increasingly greater weight relative to output variability in its loss function. For example, point A in Figure 2.2 illustrates the case in which the central bank is more averse to inflation variability than at point B, while tolerating higher output variability. Point A then indicates a more conservative stance than point B.

FIGURE 2.2 – Preferences along the Taylor Curve



Following this conceptual background, Leveuge and Lucotte (2014) propose a new index, called CONS, which is based on the value of the angle of the straight line joining the origin and

a given point on the Taylor curve. Indeed, knowing the empirical volatilities of inflation and output gap on the adjacent and opposite sides respectively, it is possible to calculate the value of any angle using standard trigonometric formula : $angle(\alpha) = atan(\sigma_y^2/\sigma_\pi^2) \times 180/\pi$. Once rescaled to $[0, 1]$, this angle measure constitutes a fair estimate of the relative degree of CBC, equivalent to the relative weight assigned to the inflation objective in a standard quadratic loss function. Thus, CONS is defined as :

$$CONS = \frac{1}{90} \left[atan \left(\frac{\sigma_y^2}{\sigma_\pi^2} \right) \times \frac{180}{\pi} \right] \quad (2.2)$$

Levieuge and Lucotte (2014) initially developed such a CONS index for the OECD countries. As (σ_π^2) and (σ_y^2) are easily observable in any country, over any period, extending this index to a broad set of countries is direct and simple. For the purposes of this paper, we have expanded the CONS index to a large set of 73 countries from 1980 to 2012. CONS is computed on an annual basis, with σ_π^2 and σ_y^2 computed over five-year rolling windows. As highlighted by Levieuge and Lucotte (2014), any change in CONS can be the result of disturbances, outside the willingness of the central bank to change its preferences. This is potentially an important point to address, as our sample includes emerging countries that are known to be subject to shocks. In this respect, Levieuge and Lucotte (2014) propose an alternative CBC indicator, labelled CONS_W (“W” for weighted), where the ratio σ_y^2/σ_π^2 in Equation (2.2) is weighted by the ratio of disturbances $\sigma_{\varepsilon y}^2/\sigma_{\varepsilon \pi}^2$. $\sigma_{\varepsilon y}^2$ and $\sigma_{\varepsilon \pi}^2$ are the variance of demand and supply shocks, respectively. They are identified from bivariate structural VAR models through the reliable decomposition scheme suggested by Blanchard and Quah (1989). Details are provided in Levieuge and Lucotte (2014).

While prudence requires *a priori* that cyclical shocks be taken into account, Figure 2.4 below shows that the two measures are highly correlated at least in their mean values.

FIGURE 2.3 – CONS index and inflation (decade average)

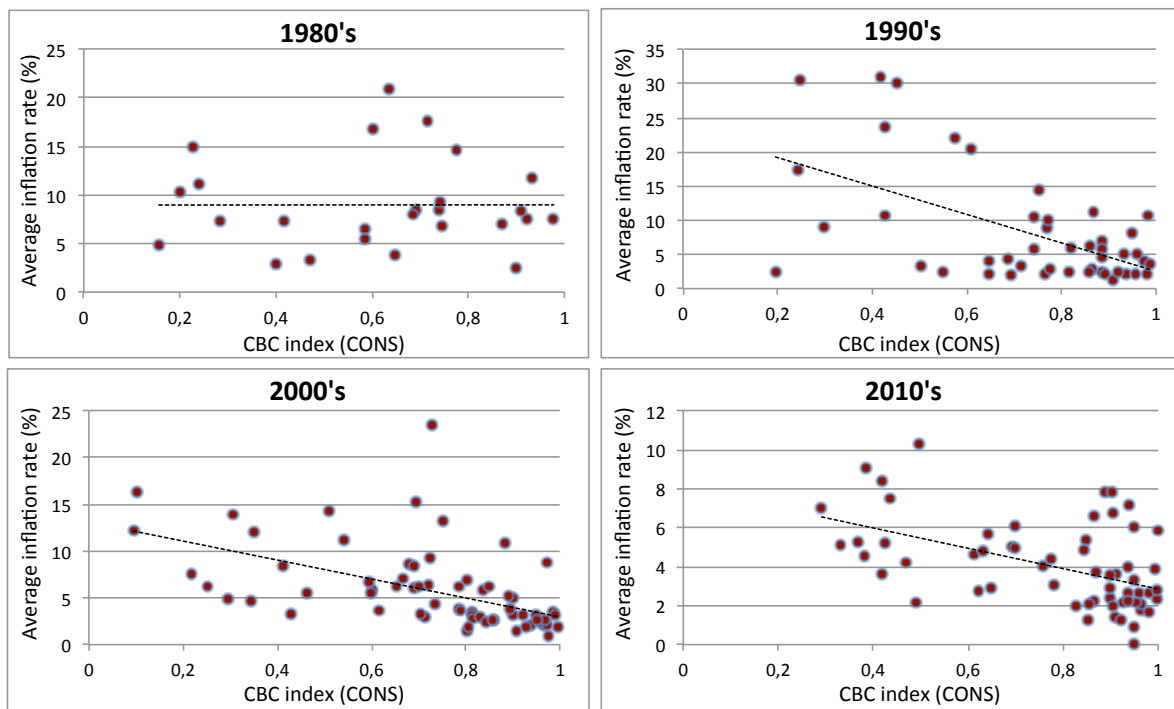


FIGURE 2.4 – Correlation between CONS and CONS_W (decade average)

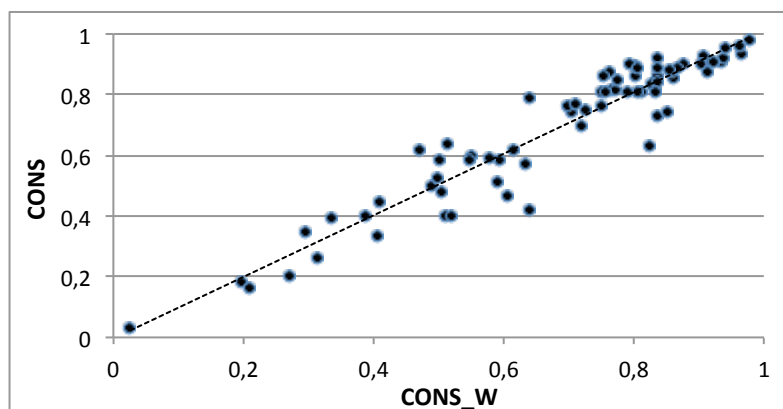


TABLE 2.11 – Countries and average CONS and CONS_W

| Decade | 1980's | | 1990's | | 2000's | |
|----------------|--------|--------|--------|--------|--------|--------|
| Country Name | CONS | CONS_W | CONS | CONS_W | CONS | CONS_W |
| Algeria | | | | | 0.405 | 0.335 |
| Argentina | | | 0.978 | | 0.711 | 0.765 |
| Armenia | | | | | 0.836 | 0.920 |
| Australia | 0.740 | 0.823 | 0.816 | 0.756 | 0.951 | 0.942 |
| Austria | 0.649 | 0.763 | 0.886 | 0.938 | | |
| Bangladesh | | | 0.741 | | 0.601 | 0.615 |
| Barbados | 0.746 | 0.949 | 0.866 | 0.901 | 0.796 | 0.691 |
| Belgium | 0.156 | 0.167 | 0.646 | 0.768 | | |
| Bolivia | | | 0.742 | 0.783 | 0.878 | 0.882 |
| Botswana | | | 0.984 | | 0.965 | 0.932 |
| Brazil | | | 0.625 | 0.788 | 0.836 | 0.909 |
| Bulgaria | | | 0.412 | | 0.658 | 0.791 |
| Canada | 0.584 | 0.830 | 0.893 | 0.805 | 0.941 | 0.945 |
| Colombia | | | 0.575 | | 0.646 | 0.421 |
| Costa Rica | | | | | 0.829 | 0.835 |
| Croatia | | | | | 0.823 | 0.703 |
| Czech Republic | | | 0.951 | | 0.818 | 0.730 |
| Denmark | 0.868 | 0.616 | 0.935 | 0.936 | 0.965 | 0.981 |
| El Salvador | | | 0.428 | 0.287 | 0.604 | 0.681 |
| Estonia | | | 0.450 | | 0.751 | 0.741 |
| Fiji | 0.977 | 0.992 | 0.972 | 0.974 | 0.985 | 0.979 |
| Finland | 0.416 | 0.614 | 0.958 | 0.962 | | |
| France | 0.284 | 0.167 | 0.695 | 0.723 | | |
| Georgia | | | | | 0.754 | 0.864 |
| Germany | | | 0.872 | 0.929 | | |
| Guatemala | | | | | 0.594 | 0.584 |
| Hong Kong | 0.922 | 0.983 | 0.885 | 0.905 | 0.918 | 0.890 |
| Hungary | | | | | 0.337 | 0.394 |
| Iceland | | | | | 0.750 | 0.806 |
| Indonesia | | | 0.751 | 0.775 | 0.404 | 0.384 |
| Iran | | | 0.429 | 0.310 | 0.692 | 0.765 |
| Ireland | 0.743 | 0.646 | 0.979 | 0.936 | | |
| Israel | 0.802 | 0.939 | 0.866 | 0.801 | 0.996 | 0.994 |
| Italy | 0.239 | 0.313 | 0.647 | 0.672 | | |
| Jamaica | | | | | 0.512 | 0.402 |
| Japan | 0.898 | 0.903 | 0.907 | 0.868 | 0.943 | 0.940 |
| Jordan | | | 0.933 | 0.930 | 0.861 | 0.900 |

Note : The table gives the list of countries included in our sample and the ten-year average values of CONS and CONS_W for each of them. The reported values of CONS and CONS_W are not those used in the econometric analysis of the article and are only intended to provide an overview of central bank preferences country by country to the reader. Euro-area member states are considered until they join the European Monetary Union.

TABLE 2.12 – Countries and average CONS and CONS_W (continued)

| Decade | 1980's | | 1990's | | 2000's | |
|-------------------|--------|--------|--------|--------|--------|--------|
| Country Name | CONS | CONS_W | CONS | CONS_W | CONS | CONS_W |
| Kazakhstan | | | 0.124 | | 0.746 | 0.762 |
| Korea, Rep. | 0.693 | 0.904 | 0.885 | 0.894 | 0.922 | 0.886 |
| Kyrgyz Republic | | | | | 0.606 | 0.469 |
| Latvia | | | 0.561 | 0.379 | 0.847 | 0.890 |
| Lithuania | | | 0.574 | | 0.839 | 0.862 |
| Malawi | 0.601 | 0.628 | 0.417 | 0.396 | 0.511 | 0.580 |
| Malaysia | | | 0.989 | 0.993 | 0.955 | 0.954 |
| Mauritius | | | | | 0.634 | 0.571 |
| Mexico | 0.806 | 0.884 | 0.609 | 0.733 | 0.908 | 0.883 |
| Moldova | | | | | 0.409 | 0.446 |
| Morocco | | | 0.884 | 0.867 | 0.927 | 0.879 |
| Netherlands | 0.400 | 0.472 | 0.552 | 0.544 | | |
| New Zealand | | | 0.765 | 0.690 | 0.872 | 0.864 |
| Nicaragua | | | | | 0.591 | 0.509 |
| Nigeria | 0.634 | 0.689 | 0.245 | 0.231 | 0.094 | 0.066 |
| Norway | 0.911 | 0.914 | 0.919 | 0.959 | 0.974 | 0.965 |
| Peru | | | 0.474 | 0.417 | 0.973 | 0.970 |
| Philippines | 0.227 | 0.236 | 0.296 | 0.184 | 0.357 | 0.326 |
| Poland | | | | | 0.806 | 0.807 |
| Portugal | 0.715 | 0.795 | 0.818 | 0.856 | | |
| Romania | | | | | 0.210 | 0.164 |
| Russian Fed. | | | 0.162 | | 0.405 | 0.403 |
| Slovak Republic | | | 0.769 | | 0.463 | 0.400 |
| Slovenia | | | | | 0.297 | 0.345 |
| South Africa | 0.775 | 0.630 | 0.774 | 0.679 | 0.655 | 0.734 |
| Spain | 0.200 | 0.212 | 0.688 | 0.780 | | |
| Sweden | 0.684 | 0.573 | 0.714 | 0.701 | 0.898 | 0.939 |
| Switzerland | 0.472 | 0.451 | 0.857 | 0.906 | 0.970 | 0.977 |
| Thailand | | | 0.961 | | 0.834 | 0.741 |
| Trinidad and Tob. | 0.934 | 0.897 | 0.859 | 0.918 | 0.780 | 0.771 |
| Tunisia | | | | | 0.726 | 0.748 |
| Turkey | | | 0.948 | 0.949 | 0.755 | 0.742 |
| Ukraine | | | | | 0.757 | 0.808 |
| United Kingdom | | | 0.504 | 0.463 | 0.829 | 0.901 |
| United States | 0.585 | 0.715 | 0.774 | 0.839 | 0.857 | 0.889 |
| Zambia | | | 0.026 | 0.029 | | |

Note : The table gives the list of countries included in our sample and the ten-year average values of CONS and CONS_W for each of them. The reported values of CONS and CONS_W are not those used in the econometric analysis of the article and are only intended to provide an overview of central bank preferences country by country to the reader. Euro-area member states are considered until they join the European Monetary Union.

Details on the methodology used to compute the “cleansed” CONS and CONS_W indexes

To compute the “cleansed” CONS and CONS_W indexes, we adopt an econometric strategy originally developed in the literature on “tax effort”. Indeed, as in our case, the actual tax revenue that a country collects is not only the result of the willingness of the tax authority. It also depends on various external factors, such as the economic, social, institutional and demographic characteristics of the country. To solve this issue, the literature on tax effort proposes to estimate the tax capacity of a country, obtained by regressing the actual tax revenue on external factors which are independent of the the willingness of the tax authority. Then, the difference between the actual tax revenue and its predicted value (i.e. the residuals), namely the tax capacity, corresponds to the tax effort, i.e. the maximum tax revenue that a country can collect given its economic, social, institutional and demographic characteristics.

In line with this approach, we regress each of our indicators of central banks’ preferences, i.e. CONS and CONS_W indexes, on a set of factors that can potentially impact the inflation and output gap volatility, regardless the conscious willingness of the central bank to prioritize inflation stabilization. Due to the censored nature of the CONS and CONS_W indexes, we consider a Tobit model, which ensures that the predicted values of the indexes are comprised in the same interval $[0,1]$. The model is estimated using a random effects estimator. In comparison to the fixed effects estimator, the main advantage of the random effects estimator is to attribute only a part of the unobserved heterogeneity to structural factors.

Formally, we estimate the following equation :

$$CBP_{i,t} = \beta_0 + \beta_1 MPI_{i,t} + \beta_2 FO_{i,t} + \beta_3 ERS_{i,t} + \beta_4 DGS_{i,t} + \epsilon_{i,t} \quad (2.3)$$

where $CBP_{i,t}$ represents alternatively one of our measures of central banks’ preferences, CONS and CONS_W, for country i in time t . $MPI_{i,t}$, $FO_{i,t}$ and $ERS_{i,t}$ are variables capturing the trilemma configuration, i.e. the monetary policy independence vis-à-vis the rest of the world, the financial openness and the exchange rate stability, respectively. These variables, bounded between 0 and 1, are taken from Aizenman et al. (2013). More precisely, monetary policy

independence corresponds to the correlation between interest rates of the home country and the country to which monetary policy is the most closely linked. Financial openness corresponds to the Chinn-Ito index (Chinn and Ito, 2008), and exchange rate stability is based on the standard deviation of the exchange rate of the local currency against a benchmark country's currency. $DGS_{i,t}$ represents the discretionary government spending. It is calculated following the methodology proposed by Ambrosius (2017). As it captures the changes in fiscal policy that only results from the willingness of the government, this variable aims to gauge the government's preferences. β_0 is the constant, and β_k are the parameters associated with the independent variables. Their estimated values are reported in Table 2.13. Finally, $\epsilon_{i,t}$ is the error term, which theoretically corresponds to the "clean" proxy for central banks' preferences. The residuals are rescaled between 0 and 1.

As the Figure 2.5 suggests, the correlation between the original indexes and their cleansed version appears very high.²⁷ Such high correlations clearly indicate that our original measures of central banks' preferences are good proxies for central banks' inflation aversion.

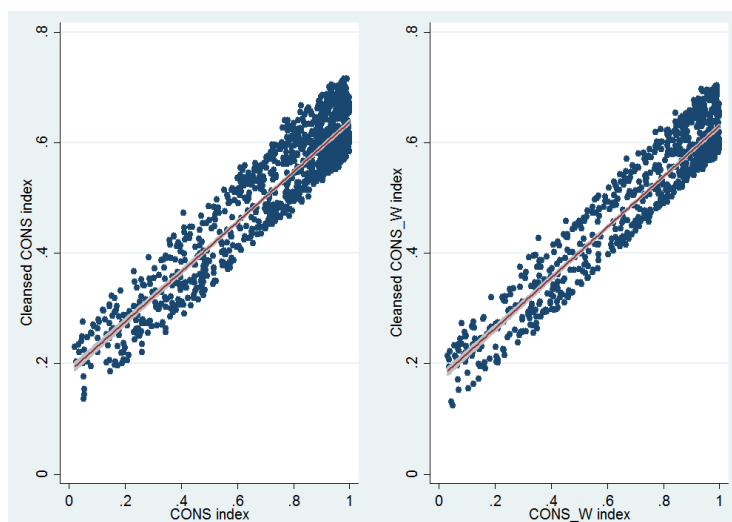
TABLE 2.13 – "Cleansed" central banks' preferences indexes : Results of the identification regression

| Dependent variable | CONS | CONS_W |
|-------------------------------|----------------------|---------------------|
| Monetary independence (MPI) | -0.123*** (0.035) | -0.070* (0.039) |
| Financial openness (FO) | 0.253*** (0.031) | 0.242*** (0.036) |
| Exchange Rate Stability (FER) | -0.050 (0.031) | -0.038 (0.035) |
| Discretionary Spendings (DGS) | -0.015 (0.053) | -0.016 (0.057) |
| Constant | 0.615*** (0.040) | 0.609*** (0.046) |
| Observations | 1,127 | 981 |
| Number of countries | 77 | 71 |

Note : Standard errors are reported in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

27. The correlation between CONS and "cleansed" CONS is strongly significant and equal to 93.22%, while in the case of CONS_W, the correlation is equal to 94.71%.

FIGURE 2.5 – Correlations between initial and “cleansed” indexes of central banks’ preferences.



Chapitre 3

The effectiveness of macroprudential policy : Does the monetary policy stance matter ?

3.1 Introduction

In the wake of the 2007-2008 global financial crisis, macroprudential policy has attracted considerable attention from policymakers and researchers.¹ A number of emerging countries were using macroprudential policy tools well before the crisis, but substantial progress has subsequently been made in both emerging and industrialised economies in putting in place dedicated institutional arrangements for macroprudential policy. The main objective of macroprudential policy is to safeguard the stability of the financial system as a whole by strengthening its resilience and preventing the build-up of systemic risk. To ensure the achievement of this primary objective, the European Systemic Risk Board (ESRB/2013/1) defines five intermediate objectives that macroprudential policy should aim to achieve : (i) mitigating and preventing excessive credit growth and leverage ; (ii) mitigating and preventing excessive maturity mismatch and market illiquidity ; (iii) limiting direct and indirect exposure concentrations ; (iv) limiting

1. This chapter gave rise to an article co-written with J. Garcia Revelo and Y. Lucotte.

the systemic impact of misaligned incentives with a view to reducing moral hazard; and (v) strengthening the resilience of financial infrastructures. These intermediate objectives are seen as transitional steps towards achieving robust financial stability.

Mitigating and preventing excessive growth in credit and leverage is particularly important for safeguarding financial stability. One important lesson of the global financial crisis is that financial imbalances largely developed because of the procyclical behaviour of the banking industry. Such behaviour tends to put upward pressure on asset prices and is often viewed as a key driver of banking crises and how severe they are. This is why several macroprudential tools have been designed to curb excessive credit growth and mitigate the procyclicality of domestic credit. Such instruments include for instance the countercyclical capital buffer and the loan-to-value ratio.

However, the implementation of macroprudential policies raises a number of challenges. The first of these is to evaluate how effective the policies are. The empirical literature on this is still in infancy, but there is a growing body of it (see, e.g., Galati and Moessner, 2018). The findings seem especially to confirm that macroprudential tools are effective at containing credit growth and housing prices. The second challenge more importantly concerns how macroprudential policy interacts with other policies that also have an impact on financial stability, such as fiscal and monetary policies.

Most notably, macroprudential and monetary policies pursue different primary objectives that could be in conflict with one another. As already noted, macroprudential policy primarily aims to promote financial stability, while the primary objective of monetary policy is to maintain price stability. Consequently, each policy can have “side effects” on the objective of the other and make it more effective or less so. Side effects from monetary policy pose significant challenges for the conduct of macroprudential policy if they are detrimental to financial stability.

Monetary policy can have detrimental side effects on financial stability through various channels (IMF, 2013). If the policy interest rate is cut, monetary policy can worsen financial stability through two channels, the risk-taking channel and the asset prices channel. The risk-taking channel means that a low interest rate environment may encourage banks to expand their

balance sheets and take on more risk, which in turn may contribute to an excessive expansion of credit and may in this way amplify boom-bust cycles (Adrian and Shin, 2010 ; Borio and Zhu, 2012). It is often argued that these effects are worse if the policy interest rate is held “too low for too long”. A low interest rate environment can also lead to sharp rises in asset prices through the “financial accelerator” mechanism (Bernanke and Gertler, 1989 ; Bernanke and Gertler, 1995). Such a rise in asset prices tends to intensify the financial cycle, which may lead to a bubble.

Meanwhile, when the policy interest rate rises, monetary policy can affect financial stability negatively through three different channels : the balance sheet channel, the risk-shifting channel, and for small open economies, the exchange rate channel. The balance sheet channel means that a tightening of the monetary policy stance can hurt the capacity of borrowers to repay their loans, which can lead to higher default rates and financial instability (see, e.g., Allen and Gale, 2001 ; Illing, 2007). The risk-shifting effect operates through the balance sheets of banks. As banks typically take in short-term deposits and make long-term loans, changes in the policy rate affect the interest rate applied to short-term deposits more than that for loans. A rise in the policy rate then reduces intermediation margins, and leads financial intermediaries to seek more risk in order to maintain their profits (Bhattacharya, 1982). As a result, monetary tightening is expected to increase financial instability. Finally, monetary policy can impact financial stability through the exchange rate channel, as the policy rate is an important determinant of capital inflows. These inflows can in turn drive credit growth and, owing to the presence of exchange rate externalities, contribute to excessive increases in leverage. The consequence is that, contrary to expectations, raising the policy rate may induce excessive growth in credit, especially in emerging markets and small open economies. Of course the strength of these side effects can vary with the financial cycle. As financial imbalances build up, monetary easing tends to reduce default rates, but can induce banks to grant riskier loans and increase their leverage. When the policy rate is raised close to the peak of the financial cycle, this can induce risk-shifting and borrower defaults.

More importantly, these side effects highlight the potential tradeoffs and complementarities between monetary policy and macroprudential measures. These interactions have been exten-

sively studied by the recent theoretical literature. Most work in this area uses New-Keynesian Dynamic Stochastic General Equilibrium (DSGE) models with financial frictions (see, e.g., Loisel, 2014). These models usually consider two authorities that conduct their policies separately and independently, focusing on the objective of each. Their results suggest that macroprudential and monetary policies are complements rather than substitutes, although the results vary for different types of shock. In the wake of a financial shock, both policies should work in the same direction, even if the reaction in terms of macroprudential policy should be larger. In the presence of productivity and demand shocks, results suggest that policy responses could differ depending on the size and nature of the shocks. More recently, DSGE models have gone a step further by explicitly assessing the benefits of coordination between macroprudential policy and monetary policy. To this end, they differentiate between two cases : the perfect coordination of policy and the non-coordination of policy. They find that coordinating the two policies stabilises the effect of real and financial shocks to the macro-environment and maximises social welfare.

Despite the apparent consensus emerging in the theoretical literature about the benefits of synchronisation between macroprudential and monetary policies, little is known from an empirical perspective. Very few empirical studies have addressed this issue and their results are far from conclusive (Bruno et al., 2017; Zhang and Tressel, 2017; Gambacorta and Murcia, 2019). Moreover they only focus on a small sample of economies. Against this background, our paper aims to fill this gap in the existing literature by investigating from a sample of 37 emerging and advanced countries whether the effectiveness of macroprudential policy is conditional on monetary policy conditions.²

Our findings suggest macroprudential policy is more effective at curbing credit growth when macroprudential and monetary policies are both working in the same direction in harmony. Considering different measures of the macroprudential stance and using the Taylor gap as a measure of the monetary policy stance, we obtain two important results. First, we find that a restrictive monetary policy enhances the impact of macroprudential tightening on domestic credit growth. Second, we find evidence that monetary policy helps to reduce the transmission

2. Our selection of sample countries is driven by data availability. Our sample contains countries listed in Table 3.9 in the Appendix, and twelve euro area countries, namely Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain.

delay of macroprudential policy actions. To the best of our knowledge, it is the first empirical paper in the literature that formally confirms the benefits of synchronisation between macroprudential and monetary policies.

The remainder of the paper is organised as follows. Section 3.2 reviews the existing empirical literature on the effectiveness of macroprudential policies and the potential role of monetary policy. Section 3.3 presents the measures of macroprudential policy stance and monetary policy stance that we consider. Section 3.4 presents some descriptive statistics, describes our econometric approach and discusses our results. Section 3.5 concludes and gives some policy recommendations.

3.2 Literature Review

In this section, we review the existing empirical literature that has analysed how macroprudential policies affect various measures of financial vulnerability and stability by discussing whether these studies deal with the challenges discussed above.³ Nabar and Ahuja (2011) and Lim et al. (2011) were the first to use a cross-country analysis to assess the effectiveness of macroprudential policies. Considering a sample of 49 emerging and advanced economies, Nabar and Ahuja (2011) investigate whether the implementation of two macroprudential instruments, namely the loan-to-value and the debt-service-to-income ratios, affects the property sector and the stability of the banking sector. Their results show that loan-to-value caps have a negative effect on the growth in housing prices and mortgage lending, while debt-service-to-income caps only reduce the growth in property lending. The findings about the stability of the banking sector are more mixed. Indeed, Nabar and Ahuja (2011) find that loan-to-value caps improve credit quality by reducing non-performing loans, but debt-service-to-income caps appear not to be statistically significant. Lim et al. (2011) consider a larger set of macroprudential instruments and analyse whether adopting these instruments is effective at reducing credit procyclicality. Their evidence suggests that tools such as caps on the loan-to-value and debt-service-to-income ratios, limits on credit growth, reserve requirements, and dynamic provisioning rules can mitigate the

3. For a comprehensive literature review on the effects of macroprudential policy, see Galati and Moessner (2018).

procyclicality of credit.

In the same vein, Cerutti et al. (2017a) investigate whether a more developed macroprudential framework is associated with lower growth in credit and house prices. To this end they construct an aggregate macroprudential index for a large sample of 119 countries over the period 2000-2013. This index contains 12 macroprudential instruments and is designed to measure the number of instruments in place in a given country. Their results confirm that macroprudential policies are effective at curbing credit growth, especially in developing and emerging countries, but they do not appear to have a statistically significant effect on the growth in real housing prices. Furthermore, Cerutti et al. (2017a) also consider two sub-indexes by distinguishing between borrower-targeted instruments and financial institution-targeted instruments. The results on the full sample indicate that both categories of instrument are significantly associated with lower credit growth. However, they do not find that these indexes have a significant effect on credit growth in advanced economies.

In addition to these cross-country studies, there are some papers that assess how effective macroprudential policies are at the micro-level. Using bank balance-sheet data, they usually analyse whether adopting a macroprudential policy framework helps in taming credit supply cycles and mitigating bank risk. The main advantage of this approach over the cross-country perspective is that it deals with the issue of potential endogeneity, since macroprudential tools are less likely to be adopted in response to the behaviour of individual banks than in response to developments in macroeconomic and financial variables at the aggregate country-level (Claessens et al., 2013 ; Galati and Moessler, 2018). The disadvantage though is that it focuses only on specific risks and market segments and so does not allow for assessment of how macroprudential policies affect the stability of the financial system as a whole, which is the main objective of the macroprudential regulation. For instance, Jiménez et al. (2017) find that dynamic provisioning rules are useful in smoothing credit supply cycles for Spain. More importantly, they find evidence that such a countercyclical macroprudential policy can help to mitigate credit crunches during downturns by upholding the availability of credit to firms and the performance of firms during recessions. Using a large panel dataset of banks around the world, Claessens et al. (2013) assess how different macroprudential instruments affect the growth in leverage,

asset and non-core to core liabilities. Their results most notably suggest that caps on the loan-to-value and debt-to-income ratios are effective at reducing the growth in the level of all three measures, especially during boom times.

One important drawback of studies cited above is how they measure macroprudential policy. As they focus only on the existence of macroprudential instruments, these studies do not capture the direction of macroprudential policy actions and the cross-country heterogeneity of macroprudential activism (Boar et al., 2017). To overcome this shortcoming, some recent studies go a step further by considering how macroprudential policy evolves over time by being tightened or loosened (Vandenbussche et al., 2015; Kuttner and Shim, 2016; Zhang and Zoli, 2016; Cerutti et al., 2017b; Akinci and Olmstead-Rumsey, 2018; Altunbas et al., 2018; Carreras et al., 2018). Akinci and Olmstead-Rumsey (2018) use the IMF Global Macroprudential Policy Instruments (GMPI) survey and national sources to analyse how macroprudential policies evolve in 57 advanced and emerging economies over the period 2000Q1-2013Q4 looking at whether the prudential tools considered in the dataset were tightened or loosened in each given quarter. They produce a cumulative macroprudential policy stance indicator that shows the sum of tightenings net of easings since 2000 for each country, and they find that tightening is associated with lower growth in bank credit, housing credit, and house prices. Their findings also suggest that borrower-targeted macroprudential instruments tend to be more effective at curbing credit growth. Similar results are obtained by Zhang and Zoli (2016) for a sample of Asian economies.

A cointegration framework is used by Carreras et al. (2018) to reinvestigate this issue for the OECD countries. They use the database compiled by Cerutti et al. (2017b) and consider both the cumulative and quarter-by-quarter changes in macroprudential policy measures. Like Akinci and Olmstead-Rumsey (2018), they find a negative and significant relationship between the cumulative changes in macroprudential tools and the quarterly growth rate of housing prices and household credit. However, the relationship appears not to be statistically significant when they consider the quarter-by-quarter changes. As argued by Akinci and Olmstead-Rumsey (2018), this result could arise because macroprudential policies may be delayed in their effect. Carreras et al. (2018) also consider the stance of each macroprudential tool individually. Unlike

Akinci and Olmstead-Rumsey (2018) though, they do not find a significant relationship between the cumulative changes in the loan-to-value ratio and the growth rate of housing prices.

Other studies focus specifically on how the stance of macroprudential policy affects the real estate market (see for instance McDonald, 2015 ; Vandebussche et al., 2015 ; Kuttner and Shim, 2016). Kuttner and Shim (2016) assess the relative effectiveness of macroprudential and housing-related tax policies in curbing housing credit and house prices. The growth rate in housing credit is considered by Kuttner and Shim (2016), who find that both policies have a negative impact on this variable. The results are more mixed when they consider housing price growth as an endogenous variable. Changes in taxes still have a statistically significant impact on house prices, but this is not the case for some of the macroprudential tools considered, such as the debt service ratio. As argued by Kuttner and Shim (2016), this result can easily be explained because the cost of buying a house, and consequently demand and prices in the real estate market, is directly affected by tax policies such as the deductibility of mortgage interest and property taxes, but not so much by macroprudential tools. More importantly, the results of Kuttner and Shim (2016) confirm that one major challenge for macroprudential policy is to interact with other policies in a way that fosters the effective conduct of this policy in pursuit of its objective of financial stability.

A key issue in both the academic literature and the policy debate is the interaction between macroprudential policy and monetary policy. As discussed in the introduction, each policy can have “side effects” on the objectives of the other. It is particularly widely recognised that monetary policy can have side effects on financial stability, for instance when policy rates are held “too low for too long”. When monetary policy is very accommodative, there are greater incentives to borrow at low interest rates that are difficult for macroprudential policy to contain fully. Consequently, an important empirical issue is to assess how far the monetary policy stance affects how effective macroprudential policy is.

However, there is still very little empirical literature on this issue. To the best of our knowledge, only few studies try to address this issue (Bruno et al., 2017 ; Gambacorta and Murcia, 2019 ; Zhang and Tressel, 2017). A sample of 12 Asia-Pacific economies over the period 2004-2013 is used by Bruno et al. (2017) to investigate two supplementary issues. First they

distinguish between the pre and post-2007 periods and investigate whether macroprudential policies are synchronised with changes in monetary policy rates.⁴ They find that before 2007 monetary policy usually changed in tandem with macroprudential measures, but the opposite result is found after 2007. After 2007, there was a slight downward trend in the average monetary policy rate in the region, while macroprudential measures were tightening slightly. Second, they assess how effective macroprudential policy measures are in curbing growth in cross-border banking flows. They find that macroprudential policies effectively reduced banking inflows over the period 2004-2007, but they were not effective after 2007. These findings indirectly suggest that monetary and macroprudential policies tend to be more successful when they are pulling in the same direction rather than when they act in opposite directions.

Gambacorta and Murcia (2019) and Zhang and Tressel (2017) investigate this issue more specifically by assessing whether the impact of macroprudential policies on credit growth depends on monetary policy conditions. Using meta-analysis techniques and credit registry data for a sample of five Latin American countries, Gambacorta and Murcia (2019) find macroprudential tools to be made more effective at dampening credit cycles when monetary policies are pushing in the same direction. Equally, the change in the real money rate as a monetary policy indicator is considered by Gambacorta and Murcia (2019), who find that a macroprudential policy tightening affects credit growth more when it is accompanied by a countercyclical monetary policy. Zhang and Tressel (2017) adopt a similar approach to gauge this issue for euro area countries. More precisely, they focus on the loan-to-value (LTV) ratio and assess whether macroprudential policy is more effective in containing credit growth and housing prices when monetary policy is tightened. They do this by interacting the LTV ratio with an interest rate gap computed using a Taylor rule. However, their results are relatively mixed especially since the sign and the significance of the estimated coefficients associated with the interaction term are unstable depending on the lag order.

As we can see, empirical studies that assess the impact of monetary policy conditions on the effectiveness of macroprudential policies only focus on a small sample of economies, and their findings are relatively mixed. Against this background, our paper contributes to the existing

4. Akinci and Olmstead-Rumsey (2018) investigate a similar issue for a sample of emerging and industrialised economies. They find a relatively high correlation between macroprudential measures and other policy actions.

literature by explicitly investigating for a large sample of emerging and industrialised countries whether synchronising macroprudential and monetary policies is a good way to strengthen the impact of macroprudential tools on domestic credit growth. Furthermore, in contrast to the existing literature, our empirical analysis considers an extensive set of prudential tools to capture the overall stance of macroprudential policy. In this way, our paper fills a gap in the literature and provides the first formal answer to an extensive academic and policy debate.

3.3 Measuring the Stance of Macroprudential and Monetary Policies

3.3.1 Measuring the stance of macroprudential policy.

To analyse how effective macroprudential instruments are at curbing the credit cycle, we first need to assess the overall macroprudential policy stance. Efforts have been made recently in the academic literature to develop datasets that capture the use of macroprudential policies in a large sample of emerging and industrialised economies.

Two types of dataset can be distinguished. First, some studies consider a large set of macroprudential tools to provide information on the number of instruments adopted by countries. This lets them give a picture of the evolution of the macroprudential policy framework. For instance, the IMF's 2017 Macroprudential Policy Survey (IMF, 2018) and national sources are used by Cerutti et al. (2017a) to construct an aggregate macroprudential index in which each instrument considered is coded as a simple binary variable, equal to 1 if the instrument is in place, and 0 otherwise. Their results indicate the increasing use of macroprudential measures across countries.

Other studies go a step further by providing data on the quarterly changes in macroprudential tools (Vandenbussche et al., 2015; Kuttner and Shim, 2016; Cerutti et al., 2017b; Akinci and Olmstead-Rumsey, 2018; Alam et al., 2019). The main objective of these datasets is to use information on easing and tightening of different macroprudential policy instruments to reflect

the policy direction.

In this paper, we use the database provided by Cerutti et al. (2017b), which is one of the most comprehensive datasets on macroprudential policy actions. Using the same survey as Cerutti et al. (2017a), Cerutti et al. (2017b) consider five types of prudential instrument across a sample of 64 countries over the period 2000Q1-2014Q4. The five types of instrument are capital buffers, interbank exposure limits, concentration limits, loan-to-value ratio limits, and reserve requirements. More precisely, capital buffers are divided into four sub-indexes : general capital requirements, specific capital buffers related to real estate credit, specific capital buffers related to consumer credit, and other specific capital buffers. Reserve requirements are also divided into two sub-indexes of reserve requirements on foreign currency-denominated accounts and reserve requirements on local currency-denominated accounts.

Then, Cerutti et al. (2017b) record the number of easing and tightening measures for each type of macroprudential instrument implemented by each country in each quarter. For a given instrument, a tightening action is coded +1 and a loosening action is coded -1, while 0 means that no change occurs during the quarter. If multiple actions are taken within a given quarter, the reported values correspond to the sum of all the changes recorded, so tightening and loosening actions taken within the same quarter cancel each other out. An instrument that is not adopted by a given country is coded as missing until it is applied by policymakers. Table 3.1 details the number of events for each macroprudential policy instrument, distinguishing between net tightening and net loosening events. As can be seen, reserve requirements on local and foreign currency-denominated accounts and capital requirements are the most frequently used instruments.

Given these characteristics of the dataset provided by Cerutti et al. (2017b), we consider six different measures for assessing the stance of macroprudential policies. Two of them, *PruC* and *PruC2*, were originally developed by Cerutti et al. (2017b), and we also propose four alternative measures. These measures aim to give a better view of cross-country differences in terms of macroprudential policy conduct.

PruC is a country index based on the sum of the quarterly changes of the nine instruments.

TABLE 3.1 – Macroprudential policy instruments : number of events

| Instruments | Target | No. of events | No. of net tightening events | No. of net loosening events |
|--------------|----------|---------------|------------------------------|-----------------------------|
| CB REC | Lender | 33 | 28 | 5 |
| CB CC | Lender | 9 | 7 | 2 |
| CB OS | Lender | 11 | 7 | 4 |
| CAP REQ | Lender | 65 | 65 | 0 |
| CONC | Lender | 15 | 14 | 1 |
| IBEX | Lender | 16 | 16 | 0 |
| LTV | Borrower | 47 | 33 | 14 |
| RR FC | Lender | 56 | 33 | 23 |
| RR LC | Lender | 108 | 47 | 61 |
| Total events | | 360 | 250 | 110 |
| [share] | | [17.86%] | [12.41%] | [5.46%] |

Source : Cerutti et al. (2017b).

Note : CB REC : real estate credit related specific capital buffers; CB CC : consumer credit related specific capital buffers; CB OS : other specific capital buffers; CAP REQ : capital requirements; CONC : concentration limits; IBEX : limits on interbank exposures; LTV : loan-to-value ratio; RR LC : reserve requirements for deposit accounts denominated in local currency; RR FC : reserve requirements for deposit accounts denominated in foreign currency. The number of events is based on our sample of 37 countries from 2000Q1 to 2014Q4.

It can take three different values : -1, 0, +1. Formally, $PruC$ is defined as follows :

$$PruC_{i,t} = \begin{cases} +1 & \text{if } \sum_a x_{a,i,t} > 0 \\ 0 & \text{if } \sum_a x_{a,i,t} = 0 \\ -1 & \text{if } \sum_a x_{a,i,t} < 0 \end{cases} \quad (3.1)$$

where subscripts i and t refer respectively to country and time period, while the subscript a represents a given macroprudential instrument from among the nine recorded in the database. It is important though to note that the number of instruments considered can vary across countries depending on which instruments have or have not been adopted. As mentioned above, the absence of legislation authorising the use of a particular macroprudential instrument by policymakers is coded in the database as missing. $x_{a,i,t}$ reflects the orientation of instrument a in country i at time t . More precisely, for each instrument, it corresponds to the difference between the number of tightening actions and the number of easing actions. Positive values of $x_{a,i,t}$ indicate a net tightening of the macroprudential policy instrument a , while negative values indicate a net easing. So if $PruC$ is equal to +1, the overall macroprudential policy framework has been tightened during the quarter, but if $PruC$ is equal to -1, then the framework has been

loosened. $PruC$ being equal to 0 can correspond to two cases : no change in any instruments, or the same number of tightening and loosening actions during the quarter.

$PruC2$ is computed in a similar fashion to $PruC$. The only difference between these two country indexes is the way in which the orientation of individual macroprudential instruments is recorded. The orientation is now bounded between -1 and +1. For a given quarter, an instrument takes the value +1 if the difference between tightening and loosening actions is positive, -1 if this difference is negative, and 0 otherwise. $PruC2$ is computed as follows :

$$PruC2_{i,t} = \begin{cases} +1 & \text{if } \sum_a y_{a,i,t} > 0 \\ 0 & \text{if } \sum_a y_{a,i,t} = 0 \\ -1 & \text{if } \sum_a y_{a,i,t} < 0 \end{cases} \quad (3.2)$$

where $y_{a,i,t} = \{-1, 0, +1\}$ summarises the orientation of the instrument a , in country i at time t . Unlike $PruC$, $PruC2$ gives the same weight to each instrument adopted, whatever the number of tightening or loosening actions taken during a quarter for any given instrument. $PruC2$ then corresponds to the difference between the number of tightened instruments and the number of eased instruments. $PruC2$ is equal to +1 if the number of tightened instruments during the quarter is higher than the number of loosened instruments, -1 if the difference between tightened and loosened instruments is negative, and 0 otherwise.

In addition to the measures proposed by Cerutti et al. (2017b), we compute four alternative country indexes. First, to have a more granular view of the macroprudential policy stance, we compute an overall index, called $PruC3$, which corresponds for a given quarter to the difference between the sum of tightening actions and the sum of loosening actions. Formally, $PruC3$ is defined as follows :

$$PruC3_{i,t} = \sum_a x_{a,i,t} \quad (3.3)$$

where, as in Equation (3.1), $x_{a,i,t}$ corresponds for each instrument a in country i at time t , to the difference between tightening and loosening actions. A larger positive value of this index indicates a more restrictive macroprudential policy, while a larger negative value reflects a more accommodative policy.

As with *PruC* and *PruC2* proposed by Cerutti et al. (2017b), one shortcoming of the *PruC3* index is that it does not take into account that the number of instruments adopted can differ across countries. Indeed it would be expected that the number of actions be partly driven by the number of instruments adopted, especially if all the instruments move in the same direction. To address this issue, we compute an additional index, called *PruC4*, which is defined as follows :

$$PruC4_{i,t} = \frac{PruC3_{i,t}}{n_{i,t}} \quad (3.4)$$

where $n_{i,t}$ corresponds to the number of instruments adopted in country i at time t . Like this, *PruC4* captures the overall direction of the macroprudential policy conditional on the number of tools implemented.

However, one potential drawback of the *PruC4* index is that we do not distinguish between instruments that have actually been changed and those for which no action has been taken. To handle this we go a step further by computing an index that reflects the macroprudential policy stance conditional on the number of instruments actually changed during a given quarter. This index, called *PruC5*, is defined as follows :

$$PruC5_{i,t} = \frac{PruC3_{i,t}}{e_{i,t}} \quad (3.5)$$

where $e_{i,t}$ corresponds to the number of instruments in country i at time t that have effectively been changed.

The last measure that we consider aims to distinguish between tightening and loosening actions. This measure, called *PruC6*, is computed as follows :

$$PruC6_{i,t} = \frac{\sum_T x_{T,i,t}}{Tight_{i,t}} + \frac{\sum_L x_{L,i,t}}{Loose_{i,t}} \quad (3.6)$$

where $x_{T,i,t}$ corresponds to the recorded value of the macroprudential instrument T that is characterised by a net tightening during the quarter, while $x_{L,i,t}$ corresponds to the recorded value of the instrument L that is characterised by a net loosening. $Tight_{i,t}$ and $Loose_{i,t}$ stand for the number of net tightening instruments and the number of net easing instruments. *PruC6* is then

complementary to the previous indexes described above, as it reflects both the macroprudential policy stance and the more or less balanced path of the policy. In comparison to *PruC5*, the *PruC6* index is notably better able to evaluate the stance of macroprudential policy when some macroprudential tools move in opposite ways. A higher value of this index indicates a more restrictive macroprudential policy.

To illustrate the pattern of our macroprudential indexes following policy changes, we consider four countries, Argentina, Colombia, Poland and the Russian Federation, where different macroprudential policy actions have been taken during a given quarter (see Table 3.2). As expected, the other macroprudential measures that we propose in this article tend to discriminate the macroprudential policy stance across countries better than *PruC* and *PruC2* do. Looking at Colombia, we can see that *PruC6* is higher in absolute terms than *PruC5*. This confirms the relevance of this index when the number of tightening actions per instrument is lower than the number of loosening actions per instrument.

TABLE 3.2 – Changes in the macroprudential indexes : country case studies

| | Argentina 2002Q1 | Colombia 2008Q3 | Poland 2012Q2 | Russian Fed. 2008Q4 |
|--|--------------------------|--------------------------|---|--------------------------|
| Macroprudential policy actions (+) : tightening actions (-) : loosening actions | RR LC : +5 RR FC : +5 | RR LC : +1 RR FC : -2 | CB REC : +1 CB CC : +1 CB OS : +1 | RR LC : -3 RR FC : -3 |
| No. of adopted inst. | 8 | 9 | 7 | 7 |
| No. of tightened inst. | 2 | 1 | 3 | 0 |
| No. of loosened inst. | 0 | 1 | 0 | 2 |
| <i>PruC</i> | 1 | -1 | 1 | -1 |
| <i>PruC2</i> | 1 | 0 | 1 | -1 |
| <i>PruC3</i> | 10 | -1 | 3 | -6 |
| <i>PruC4</i> | 1.25 | -0.11 | 0.43 | -0.86 |
| <i>PruC5</i> | 5 | -0.5 | 1 | -3 |
| <i>PruC6</i> | 5 | -1 | 1 | -3 |

Source : Cerutti et al. (2017b) and authors' calculations.

Note : RR LC : reserve requirements for deposit accounts denominated in local currency ; RR FC : reserve requirements for deposit accounts denominated in foreign currency ; CB REC : real estate credit related specific capital buffers ; CB CC : consumer credit related specific capital buffers ; CB OS : other specific capital buffers.

3.3.2 Measuring the stance of monetary policy.

To assess the monetary policy stance, we need to differentiate between “rule-based” monetary policy and “discretionary” monetary policy. We do this by following the existing literature (see, e.g., Bogdanova and Hofmann, 2012 ; Bruno et al., 2017) and using the well-known Taylor rule (Taylor, 1993). The Taylor rule constitutes an approximation of the behaviour of a central bank and has become popular in the academic literature for describing the monetary policy stance. The Taylor rule is a reaction function that defines the central bank interest rate as a function of inflation and a measure of economic activity, typically the output gap. Comparing the policy rate with the empirically estimated Taylor rate then gives an understanding of how far policy rate setting has deviated from the Taylor rule.

In line with Bogdanova and Hofmann (2012) and using historical time series for each country in our sample, we estimate the following reaction function :

$$i_t = \rho i_{t-1} + (1 - \rho)[\alpha + \beta_\pi(\pi_t) + \beta_y(y_t - \bar{y}_t)] + \varepsilon_t \quad (3.7)$$

where i_t is the actual short-term policy rate of a given country, which is lagged one period on the right side of Equation (3.7) to capture interest rate smoothing. As in the original Taylor rule, this assumes a gradual adjustment of policy rates to their benchmark level. π_t is the contemporaneous inflation rate, $y_t - \bar{y}$ is the output gap, and ε_t is the error term.⁵ A positive relationship could be expected between the inflation rate, the output gap, and the policy rate, meaning $\beta_\pi > 0$ and $\beta_y > 0$.

The central bank policy rates are taken from the database provided by the Bank for International Settlements (BIS). As these data are collected on a monthly basis, we consider the end-of-quarter rates. The annual inflation rate comes from the International Monetary Fund’s International Financial Statistics (IFS) database. Real GDP is taken from the OECD Statistics for the OECD countries, and from the IFS for the others. The inflation and GDP data series

5. Because our sample includes inflation targeting and non-inflation targeting countries, we do not consider the inflation gap in Equation (3.7). In most non-inflation targeting countries, the central bank does not publicly announce a numerical inflation target or the horizon of this target. However, under the assumption that the target is constant over time, it is captured in the constant term α .

are seasonally adjusted using the US Census Bureau X-11-ARIMA method. Finally, the output gap corresponds to the difference between actual real GDP and its trend, computed using the traditional Hodrick-Prescott filter.

Following Clarida et al. (2000) and the related literature, we estimate Equation (3.7) using the Generalised Method of Moments (GMM) estimator to overcome the issue of potential endogeneity. Furthermore, the time period for estimating Equation (3.7) covers the longest available data time span so as to give consistent estimates, and then differs across the countries in our sample. An important consideration with such an approach is the selection of valid instruments. This selection is based on the overidentification test developed by Hansen (1982). This implies that the set of instruments considered can be different for each country. The Taylor rule estimates are reported in Table 3.9 in the Appendix.

The Taylor gap then corresponds to the difference between the actual policy rate and the estimated Taylor rate ($i_t - \hat{i}_t$). This gap reflects the monetary policy stance. A positive difference can be interpreted as a restrictive monetary policy, while a negative difference can be understood as an accommodative monetary policy.

However, the use of the policy rate as the main monetary policy instrument can be challenged, and some industrialised economies actually adopted unconventional monetary policies in the aftermath of the 2007-08 financial crisis. This means that assessing the impact of the unconventional measures implemented and understanding the overall monetary policy stance using the Taylor gap can be inappropriate. To address this issue, as is usual in the literature, we do not consider the gap between the actual policy rate and the Taylor rate, but the difference between the shadow rate and the Taylor rate.

The shadow rate, first introduced by Black (1995), has recently been used by a number of papers to quantify the stance of monetary policy in a “zero lower bound” environment (see, e.g., Krippner, 2013; Wu and Xia, 2016; Wu and Xia, 2017; Lombardi and Zhu, 2018). Indeed, when the zero lower bound is binding, the policy interest rate does not display meaningful variation and so no longer conveys information about the monetary policy stance. The shadow rate meanwhile is not bounded and can freely take on negative values to reflect unconventional

monetary policy actions. Krippner (2015) and Wu and Xia (2016) argue that the shadow rate can be used in place of the policy rate to describe the stance and effects of the monetary policy in a “zero lower bound” environment. In this paper, we use the shadow rates provided by Krippner (2013) for the euro area, Japan, the United Kingdom and the United States. These data are available on the website of the Reserve Bank of New Zealand.

3.4 Empirical analysis

Using the insights from the existing literature and the arguments presented above, our empirical analysis aims to gauge the effectiveness of macroprudential policies in curbing credit growth and whether the monetary policy stance drives this effectiveness. Given data availability, we do this by considering a sample of 37 advanced and emerging economies over the period 2000Q1-2014Q4. However, before turning to the econometric analysis, this section presents some descriptive statistics and preliminary findings.

3.4.1 Preliminary findings

We start our empirical investigation by analysing in Figure 3.1 the evolution of the macroprudential policy stance in our sample of countries. Panels (A) and (B) focus on the *PruC3* index, which is the most explicit indicator for giving a clear picture of the overall evolution of macroprudential policies. Panel (A) represents the cross-sectional average value of the *PruC3* index for each quarter. The blue bars indicate positive values, while the red bars indicate negative values. As would be expected, it appears that a broad range of macroprudential instruments have been significantly tightened in the aftermath of the global financial crisis. However, this does not mean that all the economies in our sample conducted their macroprudential policy in the same direction. To illustrate this we split our sample of countries into two categories in panel (B) of countries with a net tightened macroprudential policy stance during a given quarter, and those with a net loosened macroprudential policy stance. The blue bars correspond to the average value of the *PruC3* index for the first category of countries, while the red

bars indicate the average value of the *PruC3* index for the second category of countries. A loose macroprudential policy can be observed in some countries since mid-2009. Panel (C) goes a step further by providing a picture of macroprudential activism. It represents the number of countries in which the macroprudential policy stance changed over a given quarter, and it also distinguishes the orientation of this change. The red bars correspond to the number of countries with a net loosened macroprudential policy stance, while the blue bars correspond to the number of countries with a net tightened macroprudential policy stance. It shows that macroprudential activism has tended to increase over the period considered. Finally, panel (D) presents the frequency of quarterly observations with a net tightened or a net loosened macroprudential policy stance. It shows that net tightening actions are more than twice as common as net loosening actions in our sample.

FIGURE 3.1 – Descriptive statistics on macroprudential policy stance



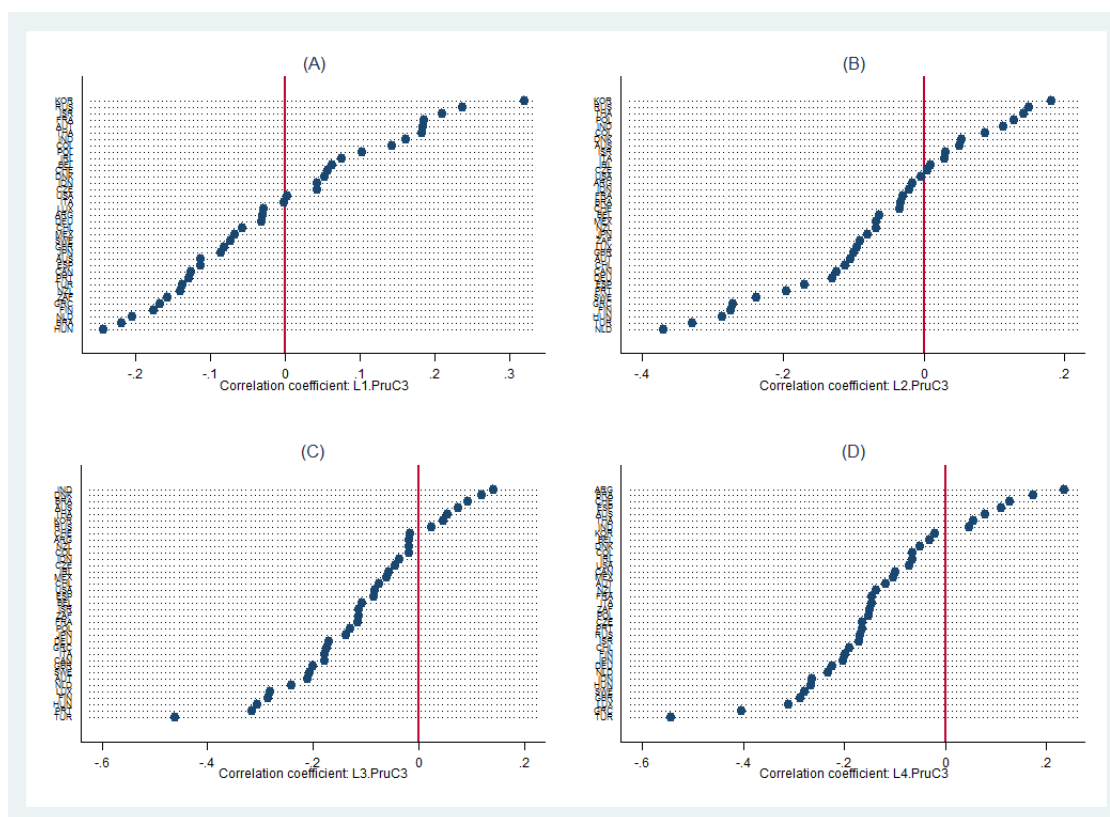
Source : Cerutti et al. (2017b) and authors' calculations.

Note : All panels are based on our sample of 37 countries. Panel (A) presents the cross-sectional average value of the *PruC3* index for each quarter. In panel (B), the blue bars correspond to the average value of the *PruC3* index of countries with a net tightened macroprudential policy stance, and the red bars correspond to the average value of the *PruC3* index of countries with a net loosened macroprudential policy stance. Panel (C) presents the number of countries in which the macroprudential policy stance changed over a given quarter by distinguishing between tightened and loosened stances. Panel (D) presents the share of quarterly observations with a net tightened or a net loosened macroprudential policy stance. No action corresponds to no change in all instruments or to the same number of tightening and loosening actions during a given quarter.

In Figure 3.2 we represent the country-by-country cross-correlation coefficient between dif-

ferent lags of the *PruC3* index and the residuals of the annual growth rate of total credit to the private non-financial sector from banks. The residuals are obtained by regressing credit growth on the annual GDP growth lagged by one period. They capture the part of credit that is not driven by real economic activity and so can be viewed as a proxy for excess credit growth. Panels (A), (B), (C) and (D) consider 1, 2, 3 and 4 lags for the *PruC3* index respectively. As expected, the cross-correlation coefficient is negative for most countries, suggesting that a net tightened macroprudential stance is associated with lower credit growth. Furthermore, we can observe that the number of countries characterised by a negative correlation increases with the lag order and that a tightening in macroprudential policy is associated with a larger reduction in annual credit growth after one year.

FIGURE 3.2 – Correlation between the macroprudential stance and credit growth



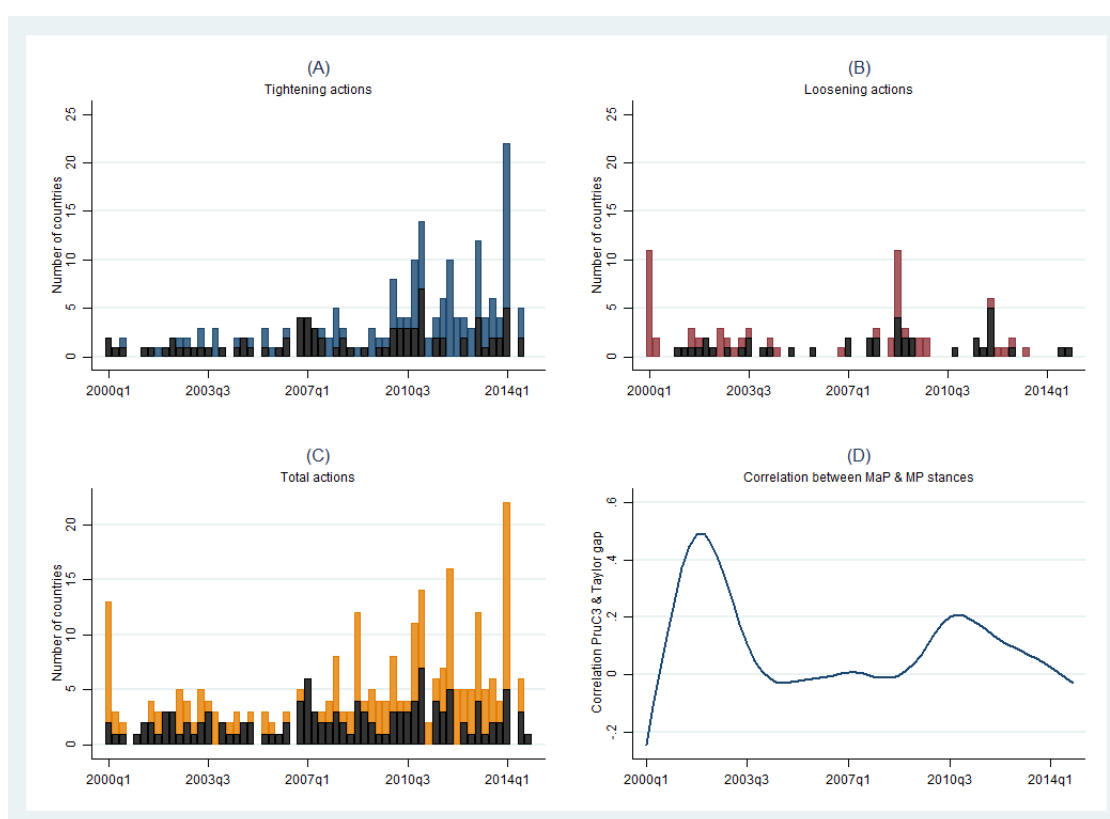
Source : Cerutti et al. (2017b), Bank for International Settlements and authors' calculations.

Note : All panels are based on our sample of 37 countries. They represent the country-by-country cross-correlation coefficient between the *PruC3* index and the residuals of the growth rate of total credit to the private non-financial sector from banks. The residuals are obtained by regressing credit growth on GDP growth lagged by one period. Panels (A), (B), (C) and (D) consider 1, 2, 3 and 4 lags for the *PruC3* index respectively.

In Figure 3.3, we give an overview of the synchronisation of macroprudential and monetary policies by comparing changes in macroprudential policy with the monetary policy stance. In panels (A), (B) and (C), grey bars represent the number of countries in each period where

both policies exhibit the same stance. Not surprisingly, panel (C) shows that monetary policy tended to desynchronise from macroprudential policy in the aftermath of the global financial crisis. During this period, most central banks around the world conducted accommodative monetary policies, and many countries strengthened their macroprudential framework at the same time [see panel (A)]. This picture is confirmed in panel (D), which represents the trend of the cross-sectional correlation between the *PruC3* index and the Taylor gap for each quarter.⁶

FIGURE 3.3 – Synchronisation of the stances of macroprudential and monetary policies



Source : Cerutti et al. (2017b) and authors' calculations.

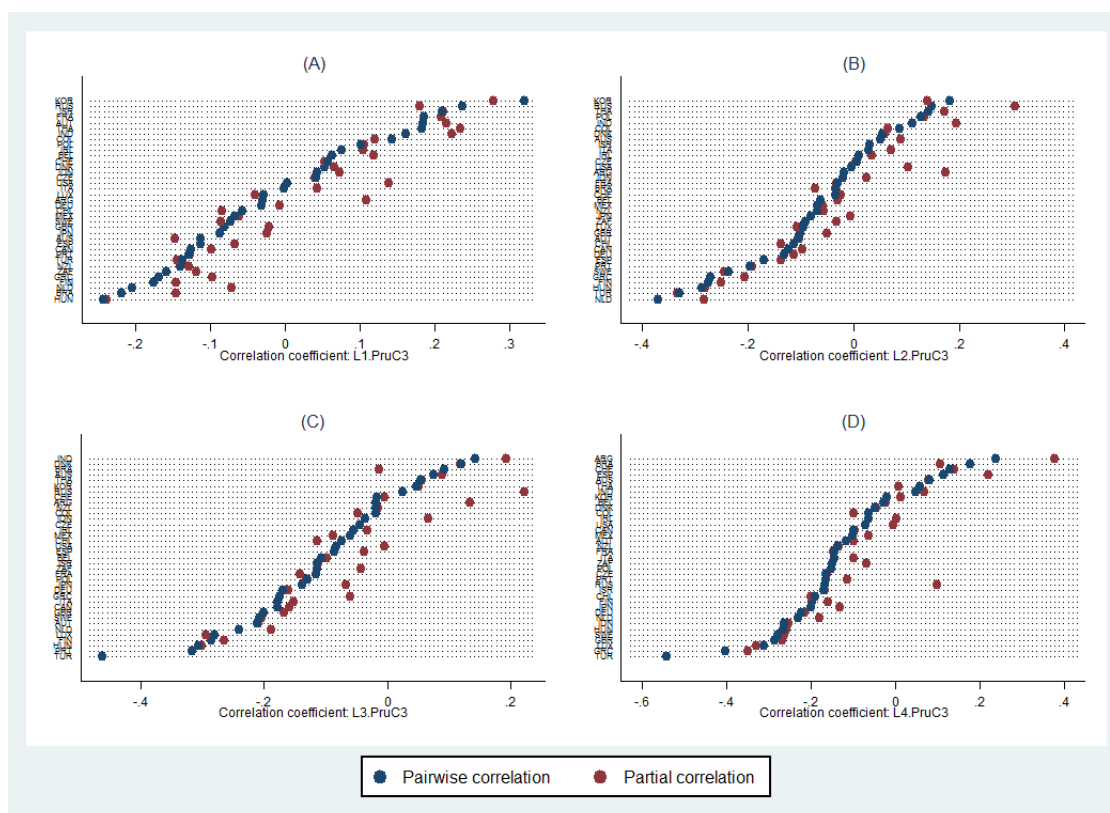
Note : All panels are based on our sample of 37 countries. Panels (A) and (B) represent the number of countries with a net tightened and a net loosened macroprudential policy stance respectively for each quarter. Panel (C) represents the number of countries in which the macroprudential policy stance changed over the given quarter, whatever the direction of the macroprudential policy. For each of these panels, the grey bars correspond to the number of cases where macroprudential and monetary policies move in the same direction. Panel (D) represents the trend of the cross-sectional correlation between the *PruC3* index and the Taylor gap for each quarter. The trend is obtained using the Hodrick-Prescott filter.

Finally, in Figure 3.4 we analyse whether the monetary policy stance drives the country-by-country cross-correlation between the *PruC3* index and credit growth. To this end, we compute the partial correlation by controlling for the Taylor gap. The partial correlation coefficients are illustrated by the red points, while the blue points indicate the correlation coefficients reported in Figure 3.2. Overall, the partial correlation coefficients are higher than the pairwise

6. See, for instance, Borio and Shim (2007) and Bruno et al. (2017) for further evidence.

correlation coefficients regardless of the lag order considered. When the coefficient is negative, this means that taking account of the monetary policy stance reduces the correlation between the macroprudential policy stance and credit growth. These preliminary findings then confirm the importance of monetary policy for the effectiveness of macroprudential policy in curbing credit growth. This issue is investigated in more detail in the next sub-section.

FIGURE 3.4 – Partial correlation between the macroprudential stance and credit growth



Source : Cerutti et al. (2017b), Bank for International Settlements and authors' calculations.

Note : All panels are based on our sample of 37 countries. Red points represent the country-by-country partial cross-correlation coefficient between the *PruC3* index and the residuals of the growth rate of total credit to the private non-financial sector from banks. The residuals are obtained by regressing credit growth on the one period lagged GDP growth. The partial correlation corresponds to the correlation between the *PruC3* index and credit growth when controlling for the Taylor gap. Blue points are the cross-correlation coefficients reported in Figure 3.2. Panels (A), (B), (C) and (D) consider 1, 2, 3 and 4 lags for the *PruC3* index, respectively.

3.4.2 Econometric approach

Our empirical analysis proceeds in two steps. First we follow the existing literature by reinvestigating how our different measures of the macroprudential policy stance affect credit growth. To this end we consider two alternative measures of domestic credit, which are total credit to the private non-financial sector from banks and total credit to households and non-

profit institutions serving households. These data are taken from the BIS.

The baseline model that we estimate is the following :

$$\Delta Credit_{i,t} = \alpha + \sum_{k=1}^4 \beta_k MaP_{i,t-k} + \eta X_{i,t-1} + \theta Crisis_t + \mu_i + \epsilon_{i,t} \quad (3.8)$$

where $\Delta Credit_{i,t}$ is the yearly growth of our different measures of credit, and $MaP_{i,t-k}$ corresponds to our alternative macroprudential policy stance indexes, for which we include four lags (see, e.g., Kuttner and Shim, 2016 ; Zhang and Tressel, 2017), as some macroprudential actions may be delayed in their effect. $X_{i,t-1}$ represents the vector of control variables. Following the existing literature, we consider two control variables, which are the annual GDP growth rate and the change in the nominal monetary policy rate. These two variables are lagged one period and are taken from the IFS database and the BIS respectively. A negative relationship should be expected between the change in policy rate and the growth of credit, while higher GDP growth should be associated with higher credit growth. The GDP growth rate is included to control for the procyclicality of credit (Athanasoglou et al., 2014), and this then allows us to capture the part of credit that is not driven by real economic activity, which is excess credit growth. $Crisis_t$ is a dummy variable capturing a potential drop in credit growth during the recent crisis period. It is equal to 1 from 2008Q3 to 2012Q4, and 0 otherwise. Country-fixed effects μ_i allow for cross-country differences in average credit growth, and $\epsilon_{i,t}$ is the error term. We could expect $\beta_k < 0$, meaning that a more restrictive macroprudential policy helps to curb domestic credit growth. In the second step, we extend our previous baseline model to assess whether a tighter macroprudential policy is more likely to curb domestic credit growth when it is accompanied by a restrictive monetary policy, giving a positive Taylor gap. More precisely, the equation that we estimate is the following :

$$\begin{aligned} \Delta Credit_{i,t} = \alpha + \sum_{k=1}^4 \beta_k MaP_{i,t-k} + \sum_{k=1}^4 \gamma_k (MaP_{i,t-k} \times TG_{i,t-k} \times D_{i,t-k}) \\ + \eta X_{i,t-1} + \theta Crisis_t + \mu_i + \epsilon_{i,t} \end{aligned} \quad (3.9)$$

where $TG_{i,t-k}$ corresponds to the Taylor gap described in the previous section and $D_{i,t-k}$ is a dummy variable equal to 1 when macroprudential and monetary policies are both restrictive in a

given quarter, and 0 otherwise. Consequently, the interaction term ($MaP_{i,t-k} \times TG_{i,t-k} \times D_{i,t-k}$) captures the additional effect of macroprudential policies on credit growth conditional on the stance of monetary policy.⁷

As we are primarily interested in assessing whether the monetary policy stance is an important determinant of the effectiveness of macroprudential policies, we focus particularly on the marginal effect of our alternative macroprudential stance indexes on credit growth. Formally, this marginal effect can be derived from Equation (3.9) as follows :

$$\frac{\delta \Delta Credit_{i,t}}{\delta MaP_{i,t-k}} = \beta_k + \gamma_k (TG_{i,t-k} \times D_{i,t-k}) \quad (3.10)$$

If we find that $\beta_k < 0$ and $\gamma_k < 0$, this means that a more restrictive monetary policy reinforces the effect of macroprudential policies on credit growth. We can also expect the case where β_k is not statistically significant at the conventional levels ($\beta_k = 0$) and $\gamma_k < 0$. Such a result indicates that credit growth cannot be contained through macroprudential policy alone, but that this needs the support of monetary policy. In other words, macroprudential tightening actions are more likely to reduce credit growth if they are implemented in tandem with a restrictive monetary policy.

Finally, we re-estimate Equation (3.9) by considering the first difference of the Taylor gap as an alternative measure of the monetary policy stance. The Taylor gap reflects whether a monetary policy is accommodative or restrictive, while its first difference captures the monetary policy orientation, meaning whether monetary policy has been tightened or loosened. Formally, the equation that we estimate is the following :

$$\begin{aligned} \Delta Credit_{i,t} = & \alpha + \sum_{k=1}^4 \beta_k MaP_{i,t-k} + \sum_{k=1}^4 \gamma_k (MaP_{i,t-k} \times \Delta TG_{i,t-k} \times I_{i,t-k}) \\ & + \eta X_{i,t-1} + \theta Crisis_t + \mu_i + \epsilon_{i,t} \end{aligned} \quad (3.11)$$

7. It is justified to consider the dummy variable $D_{i,t-k}$ because the macroprudential indexes and the Taylor gap can take positive and negative values. In this case, the estimated coefficient associated with the interaction term ($MaP_{i,t-k} \times TG_{i,t-k}$) cannot be interpreted properly. Indeed if both variables are positive, a negative coefficient would be expected, but if both variables are negative, a positive coefficient would be expected. This then justifies the use of a three-way interaction term to assess whether a tighter macroprudential policy is more likely to curb domestic credit growth when it is accompanied by a restrictive monetary policy.

where $\Delta TG_{i,t-k}$ is the first difference of the Taylor gap, and $I_{i,t-k}$ is a dummy variable equal to 1 if the macroprudential index considered and the first difference of the Taylor gap are both positive in a given quarter, and 0 otherwise. As above, if monetary policy is an important driver of macroprudential policy effectiveness, we would expect $\gamma_k < 0$.⁸

3.4.3 Results

Our results are reported in Tables 3.3 to 3.5. In Table 3.3, we report the results when we consider *PruC* and *PruC2* as alternative measures of the macroprudential policy stance, Table 3.4 displays the results obtained with *PruC3* and *PruC4*, while Table 3.5 displays the results obtained with *PruC5* and *PruC6*. To give a better view of how important the monetary policy stance is for the conduct of macroprudential policy, we present the results of the baseline and extended models side by side. For each macroprudential index considered, the first column displays the results obtained when we consider only the effects of macroprudential policy stance on credit growth. The next two columns report the results when we take the monetary policy stance into account, which is proxied using two alternative measures, the Taylor gap and its first difference.

We find three important results. First, in line with the recent literature on macroprudential policy, our empirical findings suggest that an overall tightening in macroprudential policies is associated with a reduction in credit growth. Other than for two specifications (columns [2.1] and [2.7]), we find a negative and statistically significant relationship between our macroprudential indexes and domestic credit growth. Furthermore, and as might be expected, macroprudential policy actions take time to curb domestic credit growth effectively. For most specifications, we can see that the coefficients associated with macroprudential indexes are only significant at the third and fourth order lags.

Second, the results when we add the interaction term in the baseline model show that the monetary policy stance matters for the effectiveness of macroprudential policy. The coefficients

8. Please note that we also estimate Equation (3.11) by considering the policy interest rate variation as an additional measure of the monetary policy orientation. A summary of the results is reported in Tables 3.7 and 3.8 in the Appendix.

associated with the interaction term are negative and statistically significant. When we consider the Taylor gap in the interaction term, this negative sign means that a restrictive monetary policy actually enhances the impact of macroprudential tightening actions on credit growth. Equally, the results from considering the first difference of the Taylor gap show that the marginal effect on credit growth of tightening macroprudential instruments is affected by whether the prevailing monetary policy stance is tight or loose. The benefits of synchronisation between macroprudential and monetary policies are also confirmed in columns [2.2], [2.3], [2.8] and [2.9]. While *PruC3* and *PruC4* did not appear statistically significant in the baseline specification (columns [2.1] and [2.7]), we can now observe a significant marginal effect of both indexes on credit growth when macroprudential and monetary policies complement each other.

Finally, we find evidence that monetary policy helps to reduce the transmission delay of macroprudential policy actions on private sector credit growth, as the coefficients associated with the interaction term are negative and significant at the first, second and third order lags. The results are more mixed when we consider the growth of credit to households as a dependent variable.

In sum, even though monetary and macroprudential policies pursue different primary objectives, our empirical analysis confirms that the two policies are complementary. Our results particularly emphasise the importance of implementing a monetary policy that supports the macroprudential policy by moving in the same direction, and then attenuating its potential side effects on financial stability.

TABLE 3.3 – Results obtained with *PruC* and *PruC2*

| | <i>PruC</i> | | | | | <i>PruC2</i> | | | | | | |
|---------------------|-----------------------------------|----------------------|----------------------|----------------------|-------------------------------|----------------------|-----------------------------------|----------------------|----------------------|----------------------|--------------------------------|----------------------|
| | Credit to private sector (1.1) | (1.2) | (1.3) | (1.4) | Credit to households (1.5) | (1.6) | Credit to private sector (1.7) | (1.8) | (1.9) | (1.10) | Credit to households (1.11) | (1.12) |
| L.MaP | 0.972 (1.184) | 0.931 (0.959) | 0.743 (1.032) | -0.377 (1.638) | -0.557 (1.403) | -0.697 (1.437) | 0.980 (1.199) | 0.948 (0.973) | 0.758 (1.044) | -0.416 (1.651) | -0.583 (1.418) | -0.724 (1.449) |
| L2.MaP | -0.658 (1.132) | -0.861 (0.937) | -1.007 (0.958) | -2.377 (1.679) | -2.556* (1.471) | -2.645* (1.467) | -0.721 (1.162) | -0.914 (0.966) | -1.060 (0.987) | -2.450 (1.705) | -2.616* (1.497) | -2.704* (1.489) |
| L3.MaP | -2.029 (1.388) | -2.285* (1.256) | -2.475* (1.227) | -4.030** (1.914) | -4.207** (1.703) | -4.356** (1.657) | -2.082 (1.382) | -2.324* (1.258) | -2.513** (1.229) | -4.073** (1.911) | -4.234** (1.708) | -4.382** (1.662) |
| L4.MaP | -3.073* (1.775) | -3.670** (1.473) | -3.675** (1.425) | -5.769** (2.472) | -5.987*** (1.993) | -6.058*** (1.968) | -3.053* (1.768) | -3.632** (1.468) | -3.637** (1.420) | -5.727** (2.481) | -5.927*** (2.003) | -5.998*** (1.977) |
| L.(MaP × TG × D) | -1.156*** (0.231) | -0.914*** (0.188) | -0.824*** (0.198) | -0.816* (0.433) | -0.896 (0.604) | -0.821*** (0.189) | -1.154*** (0.231) | -0.911*** (0.189) | -0.811* (0.435) | -0.891 (0.606) | -0.811* (0.435) | -0.811* (0.435) |
| L2.(MaP × TG × D) | -0.824*** (0.198) | -0.816* (0.433) | -0.771* (0.387) | -0.771* (0.387) | -0.771* (0.387) | -0.771* (0.387) | -0.821*** (0.198) | -0.821*** (0.198) | -0.821*** (0.198) | -0.821*** (0.198) | -0.821*** (0.198) | -0.821*** (0.198) |
| L3.(MaP × TG × D) | 0.215 (0.175) | 0.215 (0.175) | 0.215 (0.175) | 0.215 (0.175) | 0.215 (0.175) | 0.215 (0.175) | 0.215 (0.175) | 0.215 (0.175) | 0.215 (0.175) | 0.215 (0.175) | 0.215 (0.175) | 0.215 (0.175) |
| L.(MaP × Δ TG × I) | -1.078*** (0.209) | -0.931*** (0.136) | -0.856*** (0.111) | -0.856*** (0.111) | -0.856*** (0.111) | -0.856*** (0.111) | -1.077*** (0.209) | -0.928*** (0.136) | -0.854*** (0.111) | -1.077*** (0.209) | -0.829** (0.330) | -0.802*** (0.271) |
| L2.(MaP × Δ TG × I) | -0.829** (0.330) | -0.802*** (0.271) | -0.806*** (0.169) | -0.806*** (0.169) | -0.806*** (0.169) | -0.806*** (0.169) | -0.829** (0.330) | -0.802*** (0.271) | -0.802*** (0.271) | -0.829** (0.330) | -0.802*** (0.271) | -0.802*** (0.271) |
| L3.(MaP × Δ TG × I) | -0.802*** (0.271) | -0.806*** (0.169) | -0.806*** (0.169) | -0.806*** (0.169) | -0.806*** (0.169) | -0.806*** (0.169) | -0.802*** (0.271) | -0.802*** (0.271) | -0.802*** (0.271) | -0.802*** (0.271) | -0.802*** (0.271) | -0.802*** (0.271) |
| L4.(MaP × Δ TG × I) | -0.802*** (0.271) | -0.806*** (0.169) | -0.806*** (0.169) | -0.806*** (0.169) | -0.806*** (0.169) | -0.806*** (0.169) | -0.802*** (0.271) | -0.802*** (0.271) | -0.802*** (0.271) | -0.802*** (0.271) | -0.802*** (0.271) | -0.802*** (0.271) |
| L.Δ GDP | 2.460*** (0.256) | 2.155*** (0.241) | 2.142*** (0.234) | 2.725*** (0.296) | 2.442*** (0.363) | 2.429*** (0.347) | 2.458*** (0.256) | 2.153*** (0.242) | 2.140*** (0.234) | 2.719*** (0.294) | 2.437*** (0.365) | 2.423*** (0.348) |
| L.Δ Policy rate | -0.793 (0.722) | 2.415 (1.628) | 2.452 (1.539) | -2.406 (2.173) | -0.340 (4.511) | -0.306 (4.315) | -0.790 (0.725) | 2.408 (1.631) | 2.446 (1.541) | -2.403 (2.177) | -0.355 (4.516) | -0.318 (4.318) |
| Crisis dummy | -4.246*** (1.442) | -4.707*** (1.291) | -4.692*** (1.293) | -5.568*** (1.802) | -6.119*** (1.620) | -6.075*** (1.612) | -4.237*** (1.442) | -4.698*** (1.293) | -4.682*** (1.295) | -5.548*** (1.801) | -6.098*** (1.622) | -6.054*** (1.614) |
| Constant | 5.974*** (1.173) | 7.356*** (0.957) | 7.333*** (0.942) | 8.480*** (1.210) | 9.737*** (1.171) | 9.671*** (1.124) | 5.981*** (1.172) | 7.360*** (0.957) | 7.338*** (0.942) | 8.493*** (1.208) | 9.743*** (1.175) | 9.679*** (1.128) |
| Observations | 2,015 | 2,015 | 2,011 | 1,950 | 1,950 | 1,946 | 2,015 | 2,015 | 2,011 | 1,950 | 1,950 | 1,946 |
| Number of countries | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 |
| Adjusted R-squared | 0.248 | 0.267 | 0.270 | 0.249 | 0.262 | 0.263 | 0.248 | 0.267 | 0.270 | 0.249 | 0.262 | 0.263 |

Note : Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels respectively. MaP is the different macroprudential policy indexes considered, TG corresponds to the Taylor gap, Δ TG corresponds to the first difference of the Taylor gap, and D and I correspond to the alternative dummy variables capturing the stance of macroprudential and monetary policies.

TABLE 3.4 – Results obtained with *Pruc3* and *Pruc4*

| | <i>Pruc3</i> | | | | <i>Pruc4</i> | | | | | | | |
|---------------------|-----------------------------------|----------------------|----------------------|-------------------------------|----------------------|----------------------|-----------------------------------|----------------------|----------------------|--------------------------------|----------------------|----------------------|
| | Credit to private sector (2.1) | (2.2) | (2.3) | Credit to households (2.4) | (2.5) | (2.6) | Credit to private sector (2.7) | (2.8) | (2.9) | Credit to households (2.10) | (2.11) | (2.12) |
| L.MaP | -0.025 (0.719) | 0.343 (0.718) | 0.345 (0.736) | -0.985 (0.993) | -0.879 (1.082) | -0.855 (1.092) | 0.017 (5.470) | 2.462 (5.471) | 2.459 (5.625) | -7.708 (7.828) | -7.098 (8.364) | -6.932 (8.455) |
| L2.MaP | -0.682 (0.662) | -0.502 (0.685) | -0.480 (0.682) | -1.795 (1.130) | -1.596 (1.201) | -1.555 (1.200) | -4.499 (4.889) | -3.103 (4.981) | -2.962 (4.970) | -13.076 (8.719) | -11.516 (9.122) | -11.221 (9.128) |
| L3.MaP | -1.387 (0.825) | -1.083 (0.973) | -1.075 (0.969) | -2.430* (1.247) | -2.108 (1.430) | -2.080 (1.427) | -10.072 (6.189) | -7.906 (7.130) | -7.870 (7.099) | -18.254* (9.717) | -15.966 (10.848) | -15.774 (10.839) |
| L4.MaP | -1.526 (1.269) | -2.020* (1.148) | -1.983* (1.135) | -3.441* (1.941) | -3.332* (1.679) | -3.285* (1.670) | -11.690 (9.217) | -14.994* (8.449) | -14.726* (8.348) | -26.257* (14.269) | -25.305* (12.639) | -24.966* (12.572) |
| L.(MaP × TG × D) | -0.099*** (0.024) | | | | -0.059 (0.062) | | | -0.779*** (0.192) | | | -0.457 (0.504) | |
| L2.(MaP × TG × D) | -0.079*** (0.015) | | | | -0.060 (0.038) | | | -0.634*** (0.120) | | | -0.490 (0.306) | |
| L3.(MaP × TG × D) | -0.075*** (0.014) | | | | -0.065* (0.033) | | | -0.602*** (0.107) | | | -0.515* (0.263) | |
| L4.(MaP × TG × D) | 0.023 (0.017) | | | | -0.025 (0.045) | | | 0.175 (0.137) | | | -0.211 (0.369) | |
| L.(MaP × Δ TG × I) | | | -0.092*** (0.022) | | | -0.055 (0.057) | | | | | | -0.429 (0.460) |
| L2.(MaP × Δ TG × I) | | | -0.074*** (0.013) | | | -0.058* (0.034) | | | | | | -0.468* (0.271) |
| L3.(MaP × Δ TG × I) | | | -0.071*** (0.012) | | | -0.062** (0.029) | | | | | | -0.492** (0.231) |
| L4.(MaP × Δ TG × I) | | | 0.021 (0.016) | | | -0.023 (0.041) | | | | | | -0.196 (0.338) |
| L.Δ GDP | 2.466*** (0.267) | 2.209*** (0.237) | 2.204*** (0.234) | 2.706*** (0.297) | 2.504*** (0.343) | 2.493*** (0.336) | 2.466*** (0.267) | 2.209*** (0.236) | 2.204*** (0.233) | 2.710*** (0.298) | 2.509*** (0.343) | 2.498*** (0.336) |
| L.Δ Policy rate | -0.733 (0.834) | 1.574 (1.508) | 1.633 (1.454) | -2.362 (2.471) | -1.199 (4.191) | -1.114 (4.082) | -0.766 (0.827) | 1.544 (1.524) | 1.602 (1.469) | -2.384 (2.473) | -1.241 (4.242) | -1.157 (4.132) |
| Crisis dummy | -4.294*** (1.507) | -4.735*** (1.309) | -4.684*** (1.304) | -5.738*** (1.836) | -6.173*** (1.601) | -6.101*** (1.582) | -4.303*** (1.508) | -4.744*** (1.311) | -4.692*** (1.306) | -5.742*** (1.835) | -6.178*** (1.601) | -6.106*** (1.582) |
| Constant | 5.969*** (1.138) | 6.975*** (0.955) | 6.931*** (0.951) | 8.479*** (1.179) | 9.227*** (1.125) | 9.166*** (1.109) | 5.959*** (1.135) | 6.966*** (0.953) | 6.922*** (0.949) | 8.465*** (1.178) | 9.214*** (1.134) | 9.152*** (1.118) |
| Observations | 2,015 | 2,015 | 2,011 | 1,950 | 1,950 | 1,946 | 2,015 | 2,015 | 2,011 | 1,950 | 1,950 | 1,946 |
| Number of countries | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 |
| Adjusted R-squared | 0.246 | 0.261 | 0.261 | 0.245 | 0.252 | 0.252 | 0.246 | 0.261 | 0.261 | 0.246 | 0.253 | 0.252 |

Note : Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels respectively. MaP is the different macroprudential policy indexes considered, TG corresponds to the Taylor gap, Δ TG corresponds to the first difference of the Taylor gap, and D and I correspond to the alternative dummy variables capturing the stance of macroprudential and monetary policies.

TABLE 3.5 – Results obtained with *PruC5* and *PruC6*

| | <i>PruC5</i> | | | | | <i>PruC6</i> | | | | | | |
|---------------------|--------------------------|----------------------|----------------------|----------------------|----------------------|--------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | Credit to private sector | | Credit to households | | | Credit to private sector | | Credit to households | | | | |
| | (3.1) | (3.2) | (3.3) | (3.4) | (3.5) | (3.6) | (3.7) | (3.8) | (3.9) | (3.10) | (3.11) | (3.12) |
| L.MaP | -0.014 (1.008) | 0.384 (0.998) | 0.372 (1.023) | -1.318 (1.347) | -1.175 (1.371) | -1.156 (1.388) | -0.015 (1.009) | 0.399 (0.995) | 0.386 (1.020) | -1.323 (1.347) | -1.175 (1.368) | -1.156 (1.385) |
| L2.MaP | -1.409* (0.830) | -1.255 (0.851) | -1.240 (0.858) | -3.003** (1.379) | -2.822* (1.424) | -2.776* (1.431) | -1.416* (0.829) | -1.255 (0.844) | -1.240 (0.851) | -3.029** (1.388) | -2.845* (1.426) | -2.799* (1.434) |
| L3.MaP | -2.526** (1.032) | -2.270* (1.145) | -2.288* (1.143) | -4.237*** (1.521) | -3.952** (1.642) | -3.940** (1.643) | -2.552** (1.031) | -2.302** (1.135) | -2.319** (1.133) | -4.287*** (1.523) | -4.008** (1.631) | -3.996** (1.634) |
| L4.MaP | -2.733* (1.611) | -3.226** (1.485) | -3.182** (1.467) | -5.518** (2.300) | -5.343** (2.017) | -5.297** (2.006) | -2.791* (1.594) | -3.292** (1.478) | -3.247** (1.460) | -5.587** (2.278) | -5.418** (2.003) | -5.371** (1.992) |
| L.(MaP × TG × D) | -0.199*** (0.048) | -0.157*** (0.048) | -0.157*** (0.048) | -0.121 (0.126) | -0.124 (0.126) | -0.124 (0.126) | -0.200*** (0.048) | -0.200*** (0.048) | -0.200*** (0.048) | -0.125 (0.126) | -0.125 (0.126) | -0.125 (0.126) |
| L2.(MaP × TG × D) | -0.031 (0.078) | -0.031 (0.078) | -0.031 (0.078) | -0.127* (0.063) | -0.127* (0.063) | -0.127* (0.063) | 0.041 (0.035) | 0.041 (0.035) | 0.041 (0.035) | 0.042 (0.035) | 0.042 (0.035) | 0.042 (0.035) |
| L3.(MaP × TG × D) | -0.150*** (0.025) | -0.150*** (0.025) | -0.150*** (0.025) | -0.127* (0.063) | -0.127* (0.063) | -0.127* (0.063) | -0.150*** (0.025) | -0.150*** (0.025) | -0.150*** (0.025) | -0.127** (0.062) | -0.127** (0.062) | -0.127** (0.062) |
| L4.(MaP × TG × D) | -0.041 (0.035) | -0.041 (0.035) | -0.041 (0.035) | -0.059 (0.099) | -0.059 (0.099) | -0.059 (0.099) | 0.042 (0.035) | 0.042 (0.035) | 0.042 (0.035) | 0.042 (0.035) | 0.042 (0.035) | 0.042 (0.035) |
| L.(MaP × Δ TG × I) | -0.186*** (0.044) | -0.186*** (0.044) | -0.186*** (0.044) | -0.117 (0.114) | -0.117 (0.114) | -0.117 (0.114) | -0.186*** (0.044) | -0.186*** (0.044) | -0.186*** (0.044) | -0.117 (0.115) | -0.117 (0.115) | -0.117 (0.115) |
| L2.(MaP × Δ TG × I) | -0.149*** (0.026) | -0.149*** (0.026) | -0.149*** (0.026) | -0.143*** (0.054) | -0.143*** (0.054) | -0.143*** (0.054) | -0.149*** (0.026) | -0.149*** (0.026) | -0.149*** (0.026) | -0.117* (0.068) | -0.117* (0.068) | -0.117* (0.068) |
| L3.(MaP × Δ TG × I) | -0.143*** (0.020) | -0.143*** (0.020) | -0.143*** (0.020) | -0.122** (0.054) | -0.122** (0.054) | -0.122** (0.054) | -0.143*** (0.020) | -0.143*** (0.020) | -0.143*** (0.020) | -0.122** (0.053) | -0.122** (0.053) | -0.122** (0.053) |
| L4.(MaP × Δ TG × I) | 0.036 (0.033) | 0.036 (0.033) | 0.036 (0.033) | 0.036 (0.091) | 0.036 (0.091) | 0.036 (0.091) | 0.037 (0.033) | 0.037 (0.033) | 0.037 (0.033) | 0.042 (0.033) | 0.042 (0.033) | 0.042 (0.033) |
| L.Δ GDP | 2.485*** (0.269) | 2.225*** (0.238) | 2.218*** (0.234) | 2.732*** (0.300) | 2.525*** (0.343) | 2.514*** (0.335) | 2.488*** (0.271) | 2.228*** (0.238) | 2.222*** (0.235) | 2.740*** (0.303) | 2.532*** (0.342) | 2.521*** (0.334) |
| L.Δ Policy rate | -0.657 (0.794) | 1.763 (1.570) | 1.820 (1.503) | -2.295 (2.418) | -1.086 (4.339) | -0.997 (4.212) | -0.661 (0.789) | 1.767 (1.569) | 1.824 (1.502) | -2.304 (2.418) | -1.090 (4.338) | -1.001 (4.211) |
| Crisis dummy | -4.194*** (1.514) | -4.631*** (1.326) | -4.583*** (1.319) | -5.623*** (1.870) | -6.069*** (1.648) | -6.001*** (1.626) | -4.198*** (1.517) | -4.634*** (1.327) | -4.587*** (1.321) | -5.634*** (1.873) | -6.079*** (1.650) | -6.011*** (1.628) |
| Constant | 6.025*** (1.131) | 7.060*** (0.950) | 7.018*** (0.946) | 8.604*** (1.163) | 9.386*** (1.127) | 9.326*** (1.110) | 6.021*** (1.131) | 7.058*** (0.950) | 7.016*** (0.946) | 8.597*** (1.163) | 9.381*** (1.126) | 9.321*** (1.108) |
| Observations | 2,015 | 2,015 | 2,011 | 1,950 | 1,950 | 1,946 | 2,015 | 2,015 | 2,011 | 1,950 | 1,950 | 1,946 |
| Number of countries | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 |
| Adjusted R-squared | 0.250 | 0.265 | 0.265 | 0.252 | 0.259 | 0.259 | 0.250 | 0.265 | 0.265 | 0.253 | 0.260 | 0.260 |

Note : Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels respectively. MaP is the different macroprudential policy indexes considered, TG corresponds to the Taylor gap, Δ TG corresponds to the first difference of the Taylor gap, and D and I correspond to the alternative dummy variables capturing the stance of macroprudential and monetary policies.

3.4.4 Robustness checks

We check the robustness of our previous findings by taking account of the potential sensitivity of the interest rate gap to the Taylor rule specification. To this end, following Colletaz et al. (2018), we consider six alternative Taylor rules (see Table 3.6) and compute the median of the resulting Taylor gaps.

TABLE 3.6 – Alternative measures of the monetary policy stance

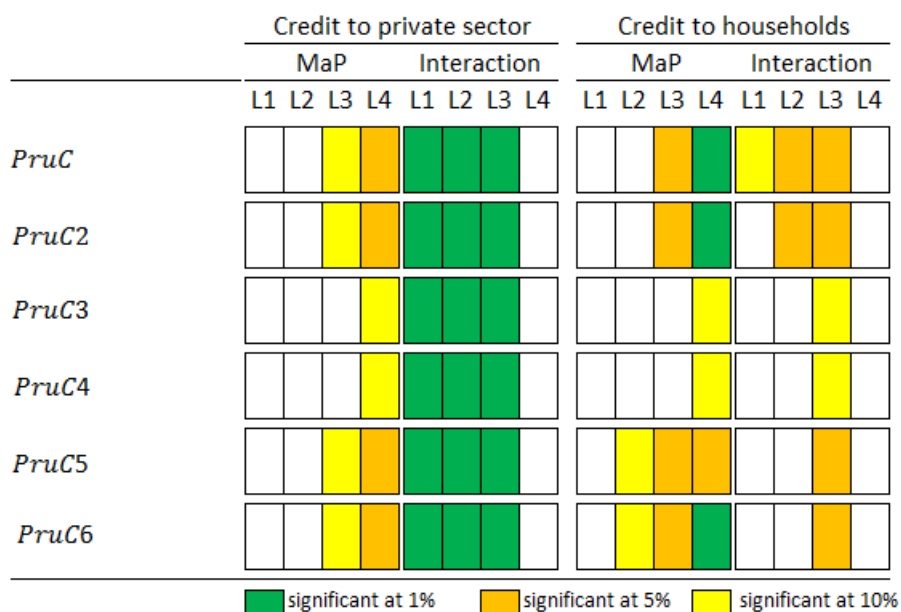
| Benchmark | Definition of the benchmark |
|------------------------------|---|
| Taylor (1) | $i_t^* = 0.9i_{t-1}^* + 0.1 \{rr_t^* + \bar{\pi} + 1.5(\pi_t - \bar{\pi}) + 0.5\tilde{y}_t\}$ |
| Taylor (2) | $i_t^* = rr_t^* + \bar{\pi} + 1.5(\pi_t - \bar{\pi}) + 0.5\tilde{y}_t$ |
| Taylor (3) | $i_t^* = 1.5\pi_{t+12} + 0.5\tilde{y}_t$ |
| Taylor (4) | $i_t^* = 0.9i_{t-1}^* + 0.1 \{rr_t^* + \bar{\pi} + 1.5(\pi_{t+12} - \bar{\pi}) + 0.5\tilde{y}_t\}$ |
| Taylor (5) | $i_t^* = i_{t-1} + \Delta i_t^*$, with $\Delta i_t^* = 0.5(\pi_{t+12} - \bar{\pi}) + 0.5\Delta\tilde{y}_t$ |
| Interest trend (6) | $i_t^* = HP(i_t)$ |
| <i>Equilibrium real rate</i> | $rr_t^* = \Delta y_t^*$, with $y_t^* = HP(y_t)$ |

Source : Colletaz et al. (2018).

Note: $\tilde{y}_t = (y_t - y_t^*)$, with $y_t^* = HP(y_t)$. $HP(x)$ means Hodrick-Prescott Filter applied to variable x . All measures of the monetary policy stance are computed as the difference between the actual interest rate i_t and the corresponding benchmark i_t^* . $\bar{\pi}$ corresponds to mean inflation over the sample period.

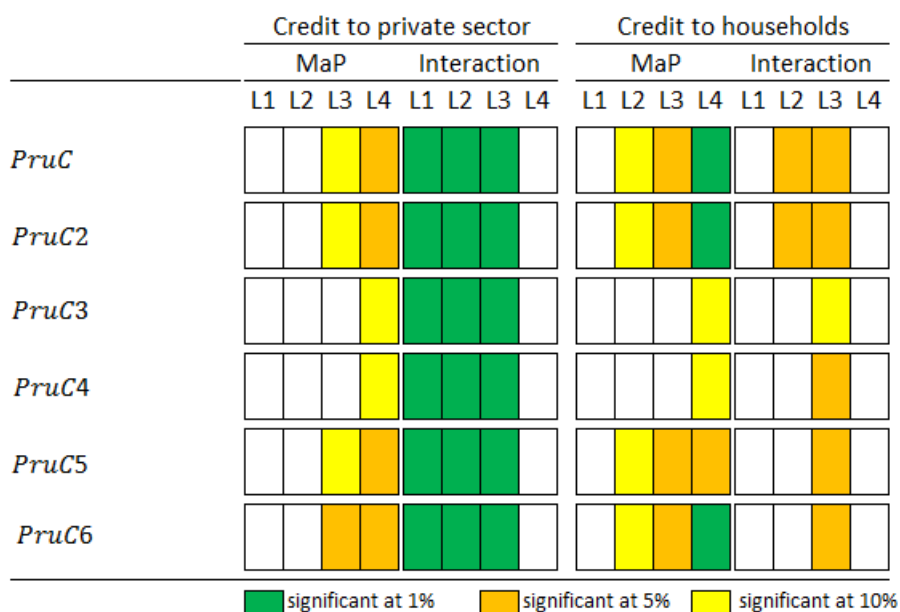
Figure 3.5 and Figure 3.6 summarise the results that we obtain by considering this alternative measure of the Taylor gap when we estimate Equation (3.9) and Equation (3.11). Like with the results discussed in the previous section, we find that the tightening of macroprudential policy tools leads to a reduction in domestic credit growth, even if macroprudential policy actions seem to take time to curb credit growth effectively. As before, the coefficient estimates associated with macroprudential indexes are only significant at the third and fourth order lags for most specifications. More importantly, our results confirm the importance of the monetary policy stance for the effectiveness of macroprudential policy. Regardless the measure of monetary policy stance considered, we find that the interaction term is negative and statistically significant at the conventional levels.

FIGURE 3.5 – Robustness checks : results obtained with the median of the alternative Taylor gaps



Note : The results reported are obtained by estimating Equation (3.9) and correspond to the coefficient estimates associated with the alternative macroprudential indexes and interaction terms. All significant coefficients have the expected negative sign.

FIGURE 3.6 – Robustness checks : results obtained with the first difference of the median of the alternative Taylor gaps



Note : The results reported are obtained by estimating Equation (3.11) and correspond to the coefficient estimates associated with the alternative macroprudential indexes and interaction terms. All significant coefficients have the expected negative sign.

3.5 Conclusion

Since the 2007-2008 global financial crisis, the conduct of macroprudential policy has raised several important issues. One of them is the interaction of macroprudential and monetary policies, and this issue is currently at the heart of the academic and policy debate. It is well-known that monetary policy can have detrimental side effects on financial stability, while financial stability is the primary objective of macroprudential policy. This means that monetary policy can make macroprudential policy less effective at achieving its objective, and this suggests the need for synchronisation.

A growing number of theoretical studies address this issue and confirm the benefits of coordination between the two policies, but little is known from an empirical standpoint. Our paper fills this gap in the existing literature by providing the first empirical evidence for a large sample of economies on how monetary policy conditions impact the effectiveness of macroprudential policy.

More specifically, we obtain two important results. First, we find that a restrictive monetary policy enhances the impact of macroprudential tightening actions on domestic credit growth. Second, we find evidence that monetary policy helps to reduce the transmission delay of macroprudential policy actions. Our findings then confirm the complementarities between the two policies and the potential benefits of coordination highlighted by the theoretical literature.

To translate this result into a policy recommendation, a crucial open question concerns what the appropriate institutional framework and governance structure for conducting macroprudential policy should be. There is no clear-cut consensus among economists about this issue and in practice countries have implemented different macroprudential policy frameworks. While some countries have assigned macroprudential mandates to an independent council, some other countries have delegated macroprudential regulation to the central bank (see, e.g., Masciandaro, 2018 ; Masciandaro and Romelli, 2018 ; Edge and Liang, 2019). This choice of assigning a leading role in macroprudential policy to the central bank is usually justified by the argument that it will facilitate policy coordination between the two policies. It can also ensure that macroprudential policy draws on the expertise of the monetary authority in financial and macroeconomic

analysis, and is expected to facilitate analysis of the side effects of each policy. Finally, as most of the central banks around the world are independent of the government, it would be expected that such an institutional arrangement would help to protect the macroprudential policy function from political pressure. This suggests it would be interesting to investigate empirically whether the institutional framework and the governance structure of macroprudential policy are the key drivers of its effectiveness. We leave this issue for further research.

3.6 Appendix

TABLE 3.7 – Results obtained with the policy interest rate variation

| | <i>PruC</i> | | <i>PruC2</i> | | <i>PruC3</i> | |
|---------------------|-----------------------------|-------------------------|-----------------------------|-------------------------|-----------------------------|-------------------------|
| | Credit to Private sector | Credit to Households | Credit to Private sector | Credit to Households | Credit to Private sector | Credit to Households |
| L.MaP | 1.246 (1.120) | -0.408 (1.615) | 1.265 (1.140) | -0.435 (1.636) | 0.483 (0.741) | -0.951 (1.223) |
| L2.MaP | -0.388 (1.099) | -2.341 (1.753) | -0.443 (1.134) | -2.404 (1.789) | -0.309 (0.701) | -1.682 (1.365) |
| L3.MaP | -1.752 (1.417) | -4.002* (2.062) | -1.795 (1.416) | -4.033* (2.067) | -0.873 (1.044) | -2.232 (1.683) |
| L4.MaP | -3.227** (1.580) | -5.704** (2.249) | -3.198** (1.573) | -5.645** (2.250) | -1.849 (1.200) | -3.370* (1.869) |
| L.(MaP × Δ PR × I) | -4.963*** (0.552) | -6.216*** (0.715) | -4.954*** (0.556) | -6.184*** (0.713) | -0.544*** (0.083) | -0.546*** (0.098) |
| L2.(MaP × Δ PR × I) | -4.263*** (1.219) | -5.517*** (1.242) | -4.231*** (1.234) | -5.471*** (1.255) | -0.471*** (0.048) | -0.508*** (0.071) |
| L3.(MaP × Δ PR × I) | -4.146*** (1.290) | -5.102*** (1.315) | -4.130*** (1.293) | -5.072*** (1.319) | -0.478*** (0.067) | -0.513*** (0.086) |
| L4.(MaP × Δ PR × I) | -0.606 (0.390) | -2.097*** (0.522) | -0.613 (0.381) | -2.090*** (0.510) | 0.017 (0.076) | -0.077 (0.100) |
| L.Δ GDP | 2.257*** (0.224) | 2.447*** (0.298) | 2.255*** (0.224) | 2.441*** (0.299) | 2.255*** (0.222) | 2.469*** (0.298) |
| Crisis dummy | -4.733*** (1.247) | -6.053*** (1.551) | -4.725*** (1.248) | -6.032*** (1.552) | -4.786*** (1.269) | -6.083*** (1.512) |
| Constant | 6.858*** (0.910) | 9.719*** (1.107) | 6.862*** (0.911) | 9.725*** (1.108) | 6.706*** (0.901) | 9.352*** (1.083) |
| Observations | 2,007 | 1,942 | 2,007 | 1,942 | 2,007 | 1,942 |
| Number of countries | 37 | 37 | 37 | 37 | 37 | 37 |
| Adjusted R-squared | 0.262 | 0.260 | 0.262 | 0.260 | 0.260 | 0.252 |

Note : Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels respectively. MaP is the different macroprudential policy indexes considered, Δ PR corresponds to the policy interest rate variation, and I corresponds to the dummy variable capturing the stance of macroprudential and monetary policies.

TABLE 3.8 – Results obtained with the policy interest rate variation

| | <i>PruC4</i> | | <i>PruC5</i> | | <i>PruC6</i> | |
|---------------------|--------------------------|----------------------|--------------------------|----------------------|--------------------------|----------------------|
| | Credit to Private sector | Credit to Households | Credit to Private sector | Credit to Households | Credit to Private sector | Credit to Households |
| L.MaP | 3.400 (5.621) | -7.615 (9.215) | 0.546 (1.038) | -1.230 (1.457) | 0.548 (1.033) | -1.223 (1.447) |
| L2.MaP | -1.799 (5.005) | -12.138 (10.092) | -0.995 (0.857) | -2.899* (1.559) | -1.000 (0.840) | -2.918* (1.546) |
| L3.MaP | -6.471 (7.521) | -16.870 (12.432) | -1.984 (1.203) | -4.082** (1.878) | -2.016* (1.187) | -4.137** (1.857) |
| L4.MaP | -13.793 (8.777) | -25.559* (13.849) | -3.006* (1.549) | -5.348** (2.203) | -3.069* (1.539) | -5.423** (2.186) |
| L.(MaP × Δ PR × I) | -4.280*** (0.639) | -4.309*** (0.756) | -1.046*** (0.144) | -1.121*** (0.172) | -1.049*** (0.144) | -1.126*** (0.173) |
| L2.(MaP × Δ PR × I) | -3.803*** (0.371) | -4.129*** (0.554) | -0.900*** (0.100) | -1.006*** (0.128) | -0.902*** (0.098) | -1.008*** (0.127) |
| L3.(MaP × Δ PR × I) | -3.826*** (0.499) | -4.112*** (0.646) | -0.924*** (0.100) | -1.000*** (0.124) | -0.923*** (0.098) | -0.999*** (0.121) |
| L4.(MaP × Δ PR × I) | 0.068 (0.562) | -0.681 (0.741) | -0.042 (0.110) | -0.243* (0.130) | -0.038 (0.109) | -0.241* (0.130) |
| L.Δ GDP | 2.255*** (0.221) | 2.472*** (0.298) | 2.279*** (0.223) | 2.492*** (0.299) | 2.283*** (0.224) | 2.499*** (0.300) |
| Crisis dummy | -4.789*** (1.272) | -6.087*** (1.513) | -4.686*** (1.279) | -5.990*** (1.552) | -4.688*** (1.281) | -6.001*** (1.554) |
| Constant | 6.701*** (0.899) | 9.344*** (1.083) | 6.757*** (0.904) | 9.504*** (1.092) | 6.754*** (0.904) | 9.499*** (1.093) |
| Observations | 2,007 | 1,942 | 2,007 | 1,942 | 2,007 | 1,942 |
| Number of countries | 37 | 37 | 37 | 37 | 37 | 37 |
| Adjusted R-squared | 0.260 | 0.253 | 0.263 | 0.260 | 0.264 | 0.260 |

Note : Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels respectively. MaP is the different macroprudential policy indexes considered, Δ PR corresponds to the policy interest rate variation, and I corresponds to the dummy variable capturing the stance of macroprudential and monetary policies.

TABLE 3.9 – Results of the Taylor rule estimations.

| Country | ρ | α | β_π | β_y | Hansen test p-value | Observations | Period of estimation |
|--------------------|----------|----------|-------------|-----------|---------------------|--------------|----------------------|
| Argentina | 0.554*** | 9.155*** | -0.171 | 0.392 | 0.844 | 85 | 1993Q2 :2015Q3 |
| Australia | 0.667*** | 1.862*** | 1.247*** | 0.818 | 0.128 | 161 | 1976Q2 :2017Q3 |
| Brazil | 0.841*** | 4.032 | 1.345** | 2.634*** | 0.569 | 81 | 1996Q2 :2017Q3 |
| Canada | 0.957*** | -2.432 | 2.249*** | 4.054** | 0.160 | 184 | 1970Q1 :2017Q3 |
| Chile | 0.532*** | 3.016*** | 0.225 | 0.731*** | 0.162 | 54 | 2003Q1 :2017Q3 |
| Colombia | 0.692*** | 1.702*** | 0.902*** | 1.047*** | 0.105 | 65 | 2000Q2 :2017Q3 |
| Czech Republic | 0.924*** | -0.482 | 0.903*** | 1.035** | 0.140 | 82 | 1996Q1 :2017Q3 |
| Denmark | 0.880*** | -0.845 | 1.367*** | 0.880*** | 0.699 | 86 | 1995Q1 :2017Q3 |
| Euro Area | 0.767*** | 0.450 | 0.831*** | 0.626*** | 0.169 | 71 | 1999Q1 :2016Q4 |
| Hungary | 0.936*** | -0.555 | 0.738*** | 2.647** | 0.326 | 81 | 1995Q1 :2017Q3 |
| India | 0.873*** | 6.768*** | 0.0381 | 1.179*** | 0.679 | 75 | 1996Q3 :2017Q3 |
| Indonesia | 0.894*** | 7.538*** | -0.0767 | 1.117*** | 0.303 | 80 | 2005Q3 :2017Q3 |
| Israel | 0.880*** | 1.418*** | 0.723*** | 0.047 | 0.283 | 86 | 1995Q1 :2017Q3 |
| Japan | 0.869*** | 0.178** | 0.016 | 0.087 | 0.309 | 72 | 1994Q1 :2013Q1 |
| Korea, Rep. | 0.928*** | 1.070 | 0.526 | 2.584*** | 0.144 | 69 | 1999Q2 :2017Q3 |
| Mexico | 0.561*** | 2.593*** | 0.763*** | 0.521*** | 0.726 | 75 | 1998Q4 :2017Q3 |
| New Zealand | 0.741*** | 3.960*** | 0.805* | 1.529** | 0.791 | 117 | 1988Q1 :2017Q3 |
| Poland | 0.676*** | 1.681*** | 1.275*** | 0.104 | 0.228 | 86 | 1995Q1 :2017Q3 |
| Russian Federation | 0.665*** | 7.356*** | 0.217*** | 0.164*** | 0.254 | 47 | 2003Q2 :2017Q2 |
| South Africa | 0.696*** | 7.206*** | 0.464*** | 1.170 | 0.240 | 147 | 1980Q4 :2017Q3 |
| Sweden | 0.929*** | 1.705* | 0.914*** | 0.873 | 0.437 | 146 | 1980Q1 :2017Q3 |
| Switzerland | 0.917*** | 0.437 | 0.763*** | 0.513** | 0.164 | 186 | 1970Q1 :2017Q3 |
| Thailand | 0.897*** | 0.513 | 0.847** | -0.280 | 0.360 | 66 | 2000Q2 :2016Q4 |
| Turkey | 0.839*** | 0.771 | 0.877*** | 1.368*** | 0.198 | 61 | 2002Q1 :2017Q3 |
| United Kingdom | 0.900*** | 2.086** | 0.705 | 1.943** | 0.290 | 113 | 1989Q1 :2017Q3 |
| United States | 0.828*** | -1.036 | 1.735*** | 0.920** | 0.175 | 188 | 1970Q1 :2017Q3 |

Note : *, **, and *** denote statistical significance at the 10%, 5% and 1% level respectively.

Conclusion générale

La crise financière de 2007-2008 a remis en cause une partie de ce que nous pensions savoir sur les politiques macroéconomiques, qu'il s'agisse de leur conduite ou du cadre institutionnel qui la régit. Elle a également démontré à quel point les chocs financiers pouvaient être dommageables pour l'économie réelle. Si de nombreuses études ont déjà cherché à déterminer les causes de la vulnérabilité financière, les questions relatives aux effets du cadre et de l'orientation des politiques macroéconomiques sur la stabilité financière sont restées très largement inexplorées. La rédaction de cette thèse vise donc en premier lieu à combler ce vide. De plus, en s'interrogeant sur l'impact de l'environnement de politique économique, cette thèse doit permettre d'isoler les déterminants institutionnels de la vulnérabilité financière, afin de proposer une base de réflexion dans l'établissement d'une nouvelle architecture pour les politiques macroéconomiques d'après crise. Outre le fait que ce sujet ait été très peu traité dans la littérature, l'originalité de cette thèse réside également dans son approche qui se veut à la jonction de la macroéconomie et de l'économie politique.

Le premier chapitre de cette thèse retient la résilience de l'économie réelle face aux crises bancaires comme définition de la stabilité financière, et s'intéresse aux déterminants de cette dernière. Nous montrons dans un premier temps que les cadres de politique budgétaire, de politique de change et de politique monétaire sont des caractéristiques importantes pour expliquer les différences de résilience observées entre les pays. Il s'agit là d'une première contribution de ce chapitre, étant donné que les arrangements de politiques économiques ont été négligés dans la littérature sur les déterminants du coût des crises jusqu'à présent. Afin de pouvoir formuler des recommandations quant au design des politiques économiques, nous cherchons à établir, dans un second temps, dans quelle mesure le degré de flexibilité du cadre d'une politique influence le

coût des crises bancaires. Le calcul de ce coût n'est toutefois pas restreint aux seules périodes de crises, ce qui constitue une seconde innovation par rapport à la littérature existante.

En matière budgétaire, il ressort que mener des politiques discrétionnaires engendre des crises plus coûteuses, tout comme le fait de suivre une règle trop rigide. En effet, si les règles budgétaires permettent une réduction des déficits en période de croissance, en contraignant les gouvernements à respecter leurs engagements, elles n'offrent pas la possibilité de fournir une réponse optimale en cas de récession trop importante. La politique discrétionnaire permet donc une politique de relance plus soutenue en période de crise, mais va également tolérer des écarts budgétaires importants le reste du temps. Nos résultats montrent ici clairement qu'une solution intermédiaire, à savoir une règle budgétaire avec une clause de sortie, est le cadre le plus adapté pour limiter le coût des crises bancaires. En période de croissance économique, la règle va lier les mains du gouvernement et le contraindre à la discipline budgétaire. Toutefois, en cas d'occurrence de crise, la clause de sortie s'applique et permet de laisser les stabilisateurs automatiques agir, voire même de mener une politique de relance discrétionnaire pour endiguer rapidement la crise.

On retrouve une logique similaire dans nos résultats en ce qui concerne les régimes de change et le cadre de politique monétaire. En change fixe, la banque centrale ne peut pas fixer les taux d'intérêt qu'elle désire car elle est contrainte par la parité qu'elle défend. À l'inverse, le flottement pur n'impose aucune contrainte dans la fixation des taux, mais se traduit généralement par une volatilité importante des taux de change, synonyme d'instabilité. Dès lors, les régimes de change intermédiaires s'imposent comme les régimes les moins coûteux. Le maintien d'une parité ajustable limite la volatilité du change tout en permettant d'avoir une politique autonome de par la possibilité de réviser l'ancrage en période de crise. Pour la politique monétaire, les pays avec les cadres les plus rigides sont également ceux qui expérimentent les crises les plus sévères. Ainsi, une forte indépendance des autorités monétaires vis-à-vis du gouvernement, ou encore un fort degré de conservatisme de la banque centrale entraînent des coûts réels plus élevés en cas de crise financière, alors qu'un régime de ciblage d'inflation se caractérisant comme une règle flexible limite au contraire l'ampleur des crises.

D'une manière globale, les résultats de ce premier chapitre plaident donc en faveur des

régimes de politique économique qui mélangent règle et discrétion pour contenir les crises bancaires. Pour réduire le risque de voir apparaître une nouvelle crise comme celle que nous venons de traverser, il serait donc judicieux de faire évoluer les cadres de politiques macroéconomiques vers plus de « discrétion contrainte ».

À ce stade, il n'est cependant pas possible de formuler une recommandation sur le cadre optimal. En effet, il convient de préciser que nos conclusions ont une portée limitée dans le sens où chaque politique économique est ici considérée de façon individuelle, sans tenir compte de l'environnement des autres politiques. Or il est essentiel de considérer les possibles interconnexions des différentes politiques si l'on souhaite établir un cadre optimal pour l'ensemble des politiques macroéconomiques. Une extension au présent chapitre serait donc d'examiner l'impact des interactions entre les différents cadres de toutes les politiques économiques et ainsi voir s'il existe des complémentarités ou au contraire des effets pervers à combiner plusieurs règles flexibles au sein d'un même pays.

Le deuxième chapitre de cette thèse se fixe pour objectif d'approfondir un des résultats obtenus dans le chapitre précédent. Le fait qu'un fort degré de conservatisme apparaisse comme un facteur aggravant du coût des crises montre qu'en période de récession il existe bien un arbitrage entre inflation et activité économique. Notamment, se focaliser sur l'inflation en période de crise peut conduire à ne pas réagir suffisamment à la baisse de la production. Mais au-delà de cela, ce résultat nous interroge également sur l'idée selon laquelle une inflation stable permet de garantir la stabilité du secteur bancaire. L'hypothèse de Schwartz établit en effet que la stabilité des prix permet une allocation optimale des actifs, assurant de ce fait la stabilité financière. La crise quant à elle tend à contredire cette affirmation puisqu'elle est intervenue dans une période où l'inflation avait quasiment disparu. Le chapitre 2 permet donc de trancher empiriquement ce débat puisqu'il ambitionne, pour la première fois dans la littérature, d'étudier l'existence potentielle d'une relation entre le degré de conservatisme des banques centrales et la vulnérabilité du secteur bancaire.

Il ressort de ce deuxième chapitre qu'il existe bien un arbitrage entre la stabilité des prix et la stabilité financière. En effet, des indicateurs de vulnérabilité comme la volatilité du crédit, la part des crédits financée par des effets de levier ou encore la part des prêts non performants

augmentent avec le degré de conservatisme. Le fait qu'une banque centrale soit focalisée sur la hausse des prix conduit cette dernière à négliger les déséquilibres financiers qui apparaissent dans les bilans bancaires. Ce résultat remet donc en cause la légitimité de nommer des banquiers centraux conservateurs au sens de Rogoff, car si cela permet de lutter contre le biais inflationniste, force est de constater que cette pratique a des effets néfastes en ce qui concerne la sphère financière.

La stabilité financière n'est toutefois pas un objectif dédié à la politique monétaire. Pour lutter contre les déséquilibres dans le système financier, il est préférable d'avoir recours à des instruments spécifiquement prévus à cet effet, plutôt qu'au taux d'intérêt dont la portée est plus globale. Les politiques macroprudentielles, mises en place depuis les années 1990 dans les pays en développement et plus récemment, après la crise financière, dans les pays développés, ont justement pour objectif de cibler les principales sources d'instabilité financière. En particulier, ces politiques vont avoir pour but de lisser le cycle financier. Néanmoins, les deux premiers chapitres de cette thèse démontrent que la politique monétaire n'est pas neutre en matière de déséquilibres financiers et notamment sur l'évolution du crédit.

Dans cette optique, le dernier chapitre de cette thèse présente un double enjeu. D'une part, l'augmentation du nombre de pays ayant recours aux politiques macroprudentielles depuis ces dernières années rend pertinent la production de nouvelles analyses concernant leur efficacité. Le premier objectif de ce chapitre est donc d'évaluer l'impact des politiques macroprudentielles sur le cycle financier, à la lumière des expériences récentes. Nos résultats montrent qu'un durcissement de la politique macroprudentielle entraîne une réduction significative du taux de croissance du crédit. L'efficacité des politiques macroprudentielles n'est donc pas remise en cause. Cependant, les chercheurs ont jusqu'à présent négligé les effets secondaires que peut avoir la politique monétaire sur les variables ciblées par les politiques macroprudentielles. Aussi, le second but affiché du chapitre 3, et sa principale innovation par rapport aux études empiriques existantes, consiste à réexaminer l'efficacité de ces politiques à la lumière du *policy-mix* entre politique macroprudentielle et politique monétaire. Il apparaît clairement que la synchronisation des deux politiques améliore l'efficacité des mesures prudentielles pour lisser le cycle financier. Lorsqu'un resserrement de la politique macroprudentielle est concomitant avec une politique

monétaire restrictive alors la réduction du crédit qui s'ensuit est plus importante et intervient également dans un délai plus court.

Ce dernier résultat suggère donc qu'une coordination des politiques macroprudentielle et monétaire est souhaitable. Toutefois, la forme concrète de cette coordination reste à définir. Une extension possible à cette thèse serait alors d'établir dans quel cadre doivent évoluer les deux politiques pour obtenir le meilleur *policy-mix*. Les banques centrales peuvent en effet prétendre au rôle de régulateurs macroprudentiels de par la position centrale qu'elles occupent dans la stabilisation macroéconomique. Dans les faits, certains pays ont d'ailleurs déjà confié ce rôle de régulateur aux autorités monétaires afin de limiter les problèmes de coordination pouvant survenir entre deux autorités distinctes. Cependant, le débat reste ouvert, puisque regrouper les compétences monétaires et prudentielles au sein des banques centrales pourrait avoir comme conséquence de réduire l'implication de la banque centrale vis-à-vis de la stabilisation de l'inflation et de l'activité, et rendrait également la mise en place de la politique monétaire plus délicate, du fait de la prise en compte de l'instabilité financière dans sa conduite. L'ajout de la stabilité financière parmi les objectifs des banques centrales semble d'ailleurs incompatible avec un fort degré de conservatisme. Mais il conviendrait d'approfondir cette question dans des travaux futurs afin de déterminer les arrangements de politique monétaire pour assurer une bonne cohabitation des deux politiques au sein des banques centrales. Il y a fort à parier que les préférences et le degré d'indépendance de ces dernières soient des déterminants importants de la structure de gouvernance optimale des politiques macroprudentielle et monétaire. Confier la politique monétaire et la politique prudentielle à deux instances distinctes reste toutefois une alternative envisageable, dans le cas où le cadre de politique monétaire ne permettrait pas d'intégrer un objectif supplémentaire.

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Florian PRADINES-JOBET

L'influence du cadre et de l'orientation des politiques macroéconomiques sur la stabilité du système bancaire.

Résumé :

La présente thèse étudie les effets du cadre et de l'orientation des politiques macroéconomiques sur la stabilité du secteur bancaire à travers trois essais. Le premier chapitre considère la flexibilité du cadre de politique économique comme un déterminant potentiel du coût des crises bancaires systémiques. Nous montrons ainsi qu'un cadre intermédiaire, ni trop flexible, ni trop rigide, qui s'apparente à de la discrétion contrainte, permet de réduire significativement les pertes en termes de production liées aux crises bancaires. Le deuxième chapitre se concentre sur l'influence du cadre et de l'orientation de la politique monétaire vis-à-vis de la stabilité du secteur bancaire. L'analyse économétrique conduite démontre alors qu'un degré de conservatisme élevé des banques centrales accroît l'instabilité du système bancaire. Enfin, le troisième chapitre mesure les effets de la politique macroprudentielle sur le taux de croissance des crédits bancaires selon l'orientation de la politique monétaire concomitante. Les résultats obtenus indiquent qu'un durcissement de la politique macroprudentielle réduit plus fortement la croissance du crédit lorsque la politique monétaire est restrictive. Nous suggérons donc qu'une synchronisation des politiques macroprudentielle et monétaire permettrait de lutter plus efficacement contre l'instabilité financière.

Mots clés : Politique monétaire, Crises bancaires, Stabilité du secteur bancaire, Cadre de politique économique, Politique macroprudentielle, Économétrie des données de panel.

The influence of the policy framework and the stance of macroeconomic policies on the banking system stability.

Abstract :

This thesis analyses the effects of the policy framework and the stance of macroeconomic policies through three essays. The first chapter investigates how the stringency of macroeconomic policy frameworks impacts the cost of systemic banking crises. We show that by combining discipline and flexibility, some policy arrangements that are based on constrained discretion, can significantly reduce the output losses related to banking crises. The second chapter focuses on the influence of the central banks' preferences on the banking sector vulnerability. The econometric analysis shows that a high degree of central bank conservatism increases banking system instability. Finally, the third chapter empirically assesses how effective macroprudential policies are in curbing banking credit growth, and whether their effectiveness is affected by monetary policy conditions. The results show that a tightening in macroprudential policies reduces credit growth in a more effective way when monetary policy is restrictive. We therefore confirm the need for coordination between macroprudential and monetary policies.

Keywords : Monetary policy, Banking crises, Banking sector stability, Policy framework, Macroprudential policy, Econometrics of panel data.

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