Essais sur les dynamiques du marché du travail

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ESSAIS SUR LES DYNAMIQUES DU MARCHE DU TRAVAIL

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Introduction générale

Comment expliquer les fluctuations des agrégats du marché du travail tels que, le taux de chômage, le niveau de l'emploi ou encore la participation, le long du cycle économique ? Cette question, aussi ancienne que la macroéconomie elle-même, se situe (toujours) au cœur de nombreuses recherches académiques. Elle a d'autant plus d'intérêt que les performances du marché du travail dans les pays développés sont hétérogènes et reliées aux institutions régissant son fonctionnement.

L'existence d'un chômage élevé et volatil est considérée comme un fléau frappant les économies industrialisées modernes. En effet, l'ensemble des pays développés est affecté par le chômage, mais, son niveau demeure variable. Selon les statistiques d'Eurostat, le taux de chômage au deuxième trimestre 2016 est de 3,1% au Japon, 4,2% en Allemagne, 4,9% aux Etats-Unis, 6,6% en Suède, 8,6% dans l'ensemble de l'Union Européenne, 9,9% en France, 11,6% en Italie et 19,9% en Espagne. En outre, l'évolution du taux de chômage est souvent caractérisée par des fluctuations cycliques non-négligeables. Ce fait stylisé est illustré par la première partie du graphique 1. Par exemple, aux Etats-Unis l'évolution du chômage suit des phases de hausse, lorsque la conjoncture économique est défavorable, et des phases de baisse, lorsque la conjoncture économique est favorable. Observons également que ces différentes phases semblent intervenir de manière assez régulière.

De telles fluctuations économiques sont-elles désirables ? Dans l'introduction de son chapitre pour le *Handbook of Monetary Economics*, Galí (2010) suggère une réponse négative à cette question :

> "... the rise in unemployment that invariably accompanies all economic downturns is, arguably, one of the main reasons why cyclical fluctuations are generally viewed as undesirable."
>
> (Jordi Gali (2010), *Handbook of Monetary Economics*, Chapitre 10, page 488)

D'autres éléments plus tangibles viennent confirmer cette intuition. Par le biais d'une enquête menée aux Etats-Unis, Shiller (1997) trouve que 70% des interrogés pensent qu'il est important de prévenir les récessions. Parmi ces derniers, plus de 80% sont d'accord avec l'idée selon laquelle il est préférable d'avoir un lissage des phases d'expansion et de récession plutôt que des cycles économiques bien marqués. Dans le même ordre d'idée, Wolfers (2003) montre, à partir d'une enquête sur le bien être subjectif, que la suppression des fluctuations du chômage augmenterait le bien être d'un niveau équivalent à une diminution du chômage d'un point de pourcentage par trimestre. De mon point de vue, de simples éléments de statistique descriptive confirment également l'idée que certaines phases des fluctuations cycliques engendrent des coûts supportés par l'ensemble de la société. Par exemple, selon les statistiques officielles de l'Institut National de la Statistique et des Etudes Economiques (INSEE), la part des chômeurs de longue durée a sensiblement augmenté depuis environ une décennie en France. Le point de départ de cette hausse semble être la Grande Récession des années 2008-2009. En effet, le taux de chômage de longue durée[1] atteignait 2,6% en 2008, soit son plus bas niveau depuis le début du XXIème siècle. Entre 2008 et 2015 ce taux n'a jamais cessé de croître augmentant de 1,7 points de pourcentage. L'augmentation du nombre de chômeurs de longue durée est problématique à plusieurs égards. En particulier, les chances de retour à l'emploi s'amenuisant à mesure que la durée du chômage augmente, elle éloigne une partie de la population du marché du travail. Ainsi, l'accentuation des difficultés économiques en France, caractérisée par une montée presque ininterrompue du chômage et une augmentation du taux de non-emploi depuis 2008, a eu des répercussions sur le taux de pauvreté[2]. Ce dernier a lui aussi augmenté entre 2008 et 2011 passant de 13% à 14,3%. Selon l'INSEE, l'augmentation perceptible de la pauvreté "*proviendrait principalement de l'augmentation du nombre de chômeurs vivant au-dessous du seuil de pauvreté, elle-même liée à celle du nombre de chômeurs de longue ou très longue durée*"[3].

La première évaluation quantitative formelle du coût des cycles économiques est due à Lucas (1987). Ce dernier argumente que les cycles économiques peuvent être principalement assimilés à un risque de fluctuation de la consommation agrégée, qui, en moyenne est négligeable. Toutefois, ces résultats quantitatifs ont été l'objet de nombreux débats relatifs aux hypothèses de calcul, d'une part, et à l'ampleur du coût en bien-être global, d'autre part. Krusell and Smith (1999) ainsi que Krusell et al. (2009) suggèrent que les coûts en bien-être des cycles économiques ne doivent pas uniquement être envisagés de manière agrégée puisqu'une telle approche mettrait en second plan des effets hétérogènes sur différentes partitions de la population. L'idée sous-jacente de leur postulat de départ est que certaines couches de la population, notamment les personnes les plus pauvres et sans emploi, souffriraient plus des

1. Le taux de chômage de longue durée est défini comme le nombre personnes se déclarant au chômage depuis plus d'un an divisé par la population active.

2. Le taux de pauvreté est défini comme la proportion d'individus vivant avec moins de 60% du revenu médian.

3. Cf. Durand (2016).

séquences défavorables du cycle. Avec une telle approche, les coûts en bien-être des cycles économiques sont d'une ampleur plus importantes que ceux initialement mis en avant par Lucas (1987). Les trois papiers que je viens de citer maintiennent, cependant, l'hypothèse que les fluctuations économiques n'ont pas d'impact sur le niveau moyen des agrégats économiques tels que le taux de chômage ou la consommation. Lorsque cette hypothèse est relâchée, Jung and Kuester (2011) trouvent que le niveau moyen du taux de chômage est plus élevé dans une économie où les cycles existent que dans une économie sans cycles. Hairault et al. (2010) montrent que les frictions qui existent sur le marché du travail peuvent induire des coûts en bien-être d'une ampleur considérable. Ainsi, l'alternance de phases d'expansion et de récession réduit le niveau moyen de la consommation et de l'emploi en raison de l'existence d'importantes non-linéarités dans l'économie. Il apparait également de leur analyse que le rôle des flux de travailleurs, matérialisés par les probabilités de transition impliquant conjointement le chômage et l'emploi, est singulier. Plus spécifiquement, les variations du taux de retour à l'emploi des chômeurs auraient plus d'impact sur le niveau moyen du chômage, sa volatilité, et par voie de conséquence, sur les coûts des cycles économiques.

Un consensus semble émerger des articles cités dans le paragraphe précédent : lorsque certaines complexités de l'économie sont prises en compte, comme l'hétérogénéité des agents économiques ou encore l'existence de frictions sur le marché du travail, les coûts en bien-être des fluctuations cycliques ne peuvent être considérés comme négligeables. D'un côté, les agrégats économiques fluctuent de manière intrinsèque en fonction du cycle. De l'autre, son existence peut altérer leur niveau moyen. Ces arguments viennent appuyer, dans une certaine mesure, la nécessité d'une intervention de l'Etat afin de limiter les coûts qui accompagnent les séquences défavorables du cycle. Se faisant, la vision positive de la mise en évidence des coûts en bien-être des fluctuations cycliques est déplacée vers des enjeux plus normatifs. A ce stade, rappelons le caractère “non-souhaitable” de l'intervention de l'autorité publique lorsque le marché du travail fonctionne selon les règles de la concurrence pure et parfaite. En revanche, lorsque le fonctionnement du marché du travail est entravé par certaines imperfections, comme des frictions de recherche, la politique économique peut avoir des effets désirables sur le fonctionnement de l'économie. Dans cette lignée, Hairault et al. (2010) concluent qu'il est nécessaire de limiter l'influence des fluctuations du taux de retour à l'emploi sur le cycle par l'intermédiaire de subventions à l'embauche. Une politique de ce genre permettrait d'augmenter le niveau moyen des créations d'emploi. La question de l'adaptabilité des instruments de lutte contre la montée du chômage, en période de conjoncture économique défavorable, a connu des évolutions notoires au cours des dernières années. Dans un récent article, Jung and Kuester (2015) montrent qu'une politique économique optimale doit avant tout s'atteler à la réduction des fluctuations du chômage notamment au cours des périodes de ralentissement économique. Comparativement à la plupart des travaux de cette littérature (Landais et al. (2010), Mitman and Rabinovich (2011), entre autres), ces derniers considèrent, non pas un seul instrument de politique économique pris isolément, mais plusieurs. Il ressort de leur article que la conjoncture ainsi que les imperfections du marché du travail, comme l'existence de frictions de recherche et de rigidités salariales, ont des implications non-négligeables sur la mise en place des modalités de la politique économique. Ainsi, lorsque l'économie est frappée par une récession, l'autorité publique doit favoriser la création d'emploi, en augmentant les subventions à l'ébauche, et réduire les séparations d'emploi, en augmentant les taxes liées au licenciement. Dans pareil contexte, la variation du niveau de générosité des allocations chômage ne peut avoir qu'une influence de second plan [4].

Cette thèse s'inscrit plus dans une démarche positive que normative. Les aspects normatifs sont évoqués dans la plupart des chapitres mais ils ne constituent pas le coeur de la démarche. L'idée sous-jacente est que, pour mettre en place des politiques économiques adaptées sur le marché du travail, il est nécessaire de comprendre son fonctionnement de manière dynamique. Comme évoqué plus haut, les fluctuations économiques sont une caractéristique commune à l'ensemble des économies développées et ces dernières engendrent des coûts en bien-être supportés par la société dans son ensemble. Ainsi, il s'agit de comprendre en adoptant à la fois une approche appliquée et théorique, les origines des dynamiques du marché du travail. Pour ce faire, l'attention ne sera pas portée uniquement aux évolutions des variables de stock mais aussi aux dynamiques des flux de travailleurs, qui, par définition, façonnent les variations du taux de chômage. Depuis plus de deux décennies, les études empiriques sur cette thématique se sont multipliées et ont ouverts de nouvelles perspectives concernant l'analyse du marché du travail. Elles montrent notamment que le marché du travail est caractérisé par des mouvements importants entre l'emploi et le non-emploi. Les deux premiers chapitres de cette thèse se situent sur cette lignée de recherche en utilisant des approches différentes mais complémentaires. Plus spécifiquement, ils cherchent à quantifier les contributions relatives des taux de transition aux variations du taux de chômage.

Un autre des objectifs de cette thèse est de prendre en compte, autant que faire se peut, les différentes facettes du non-emploi. Si on se réfère aux définitions du Bureau International du Travail (BIT, par la suite), il correspond à la somme des chômeurs et des inactifs. Pour rappel, un individu est considéré au chômage dès lors qu'il est sans-emploi, qu'il recherche activement un emploi et qu'il est disponible pour prendre possession d'un emploi dans un délai

4. Landais et al. (2010) mettent en avant que les allocations chômage doivent augmenter pendant les récessions. Toutefois, comme le souligne Jung and Kuester (2015), Landais et al. (2010) ne considèrent qu'un seul instrument de politique économique. Par conséquent, et par définition, les salaires ne sont pas sensibles aux autres instruments de politique économique. En considérant, un éventail plus large de dispositifs à disposition de l'Etat, Jung and Kuester (2015) peuvent mettre en évidence d'autres mécanisme de stabilisation en phase de récession.

court. Si l'une des deux dernières conditions n'est pas respectée, alors l'individu est classé inactif[5]. Outre les disparités en termes de définitions, les deux versants qui forment le non-emploi masquent des phénomènes économiques différents. Du côté du chômage nous avons un ensemble d'individus engagés de manière explicite dans un processus de recherche d'emploi. Du côté de l'inactivité, nous avons un groupe d'individus qui, pour des raisons inhérentes à l'environnement économique, aux opportunités propres, aux considérations familiales, ne portent pas leur offre sur le marché du travail. Dans cette optique, le chapitre 1 de la thèse montre que les entrées/sorties de la population active joue un rôle non-négligeable dans l'explication des variations du chômage en France. Le chapitre 3, quant à lui, montre que la prise en compte de l'état d'inactif peut modifier le comportement dynamique de l'économie face aux chocs. Enfin, le chapitre 4 étudie avec un angle microéconomique un des freins potentiels à l'offre de travail des femmes, à savoir le nombre d'enfants.

0.1 Les faits stylisés

En tant que première approche, cette section documente un ensemble de faits stylisés relatifs à l'ampleur des fluctuations des agrégats du marché du travail pour la France et les Etats-Unis, deux pays étudiés au cours des différents chapitres de cette thèse.

0.1.1 Les indicateurs de stock

Tout d'abord, comme l'indique le graphique 1, les expériences en matière d'évolution du taux de chômage sont diversifiées. Tandis que le taux de chômage américain se caractérise par des cycles de hausse et de baisse de fréquence régulière, le taux de chômage français, lui, augmente graduellement sur la période 1975-1990. Depuis cette date, ce dernier semble avoir atteint un plancher minimal et n'a jamais diminué en dessous de 6,5%. De manière assez claire, le début de la hausse du taux de chômage marque le début des périodes de récession (caractérisées par des zones grisées sur le graphique) aux Etats-Unis. Ce constat semble moins vrai en France. En revanche, la Grande Récession de 2008 enclenche la rupture de tendance conduisant à une augmentation du chômage de 2 points en moins d'un an. Sans surprise, les périodes de récession sont caractérisées par des diminutions du nombre d'employés et des offres d'emplois proposées par les entreprises. Remarquons que ces dernières ont diminué d'environ 25% pendant la Grande Récession, passant de 300000 offres au deuxième trimestre

5. Il convient de noter que la frontière entre les deux principaux états du non-emploi demeure floue. En effet, au sein même de l'inactivité il est possible de dégager un autre groupe d'individus formant le "halo" autour du chômage. Ce halo intègre des inactifs qui sont disponibles pour prendre un emploi ou qui ne recherchent pas "activement" un emploi.

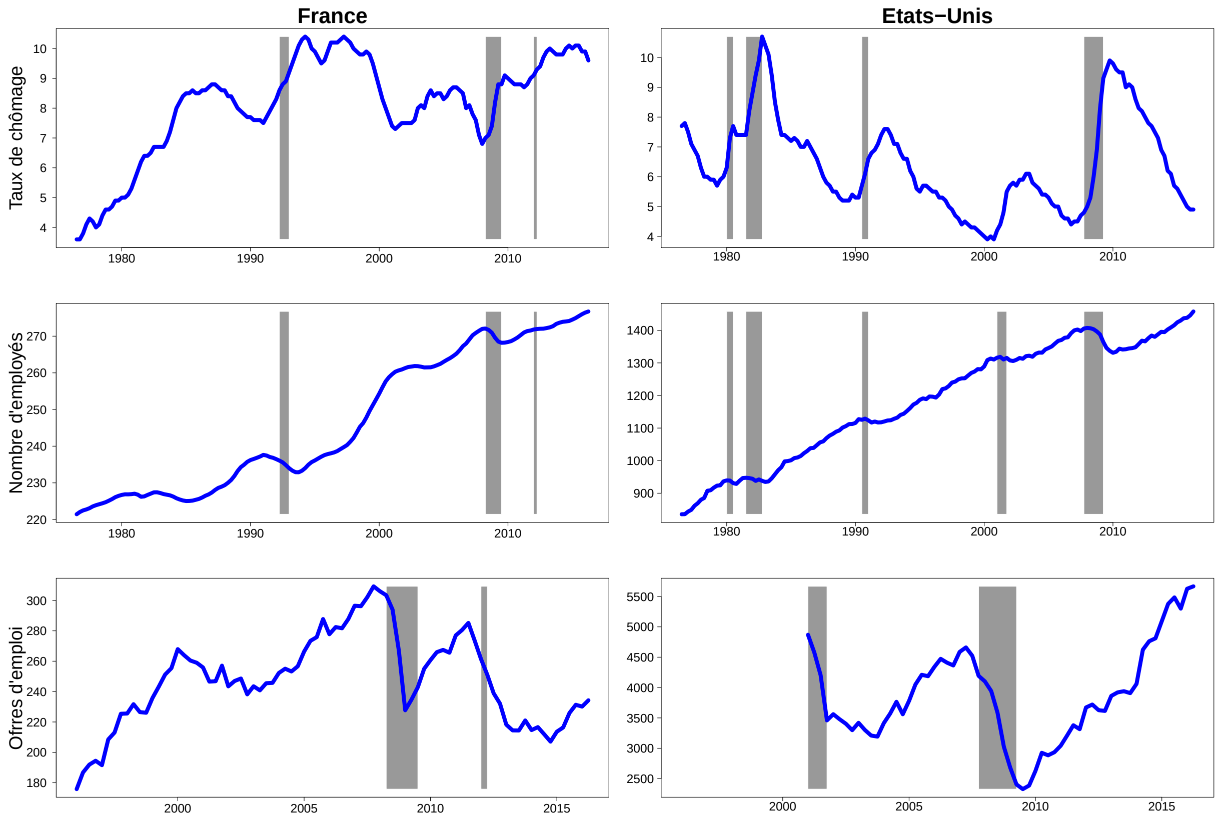

FIG. 1 – Taux de chômage, nombre d'employés et offres d'emplois en France et aux Etats-Unis.
Sources : INSEE pour les séries françaises, BLS pour les séries américaines
Notes : La première colonne correspond aux séries françaises, la deuxième aux séries américaines. Le taux de chômage est exprimé en pourcentage. Le taux de chômage est définit conformément à la définition du Bureau International du Travail. Les offres d'emplois en France correspondent aux offres collectées par Pôle Emploi. Les offres d'emplois aux Etats-Unis correspondent aux offres mesurées par le *Job Openings and Labor Turnover Survey*. Ces dernières sont disponibles sur une période plus courte, 1996Q1-2016Q2 et 2001Q1-2016Q2, respectivement. Le nombre d'employés est renseigné en centaines de milliers et les offres d'emplois en milliers

2008 à 230000 au premier trimestre 2009. Ce constat indique qu'au cours de cette période le marché du travail s'est tendu du point de vue des chercheurs d'emploi. Des évolutions similaires sont perceptibles aux Etats-Unis.

0.1.2 Les indicateurs de dynamique : les flux de travailleurs

L'analyse des faits stylisés relatifs à la dynamique du marché du travail ne doit pas se focaliser uniquement sur les variations nettes de stock. En effet, une telle abstraction peut être trompeuse car elle masque un mouvement perpétuel de flux main d'œuvre [6]. Lorsque

6. Les flux d'emploi et de main d'oeuvre font référence à des concepts différents. Par définition, les flux de main d'œuvre sont plus importants car, en plus des entrées et des sorties directement reliées au processus

Depuis... ...Vers	Emploi	Chômage	Inactivité
Emploi	–	1,8	2,8
Chômage	1,4	–	1,4
Inactivité	3	1,4	–

TAB. 1 – Flux de travailleurs mensuels moyens aux Etats-Unis au cours de la période 1996-2003
Sources : Davis et al. (2006) Graphique 1
Notes : Les flux de travailleurs sont exprimés en millions. L'origine du flux est donnée en colonne, la destination en ligne.

certaines personnes perdent leur emploi pour se retrouver au chômage ou inactif, d'autres en trouvent un en recherchant activement, tandis que d'autres encore, transitent directement de l'inactivité vers l'emploi sans connaitre un épisode de chômage. Le tableau 1 résume ces possibilités pour la période 1996-2003 aux Etats-Unis. Ainsi, en moyenne mensuelle 12 millions d'individus (soit 7% de la population en âge de travailler) changent de statut sur le marché du travail américain. Les mouvements depuis et vers l'inactivité sont loin d'être marginaux puisqu'ils représentent environ 70% des flux de travailleurs. Remarquons, que de telles statistiques descriptives ne sont pas disponibles pour la France. Le chapitre 1 de cette thèse aura notamment pour ambition de mesurer les flux de travailleurs avec des données françaises.

Même si les flux "bruts" de travailleurs ne sont pas directement comparables entre la France et les Etats-Unis, il est possible, depuis l'article de Hairault et al. (2015), d'avoir une mesure des taux de transition entre l'emploi et le chômage en France. Ces derniers correspondent à la probabilité qu'a un individu étant au chômage (respectivement en emploi) d'être en emploi (respectivement au chômage) à la période suivante [7]. Le graphique 2 fournit les taux de transition en France et aux Etats-Unis pour la période 1990-2010 [8]. Une nouvelle fois, le graphique fait apparaitre des disparités importantes entre la France et les Etats-Unis. En termes de magnitude, les probabilités de transitions sont plus élevées aux Etats-Unis. En moyenne, pour un chômeur la probabilité d'être en emploi un mois plus tard s'élève à 26,4% aux Etats-Unis. La même statistique est trois fois moins élevée en France puisqu'elle est de

de création/destruction des emplois, ils incluent les rotations sur les mêmes emplois et parfois les transitions depuis et vers la non-participation. Cette thèse se concentre plus sur l'étude des flux de main d'œuvre que sur l'évolution des flux d'emploi.

7. Les périodes correspondent en général au mois ou au trimestre.

8. Strictement parlant, les mesures des taux de transition ne sont pas directement comparables entre elles. Les taux de transition en France sont basés sur des déclarations individuelles. Ceux des Etats-Unis sont calculés à partir du *Current Population Survey* et sont donc conformes aux définitions du BIT. Toutefois, la comparaison reste utile pour fixer des ordres de grandeur.

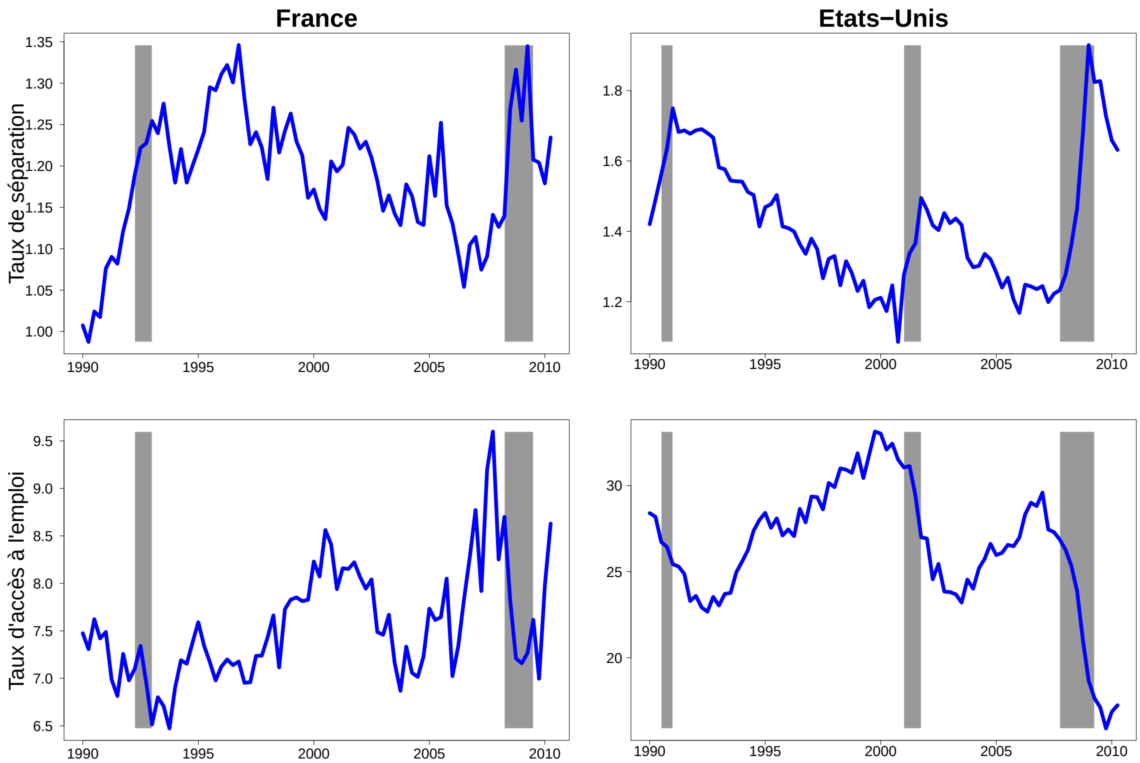

FIG. 2 – Taux de retour et taux de séparation de l'emploi en France et aux Etats-Unis.
Sources : Hairault et al. (2015) et calculs de l'auteur pour les données françaises, Elsby et al. (2015) pour les données américaines.
Notes : Les transitions reportées ne concernent que l'emploi et le chômage. La première colonne correspond aux données françaises, la deuxième aux données américaines. Les taux de transition sont exprimés en pourcentage. Les séries correspondent à des moyennes trimestrielles de données mensuelles.

7,5%. S'il est plus facile pour un chômeur américain de trouver un emploi, il est également plus facile pour lui de perdre son emploi lorsqu'il en a un. Cette hétérogénéité en matière de transition sur le marché du travail a également été mise en avant par Elsby et al. (2013). Ces derniers montrent, pour un échantillon de 14 pays de l'OCDE, qu'il est possible de faire le distinguo entre deux groupes de pays. D'un côté, les pays anglophones et nordiques seraient caractérisés à la fois par des fortes probabilités de retour à l'emploi (supérieures à 20%) et de séparation de l'emploi (supérieures à 1,5%). De l'autre, les pays d'Europe continentale, qu'ils qualifient de sclérosé, seraient caractérisés par des faibles taux de retour à l'emploi (inférieurs à 10%) et de séparation de l'emploi (compris entre 0,5% et 1%).

Bien que les disparités en termes d'amplitude des taux de transition sont importantes entre la France et les Etats-Unis, il convient de remarquer que le comportement cyclique des séries est proche. Ainsi, les périodes de récession sont marquées par une élévation du taux auquel les individus sont séparés de leur emploi et une diminution du taux auquel ils accèdent à l'emploi depuis le chômage. Ces taux de transition entre les différents états du marché du travail sont d'autant plus importants qu'ils façonnent les variations des agrégats comme le chômage ou l'emploi. Ainsi, un niveau de chômage identique peut refléter des situations différentes en matière de probabilité de transition. A un moment donné, le taux de chômage peut être élevé car les séparations de l'emploi sont plus importantes. A l'inverse, un taux de chômage élevé peut également être la conséquence d'un processus de retour à l'emploi atone matérialisé par de faibles taux d'accès à l'emploi et des durées de chômage plus longues.

0.1.3 L'ampleur des fluctuations

Pour clore cette section sur les faits stylisés, je présente un ensemble de statistiques descriptives relatif à la volatilité et à la corrélation des variables du marché du travail. Dans le but de mesurer les fluctuations et les co-mouvements des variables du marché du travail le long du cycle économique, je procède à l'instar de Shimer (2005). En particulier, chaque série est transformée en logarithme et sa composante tendancielle est extraite à l'aide d'un filtre Hodrick-Prescott avec un paramètre de lissage égal à 100000. Le tableau 2 consigne les résultats. Tout d'abord, remarquons qu'à l'exception du niveau de l'emploi, toutes les variables relatives au marché du travail sont plus volatiles que le Produit Intérieur Brut réel (PIB, dans ce qui suit). Ainsi, en France le taux de chômage et le taux de vacance sont approximativement 5 fois plus volatils que le PIB, alors que, l'indicateur de tension est presque 8 fois plus volatil que ce dernier. Là aussi, un contraste apparaît lorsqu'on compare les écarts-type des composantes cycliques en France et aux Etats-Unis. Les grandeurs macroéconomiques relatives au marché du travail sont bien plus volatiles aux Etats-Unis. D'une part, le niveau des écarts-type y est toujours plus élevé qu'en France. D'autre part, les volatilités relatives au PIB sont très élevées (cf. ligne 4 du tableau 2). Ainsi, l'écart-type du taux de chômage est 8 fois plus important que celui du PIB. La volatilité de l'indicateur de tension sur le marché du travail est encore plus élevé puisqu'elle est 20 fois plus importantes que celle PIB.

La deuxième partie du tableau 2 fournit les matrices de corrélation pour la France et les Etats-Unis. Ces dernières nous renseignent notamment sur les co-mouvements des variables prises deux à deux. Dans l'ensemble, le sens des corrélations est le même en France et aux Etats-Unis. Le taux de chômage et le taux de séparation de l'emploi sont contre-cycliques, tandis que, les autres agrégats du marché du travail sont pro-cycliques. Au global, le signe des corrélations est intuitif et corrobore les premiers éléments de statistique descriptive mises en avant au cours des sous-sections précédentes. Le taux de chômage augmente au moment des récessions, tandis que, le taux d'accès à l'emploi, l'indicateur de tension ou encore les offres d'emplois diminuent. Des différences entre les marchés du travail américain et français existent, mais ces dernières sont moins prononcées qu'auparavant. Notons toutefois que les taux de transitions sont moins corrélés avec les autres variables en France qu'aux Etats-Unis. Finalement, la corrélation entre le taux de chômage et les postes vacants est négative dans les deux cas, mais, son ampleur varie fortement (proche de l'unité pour le marché du travail américain contre une valeur avoisinant -0,5 en France).

	France							Etats-Unis						
x	y	E	u	v	θ	s	f	y	E	u	v	θ	s	f
σ_x	0,017	0,012	0,091	0,080	0,139	0,059	0,065	0,023	0,018	0,190	0,174	0,390	0,096	0,114
$\frac{\sigma_x}{\sigma_y}$	1	0,66	5,20	4,58	7,96	2,98	3,28	1	0,74	8,15	7,45	19,60	4,15	4,91
Matrice de corrélation														
y	1	0,88	-0,78	0,70	0,85	-0,67	0,49	1	0,80	-0,75	0,68	0,74	-0,70	0,79
E	–	1	-0,89	0,47	0,79	-0,46	0,44	–	1	-0,86	0,68	0,80	-0,47	0,79
u	–	–	1	-0,47	0,87	0,27	-0,42	–	–	1	-0,93	0,99	0,78	-0,93
v	–	–	–	1	0,84	-0,57	0,56	–	–	–	1	0,97	-0,86	0,90
θ	–	–	–	–	1	-0,45	0,59	–	–	–	–	1	-0,84	0,94
s	–	–	–	–	–	1	-0,22	–	–	–	–	–	1	-0,82
f	–	–	–	–	–	–	1	–	–	–	–	–	–	1

TAB. 2 – Statistiques descriptives sur données trimestrielles

Sources : INSEE pour les données françaises, BLS et FRED pour les données américaines et calculs de l'auteur

Notes : y = PIB réel, E = nombre d'employés, u = taux de chômage, v = taux de vacance, θ = la tension sur le marché du travail, soit le ratio $\frac{v}{u}$. Le taux de vacance d'emploi est définit comme $v = \frac{\text{Offres d'emplois}}{\text{Offres d'emplois+Nombre d'employes}}$. Toutes les variables sont en logarithme et ont été purgées de leur tendance par le biais d'un filtre Hodrick-Prescott avec un paramètre de lissage égal à 10^5. L'horizon temporel couvre la période 1996Q1-2016Q2 pour la France et 2001Q1-2016Q2 pour les Etats-Unis. Les restrictions temporelles sont contraintes par la disponibilité des données sur les offres d'emplois.

Cette première section nous a permis de mettre en évidence certaines disparités entre les marchés du travail de deux pays développés : les Etats-Unis et la France. Cependant, il convient de remarquer que, même si leur ampleur varie, les fluctuations importantes des agrégats comme le taux de chômage ou l'indicateur de tension constituent un trait commun caractéristique de ces deux marchés. Dans le but de comprendre les mécanismes à l'origine de ces fluctuations, la littérature macroéconomique a fait appel à plusieurs types de modélisation. La prochaine section retrace, sans prétendre à l'exhaustivité, les grandes évolutions théoriques liées à la compréhension des dynamiques du marché du travail. Nous verrons notamment que, d'un point de vue quantitatif, la réplication de ces fluctuations n'est pas directe.

0.2 Approche macroéconomique des fluctuations du chômage

0.2.1 De la vision macroéconomique traditionnelle aux fondements microéconomiques

La considération du chômage dans la modélisation macroéconomique n'a pas toujours été convaincante. La modélisation néoclassique standard, caractérisant l'économie comme n'étant assujettie à aucune friction, où l'information est parfaite et dans laquelle prix et salaires sont fixés de manière concurrentielle par un commissaire-priseur, aboutit à l'absence de chômage. Les premières réponses à ces insuffisances sont données par la macroéconomie d'inspiration Keynésienne, qui se structure autour de la relation de Philips faisant état d'une relation négative entre les salaires nominaux et le taux de chômage. Ainsi, en supposant que les prix et les salaires sont rigides à court-terme, les modélisation canoniques arrivent à générer un chômage qualifié d'involontaire. Malgré cela, ces modèles macroéconomiques "traditionnels" font preuve de certaines insuffisances. Ils restent critiquables sur l'aspect "ad-hoc" de leurs hypothèses de départ, ainsi que, sur l'absence totale de fondements microéconomiques du comportement des agents.

A la recherche de fondements microéconomiques, Lucas and Rapping (1969) proposent le modèle de substitution intertemporelle de l'offre de travail. Cette théorie constitue le point de départ des analyses modernes (modèles RBC, Néo-Keynésiens entre autres) des fluctuations de l'emploi et du chômage. Dans ce type de modèle, les individus déterminent à chaque période la quantité de temps qu'ils consacrent aux activités rémunératrices de travail. L'offre de travail étant élastique, les heures travaillées fluctuent avec les variations du salaire. D'un point de vue purement qualitatif le modèle de substitution intertemporelle offre un ensemble de résultats cohérents. Cependant, il met en avant d'autres problématiques liées, notamment, à l'égalité entre le taux marginal de substitution de la consommation au loisir et le produit marginal du travail (qui ne tient pas dans les données), et, à son incapacité à générer du chômage au sens où on peut le concevoir empiriquement (cf. Rogerson and Shimer (2011)).

A partir des années 1970, l'analyse microéconomique du marché du travail est l'objet d'une littérature abondante. Les modèles microéconomiques développés (McCall (1970), Lippman and McCall (1976), Mortensen (1986)) s'affranchissent de certains postulats de la théorie classique. Le marché du travail est modélisé comme un marché caractérisé par une forte incertitude au sein duquel les décisions sont prises de manière décentralisée. Ainsi, les modèles de la prospection d'emploi sont les premiers à donner du sens au statut de chômeur, dans le mesure où, ce dernier est un individu sans emploi qui consacre du temps à la recherche d'un emploi (ce qui nous rapproche des définitions internationales actuelles). En particulier, dans les premières modélisations (partielles) il est supposé que les chômeurs connaissent la distribution des salaires offertes par les firmes. En revanche, ils ne savent pas précisément où sont localisées les meilleures propositions de salaire. Lorsque l'individu reçoit une offre de salaire, il la compare à son salaire de réservation [9]. Deux options s'offrent à lui : accepter l'offre et prendre l'emploi ou continuer sa prospection. Les propriétés de statique comparative apportent de nombreux enseignements pertinents, notamment sur l'évolution de la durée des épisodes du chômage en fonction de certains paramètres exogènes du modèle (le niveau des allocations chômage, par exemple).

Les versions d'équilibre des modèles de recherche d'emploi, intégrant explicitement le comportement des demandeurs de travail, constituent une extension naturelle des modélisations partielles. Toutefois, Diamond (1971) met en avant l'existence d'un paradoxe. Dans un modèle où les firmes et les chômeurs sont homogènes, il montre que la distribution des salaires offerts se concentre en un seul point : le salaire de réservation. On parle alors de distribution de salaire dégénérée. Plusieurs réponses ont été formulées pour contrer ce paradoxe. Albrecht and Axell (1984) introduisent de l'hétérogénéité des agents, tandis que, Burdett and Mortensen (1998) introduisent la possibilité de recherche d'un autre emploi lorsqu'un individu est déjà en emploi.

0.2.2 Le renouveau de la modélisation macroéconomique du chômage : le modèle de *matching*

Les modèles de la prospection d'emploi bien qu'instructifs adoptent principalement une vision microéconomique du marché du travail. En outre, dans leurs versions d'équilibre, ces derniers cherchent à expliquer la formation des salaires plutôt que les mécanismes à l'ori-

9. Le salaire de réservation correspond au montant de salaire le plus petit acceptable.

gine des fluctuations du chômage. L'analyse "macroéconomique" du marché du travail s'est construite à travers une "synthèse" des modèles de recherche d'emploi combinée des contributions fondatrices de Diamond (1981), Mortensen (1982) et Pissarides (1985). L'ensemble de ces travaux a abouti à la formulation du modèle dominant pour l'étude des questions macroéconomiques relatives marché du travail : le modèle de *matching*, soit en français, le modèle d'appariement [10].

Le modèle d'appariement repose sur trois piliers. Le premier est l'existence de frictions de recherche. Au sein du marché du travail, l'information circule de manière imparfaite. Une des conséquences directes de cette imperfection de l'information est que les agents ont une méconnaissance des opportunités d'échange disponibles. Lorsqu'un individu souhaite décrocher un emploi, ou lorsqu'une entreprise cherche à pourvoir un poste vacant, il ou elle doit s'engager dans une activité de recherche. Les deux parties prenantes doivent consacrer du temps, mais aussi des ressources financières, pour acquérir de l'information et nouer une relation d'échange (un appariement). Cette imperfection de l'information constitue une caractéristique intangible liée à l'existence de coûts de collecte d'information, à la motivation des travailleurs, à la dispersion spatiale des activités économiques etc. Le deuxième pilier du modèle est l'existence d'une fonction d'appariement qui détermine, pour un nombre de postes vacants et de chercheurs d'emploi donné, le nombre de rencontres firmes/chômeurs couronné de succès par période. La fonction d'appariement possède des propriétés semblables à une fonction de production classique pour laquelle "l'output", le flux des nouvelles embauches, est le produit des efforts de recherche émis par les "inputs", à savoir les chômeurs et les firmes. Elle promeut un rôle central à l'indicateur de tension du marché du travail qui correspond au ratio des postes vacants sur le nombre de chercheurs d'emploi. Ainsi, la tension sur le marché du travail concrétise l'idée que les décisions d'un groupe (par exemple les firmes) ont des répercussions directes sur l'activité de recherche de l'autre groupe (par exemple, les chômeurs). Si par exemple le nombre de postes vacants augmente pour des raisons exogènes, alors la probabilité de retour à l'emploi s'accroit. Par ailleurs, la fonction d'appariement permet également de mettre en évidence l'existence d'externalités matérialisant les concurrences intra-groupes. En effet, les chômeurs (respectivement les firmes) sont mis en concurrence pour accéder à l'échange. Plus le nombre de chercheurs d'emploi est important, plus il est difficile pour un chômeur pris individuellement de trouver un emploi. On parle alors d'effets de congestion. Le troisième pilier concerne le mode de fixation des salaires qui, dans le modèle d'appariement, correspond à une négociation bilatérale entre la firme et l'individu. En général, le salaire sera le résultat d'un produit de Nash. Chacune des parties compare les gains potentiels qu'elle peut retirer de l'appariement à ce qu'elle obtiendrait si elle continuait

10. Pour une description détaillée voir Pissarides (2000).

son activité de recherche. Ainsi, la création d'un appariement est conditionnée à l'existence d'un gain à l'échange supérieur aux opportunités extérieures propres des deux parties. Dans la plupart des cas, la répartition de cette rente est négociée en fonction du pouvoir respectif des agents.

Le modèle de *matching* a connu un succès retentissant au sein de la littérature économique à tel point que ses pères fondateurs, à savoir Peter Diamond, Dale Mortensen et Christopher Pissarides, ont été récompensés par le prix 2010 en mémoire d'Alfred Nobel. Les origines de ce succès tiennent dans la relative simplicité du modèle de départ où les frictions jouent un rôle central sur les marchés, mais aussi, à sa pertinence à expliquer les mécanismes qualitatifs conduisant au chômage. Qui plus est, les fondamentaux du modèle sont facilement transposables à d'autres marchés tels que celui de la finance, du logement ou encore du mariage. Appliqué au marché du travail, le modèle fournit un cadre rigoureux propice à l'étude des fluctuations du taux de chômage et des flux de travailleurs. Par ailleurs, en attribuant des fondements microéconomiques à l'existence d'un chômage d'équilibre frictionnel, il comble certaines des limites des modélisations antérieures. Aussi, il convient de remarquer que la fonction d'appariement combinée à la condition d'équilibre des flux confère un fondement microéconomique à la coexistence de chômage et d'emplois vacants. En ce sens, le modèle d'appariement franchit un palier non-négligeable en donnant une justification théorique à la courbe de Beveridge. Une autre clé du succès de ce type de modélisation est qu'il offre un cadre privilégié pour l'analyse des instruments de la politique économique comme celle relative aux taxes appliqués sur les salaires, à l'assurance chômage, aux coûts de licenciement, aux subventions à la création d'emploi etc.

0.2.3 Un léger détour : la macroéconomie depuis les années 1980

Si la considération du marché du travail et du statut de chômeur a évolué depuis les années 1970, la macroéconomie a, quant à elle, connu un changement de paradigme à partir des années 1980. Portée par les travaux pionniers de macroéconomistes de renom tels que, Robert Lucas, Finn Kydland ou encore Edward Prescott, cette révolution a fait émerger le courant dominant de la macroéconomie moderne. Dans un article pionnier, Kydland and Prescott (1982) mettent en avant deux idées nouvelles. La première est que les cycles économiques peuvent être étudiés par le biais d'un modèle d'équilibre général dynamique dans lequel les agents émettent des anticipations rationnelles quant à l'avenir. La deuxième est que la démarche du macroéconomiste doit aller au-delà d'une simple comparaison qualitative entre les propriétés des modèles et les faits stylisés. Ainsi, ils proposent une démarche empirique fondée sur des protocoles expérimentaux. Les fondements microéconomiques des modèles macroéconomiques d'aujourd'hui, la méthode de la calibration ainsi que l'étude des fluctuations cycliques à travers des simulations sont les marqueurs principaux de ces bouleversements méthodologiques. Avec une telle approche, Kydland and Prescott (1982) montrent que les données simulées de leur modèle reproduisent de manière correcte la volatilité, la persistance et les co-mouvements observés sur données américaines. Leurs résultats sont d'autant plus surprenants qu'ils font abstraction de la politique monétaire et qu'ils considèrent que les cycles sont gouvernés uniquement par un choc de nature réel : le choc technologique. Dans cette même lignée, Prescott (1986) indique que, sur la période postérieure à la Seconde Guerre Mondiale, 75% des fluctuations macroéconomiques aux Etats-Unis s'expliquent par les chocs technologiques. L'école de pensée mettant en avant l'idée que les cycles sont gouvernés uniquement pas des chocs réels et que la monnaie est neutre, est dénommée dans la littérature le courant des cycles réels (ou RBC pour *real business cycles*).

L'idée selon laquelle les chocs technologiques sont centraux pour le façonnement des cycles économiques est le sujet de nombreuses controverses. Tout d'abord, certains travaux critiquent la mesure de productivité utilisée par Prescott (1986) [11] en avançant qu'elle ne serait pas purement exogène (Hall (1988), Evans (1992), Basu (1996)). Ainsi, avec un raffinement de la variable de productivité, il est possible de montrer qu'elle explique une proportion moins importante des fluctuations cycliques. Ensuite, si les macroéconomistes sont, pour la plupart, d'accord sur le fait que les phases d'expansion sont associées à du progrès technique, l'idée selon laquelle les récessions seraient engendrées par du recul technologique soulève plus de scepticisme. Enfin et non des moindres, dans un article empirique Gali (1999) remet en question l'aptitude des modèles de cycles réels à générer des réponses pertinentes des heures consécutivement aux chocs de technologie. Plus spécifiquement, ce dernier estime un modèle VAR structurel dans lequel seuls les chocs technologiques peuvent impacter à long terme la productivité du travail. A partir d'un tel cadre empirique, Gali (1999) trouve que, à court terme, les heures travaillées diminuent en réponse à un choc technologique positif. Ce constat empirique contredit l'une des grandes prédictions des modèles de cycles réels faisant état d'un co-mouvement positif entre la productivité et les heures (King et al. (1988)). Le résultat mis en avant par Gali a, lui aussi, suscité de nombreuses réactions notamment sur sa robustesse à la spécification de la variable mesurant le volume horaire travaillé [12]. Toutefois, le papier de Fève and Guay (2009) fournit une réponse à ces débats grâce à une stratégie empirique particulière, en deux temps, englobant le cadre de Gali (1999) et de Christiano et al. (2003). En

11. Plus spécifiquement, Prescott (1986) calcule le *total factor productivity* (TFP) et le considère comme une source exogène de productivité.

12. Christiano et al. (2003) trouve que le résultat de Gali n'est pas robuste à une inclusion des heures en niveau. A l'inverse, Basu et al. (2006) et Francis and Ramey (2005) confirment l'existence d'une réponse négative des heures à la suite d'un choc de technologie. Ces résultats dépendent clairement de l'existence d'une racine unitaire dans la série des heures travaillées. Or, cette dernière ne peut être ni fermement validée, ni fermement rejetée.

effet, ces derniers montrent qu'un choc technologique fait diminuer à court terme les heures travaillées. Ce résultat étant insensible à la spécification de la variable d'heures travaillées.

Même si ils n'ont pas été initialement construits dans cette optique, les modèles Néo-Keynésiens [13] (NK) apportent une réponse à "l'énigme" mise en avant par Gali (1999). Le modèle NK canonique reprend en partie la structure auparavant développée par le courant des cycles réels. Ainsi, les deux types de modélisation partagent certaines hypothèses de base, à savoir celles de l'anticipation rationnelle des agents économiques, du nombre infini d'agents occupant les marchés, des fondements microéconomiques. Par ailleurs, la stratégie méthodologique est également similaire, l'économie, modélisée par le biais d'un modèle d'équilibre général stochastique, est calibrée et ses réponses aux chocs sont simulées. Toutefois, les modèles NK se distinguent des modèles RBC par d'autres postulats non-négligeables. D'un côté, l'hypothèse de concurrence sur le marché des biens est abandonnée au profit d'une concurrence monopolistique. Ainsi, les prix sont fixés par des agents privés cherchant à maximiser leurs objectifs et ne sont plus déterminés par un commissaire-priseur Walrasien. De l'autre, les modèles NK introduisent des rigidités nominales. Les firmes sont soumises à des contraintes sur la fréquence d'ajustement de leurs prix. En général, ces contraintes sont modélisées conformément au schéma de Calvo (1983) [14]. Une des conséquences directes des rigidités nominales est que la politique monétaire peut avoir des effets réels à court terme. En effet, comme les prix ne s'ajustent pas à court-terme, les modifications du taux d'intérêt nominal ne sont pas compensées par un changement immédiat et proportionnel du niveau des prix. Une telle modélisation permet de "ressusciter" le canal de la demande. Une augmentation du taux d'intérêt nominal modifie le comportement de consommation et d'investissement des agents. Les firmes vont ajuster la quantité de biens qu'elles offrent au nouveau niveau de la demande. C'est ce type de mécanisme qui offre des éléments de réponse au "puzzle" de Gali. En effet, un choc technologique améliore la productivité des facteurs de production. Comme les firmes ne peuvent ajuster librement leurs prix à la baisse, elle vont diminuer la quantité d'input (généralement les heures de travail) utilisée dans le processus de production pour faire face à la demande. Par conséquent, les modèles NK proposent un fondement théorique à la diminution des heures travaillées à la suite du choc technologique.

En guise de conclusion à cette sous-section, remarquons que de nombreux modèles de cycles réels adoptent une description rudimentaire du marché du travail. Le plus souvent, les firmes se procurent le facteur travail (généralement des heures) sur un marché compétitif ne laissant pas de place à l'existence de chômage. Qui plus est, et jusqu'à récemment, la variable

13. Les développements des modèles NK canoniques peuvent être trouvés dans Clarida et al. (1999), Woodford (2003) et Gali (2008).

14. Une modélisation alternative des rigidités nominales consiste à introduire des coûts d'ajustement des prix *à la* Rottemberg.

chômage n'était pas non plus présente dans les modèles Néo-Keynésiens [15]. Par ailleurs, pour reproduire des fluctuations cycliques en accord avec les observations empiriques, la plupart des modèles de cycles réels requiert une élasticité de l'offre de travail très élevée. Or les estimations micro-économétriques suggèrent que cette dernière est très faible. Une tentative de réconciliation consiste à introduire un facteur travail indivisible (Hansen (1985)) [16].

0.2.4 La critique quantitative du modèle de *matching*

L'énigme de Shimer

Une des extensions naturelle de cette littérature concerne l'intégration d'un marché du travail frictionnel à ces modèles macroéconomiques d'équilibre général. Se faisant, l'attention se focalise explicitement sur l'explication des fluctuations cycliques des agrégats du marché du travail. Compte tenu du succès indéniable des modèles de *matching*, une telle démarche semble prometteuse. Pourtant, les premières évaluations quantitatives sont mitigées et remettent en question, du moins partiellement, l'aptitude des modèles d'appariement à expliquer les dynamiques du marché du travail.

Dans un article largement cité, Shimer (2005) considère une version agrégée du modèle de Pissarides (2000) dans laquelle la productivité du travail suit un processus Markovien [17]. Dans ce contexte, il observe que le modèle calibré est incapable de reproduire, pour les variables du marché du travail, des moments simulés d'un ordre de grandeur semblable à ceux observés aux Etats-Unis au cours de la période 1951-2003. Ainsi, dans le modèle les volatilités des emplois vacants, de la tension et du taux d'accès à l'emploi, sont 10 fois inférieures à celles observées empiriquement. Concernant le taux de chômage, seul un vingtième de sa volatilité est reproduite par la simulation du modèle [18]. Selon Shimer, le problème ne se cantonne pas uniquement à des volatilités atones, les canaux de transmission du choc de productivité seraient également inadaptés. A la suite d'un choc de productivité, du fait de la hausse du profit engendrée par un appariement, les firmes ont une incitation à ouvrir plus de postes vacants. Toutes choses égales par ailleurs, la tension sur le marché du travail augmente. Comme indiqué plus haut, le comportement des firmes en matière de recrutement impacte directement l'activité de recherche des agents à la quête d'un emploi. En l'espèce, consécutivement à l'aug-

15. La non prise en compte du chômage peut être justifiée par le fait que l'explication de ses fluctuations et de ses déterminants ne se situait pas au cœur des intérêts premiers de ces deux littératures.

16. Les premières prises en compte d'un marché du travail frictionnel au sein d'un modèle de type RBC viennent des travaux de Andolfatto (1996), Merz (1995) et den Haan et al. (2000).

17. Shimer (2005) considère également une version du modèle dans laquelle le taux de séparation suit un processus Markovien. Comme les résultats quantitatifs de Shimer sont très peu sensibles à cette inclusion, je ne considère que les implications du choc de productivité dans le corps du texte.

18. Cf. les tableaux 1 et 3 de Shimer (2005).

mentation des ouvertures de postes, les chances de retour à l'emploi des chercheurs d'emploi s'améliorent, ce qui fait diminuer la durée des épisodes de chômage. Cette dernière augmente le pouvoir de négociation salariale des individus poussant à la hausse le salaire. La pression à la hausse des salaires s'exerce jusqu'à ce que cette dernière absorbe les gains de productivité initiaux. *In fine*, le choc de productivité n'a qu'un impact quantitatif négligeable sur les grandeurs du marché du travail. Dans le modèle calibré par Shimer (2005), ce mécanisme de transmission du choc de productivité est exacerbé par une corrélation presque unitaire entre d'un côté la productivité, et de l'autre des agrégats comme la tension et le taux d'accès à l'emploi. Aussi, dans le modèle l'élasticité du salaire aux variations de la productivité est proche de l'unité alors qu'elle avoisine 0,40 empiriquement. Cette relative "sur-réaction" du salaire aux variations de la productivité est, selon Shimer, responsable du manque d'amplification des chocs dans le modèle [19].

Les réponses à l'énigme de Shimer

Afin d'apporter une réponse au "puzzle de Shimer", de nombreuses solutions ont été proposées. Ces dernières peuvent être regroupées en trois grandes catégories. Tout d'abord, Hagedorn and Manovskii (2008) argumentent qu'une calibration alternative de la valeur du non-emploi (le loisir et les allocations chômages) et du pouvoir de négociation des chômeurs permet de résoudre le problème de la volatilité. Effectivement, en fixant la valeur du non-emploi à un niveau proche de celui du salaire (seulement 3% à 5% inférieure) et en attribuant aux chercheurs d'emploi un faible pouvoir de négociation, ils montrent que le modèle génère des fluctuations satisfaisantes. Notons qu'une telle calibration est critiquable sur plusieurs aspects. En particulier, elle rend le modèle très sensible aux paramètres de la politique économique. Par ailleurs, la fixation de la valeur du non-emploi à une valeur aussi irréaliste empêche, de manière mécanique, l'étude des implications des allocations chômage sur le cycle économique (Costain and Reiter (2008)). Ensuite, la deuxième des réponses au puzzle consiste à introduire de la rigidité salariale. Cette entreprise, initialement proposée par Shimer (2005), a également été poursuivie par des travaux importants comme ceux de Hall (2005a), Gertler et al. (2008) et de Hall and Milgrom (2008) (entre autres). Pour arriver à un salaire rigide,

19. Dans leur contribution pour le *Handbook of Labor Economics*, Rogerson and Shimer (2011) évaluent également la capacité du modèle d'appariement à générer les fluctuations du marché du travail. Pour ce faire, ils comparent les volatilités simulées de ce dernier à celles d'un modèle sans friction où le travail est indivisible *à la* Hansen (1985). Ils trouvent que l'introduction des frictions amortit les fluctuations des variables macroéconomiques. Ainsi, dans le modèle où le marché du travail est frictionnel, la volatilité de l'emploi est 0,9 fois inférieure comparativement à un modèle sans aucune friction. Une des explications avancées par les auteurs est que les frictions de recherche agissent de manière semblable à des coûts d'ajustement. Par conséquent, en période d'expansion, les firmes embauchent moins sur un marché du travail frictionnel qu'elles le feraient dans un environnement sans frictions.

plusieurs alternatives sont envisageables. Lorsque Hall (2005a) choisit d'introduire une rigidité salariale de manière “ad-hoc”, Hall and Milgrom (2008) modifie le point de menace des parties prenantes à la négociation salariale. Peu importe la manière dont la rigidité des salaires est introduite, un résultat robuste semble se dégager : lorsque les salaires ne s'ajustent plus librement, le modèle est davantage en mesure de reproduire des faits stylisés conformes aux données [20]. Pissarides (2009) conteste le fondement empirique de l'hypothèse de rigidité salariale comme solution réaliste au problème d'amplification du modèle d'appariement. En effet, ce dernier émet des doutes sur cette hypothèse en remarquant que, à l'inverse du salaire agrégé, le salaire de ceux qui accèdent à l'emploi n'est pas rigide. Cette intuition est renforcée par le travail empirique de Haefke et al. (2013) qui montrent que l'élasticité du salaire des nouvelles embauches aux variations de la productivité est proche de 1. *A contrario*, pour les autres emplois, ceux qui ont été créés depuis plus longtemps, cette élasticité s'élève seulement à 0,2. Selon Pissarides (2009), ce qui prévaut pour la création d'emploi c'est la différence entre le productivité espérée et le coût espéré du travail sur les nouvelles embauches. Afin de prendre en compte ce fait empirique, il modifie le modèle en incluant une partie fixe aux coûts de création d'emploi. Une telle spécification du modèle permet d'augmenter la volatilité des variables du marché du travail. Enfin, la dernière catégorie de réponse au puzzle se distingue des deux autres, dans la mesure où elle ne cherche pas à introduire, directement ou indirectement, de la rigidité salariale. Il s'agit plutôt d'introduire de l'hétérogénéité de l'emploi et de la recherche d'emploi pendant l'emploi (Robin (2011) ou encore Chassamboulli (2013)).

Outre les modifications de la structure du modèle d'appariement, il convient de s'interroger si ce dernier souffre de la critique de Shimer lorsqu'il est intégré à un modèle DSGE Néo-Keynésien. Dans cette optique, Pizzo (2015) montre que l'introduction de frictions nominales joue un rôle fondamental. En effet, lorsque les rigidités de prix existent à court terme, le problème de volatilité mis en avant par Shimer (2005) est résolu et passe en second plan. Qui plus est, les mécanismes de transmission du choc de productivité sont plus en accord avec les observations empiriques de Gali (1999). En effet, elle montre que l'introduction de frictions nominales réduit la corrélation contemporaine entre la productivité et le chômage. Le deuxième essai de cette thèse envisage également ces possibilités. A partir d'un modèle DSGE Néo-Keynésien avec marché du travail frictionnel, il montre que la résolution du “puzzle de Shimer” dépend de la calibration de quelques paramètres importants du modèle, dont le coût total engendré par les postes vacants. Toutefois, malgré une calibration réaliste, le modèle ne permet pas de retrouver les bonnes origines des variations du chômage en termes de flux.

20. Dans un article récent, Christiano et al. (2013) construisent un modèle dans lequel l'inertie du salaire n'est pas imposée mais déduite du mécanisme de négociation salariale.

Malgré les critiques sur l'évaluation quantitative du modèle d'appariement, force est de constater que le socle construit par Diamond, Mortensen et Pissarides, n'a pas été abandonné. Au contraire, les réponses apportées au "puzzle" se sont plus orientées vers l'amendement de certaines des hypothèses du modèle, parfois simplificatrices, au profit d'autres plus réalistes (non-flexibilité des salaires, hétérogénéité des travailleurs et des firmes, recherche dans l'emploi etc.). L'un des intérêts essentiel du modèle d'appariement est qu'il permet de faire facilement le lien entre les données et les mécanismes théoriques. D'une part, parce que le statut de chômeur dans le modèle est proche de celui qu'on observe dans les *Labour Force Survey*, dans la mesure où, il s'agit d'un individu actif engagé dans un processus de recherche. Un modèle sans aucune friction ne permet pas un tel degré de raffinement. D'autre part, les modèles avec frictions sur le marché du travail permettent d'envisager les variations du chômage comme la conséquence des mouvements des flux de travailleurs depuis et vers le chômage. Par exemple, le chômage peut être élevé car les individus perdent leur emploi à un taux élevé. De manière alternative, le chômage peut être faible car le taux auquel un individu trouve un emploi est élevé. Aucune de ces deux possibilités ne peut être considérée de manière cohérente dans un modèle sans friction. [21]

0.3 Les apports de cette thèse

0.3.1 Dynamiques du chômage français : une approche considérant les trois états sur le marché du travail

Le chapitre 1 de cette thèse étudie, d'un point de vue empirique, les origines du taux de chômage français en termes de flux de travailleurs. Toutefois, et à l'inverse de ce qui est fait traditionnellement dans les modèles d'appariement et dans la littérature empirique (par exemple, Hairault et al. (2015) ou Elsby et al. (2013)), la participation n'est pas considérée comme constante. En effet, lorsque les individus transitent sur le marché du travail, ils ont la possibilité de se retirer de la participation lorsqu'ils sont actifs, ou encore, lorsqu'ils sont inactifs de se porter sur le marché du travail. Afin de prendre en compte ces possibilités, l'Enquête Emploi en Continu est mobilisée. Il s'agit d'exploiter son volet longitudinal de manière à repérer les mouvements individuels entre deux trimestres, et par agrégation, les flux de travailleurs et les taux de transition. Pour fournir une vision robuste des flux, les échantillons longitudinaux sont repondérés par la méthode dite de calage sur marge. Cette étape de repondération est primordiale car elle permet de réduire considérablement le biais

21. Remarquons que le degré de raffinement du modèle d'appariement peut être poussé jusqu'à l'intégration explicite des comportements de participation sur le marché du travail.

de non-réponse (conséquence de la structure panel de l'échantillon) ainsi que les fluctuations d'échantillonnage. De pllus, l'utilisation de l'EEC est primordiale car il s'agit de la seule source qui permet de mesurer les transitions conformément aux définitions du BIT. Ainsi, elle permet de capter de manière claire les mouvements impliquant l'inactivité. Le chapitre montre que les entrées/sorties de la population active sont fréquentes, puisque 60% des flux de travailleurs impliquent l'état d'inactif. *In fine*, avec des exercices de décomposition des variations du chômage similaires à ceux employées par Hairault et al. (2015) ou Smith (2011), le papier conclue que le tiers des fluctuations du chômage trouve son origine dans les mouvements depuis et vers l'inactivité. Un autre grand résultat du papier est de confirmer les travaux de la littérature (Hairault et al. (2015), Petrongolo and Pissarides (2008)) en indiquant que les fluctuations du taux d'accès à l'emploi expliquent environ la moitié des variations du chômage.

La richesse de l'EEC me permet d'affiner mon analyse. Ainsi, le calcul des taux de transition et les exercices de décomposition peuvent être appliqués à des sous-ensembles de la population agrégée. Dans cette optique, je subdivise la population agrégée selon le sexe, l'âge et le niveau de diplôme. Il apparait que les expériences en matière de transition sur le marché du travail sont variées. Les jeunes sont plus "mobiles", les seniors s'orientent plus souvent vers l'inactivité, les moins qualifiés connaissent les trajectoires les plus compliquées (leurs probabilités de séparation de l'emploi est plus forte, leurs chances de trouver un emploi plus faibles, leurs sorties de l'inactivité moins fréquentes etc.). Les exercices de décomposition menées sur les sous-populations confirment le rôle dominant du taux d'accès à l'emploi et l'influence non-marginale des entrées/sorties de l'inactivité.

0.3.2 Une analyse conditionnelle des entrées/sorties du chômage français

Le deuxième chapitre de cette thèse va plus loin dans l'analyse des origines des fluctuations du chômage en termes de flux. En effet, il pose la question de savoir comment les taux de transition (et donc le chômage) répondent aux chocs macroéconomiques agrégés affectant l'économie. Pour ce faire, les réponses des flux sont étudiées conditionnellement à deux chocs de nature différente. D'un côté, un choc d'offre de technologie. De l'autre, un choc de demande monétaire. En effet, la littérature étudie de manière très approfondie les impacts de ces chocs sur l'économie réelle, sans toutefois s'intéresser outre mesure aux réponses des flux du marché du travail. De plus, il n'est pas évident que des chocs macroéconomiques différents provoquent le même processus de réallocation de main d'œuvre.

Le chapitre propose deux approches complémentaires. La première consiste à construire un modèle de type DSGE incorporant un marché du travail frictionnel et de la séparation endogène. Ce modèle théorique est utilisé à des fins biens distincts. D'un côté, il sert de guide à l'analyse empirique. De l'autre, une fois calibré, il permet d'effectuer des analyses contrefactuelles complémentaires. La deuxième approche est empirique et consiste à estimer un modèle VAR sur données françaises. Les chocs structurels (technologiques et monétaires) sont identifiés par la méthode des restrictions de signe initialement proposée par Uhlig (2005).

Trois résultats ressortent de l'analyse. Premièrement, dans la lignée de Shimer (2005), je montre que la reproduction de la volatilité empirique des agrégats du marché du travail par le modèle n'est pas directe. La bonne adéquation entre moments empiriques et moments théoriques reposent sur la calibration de trois paramètres essentiels : le degré de rigidité de prix, le coût total des postes vacants et la part des séparations endogènes. Deuxièmement, le modèle VAR indique que le processus d'ajustement de la main d'œuvre s'opère principalement par le taux d'accès à l'emploi après un choc technologique. S'agissant du choc monétaire, les contributions empiriques des taux de transition paraissent plus équilibrées. Ce constat vient conforter l'idée qu'à des chocs de nature différentes correspondent des processus de réallocation de main d'œuvre différents. Troisièmement, si une calibration rigoureuse du modèle permet de s'écarter de "l'énigme de Shimer", cette dernière ne permet pas pour autant de retrouver les bonnes origines des fluctuations du chômage. En effet, peu importe la nature du choc, dans le modèle la hausse du chômage est la conséquence de séparations plus intenses, et non pas, comme le montre les données d'une faiblesse du taux d'accès à l'emploi. Ce résultat est robuste à la calibration des paramètres du modèle.

0.3.3 Incertitude et participation au marché du travail

Le troisième essai de cette thèse étudie les fluctuations du marché du travail à la suite d'un choc d'incertitude. Depuis la Grande Récession de 2008, l'économie américaine est caractérisée par un niveau d'incertitude élevé [22]. De multiples contributions (Bloom (2009), Basu and Bundick (2014) etc.) ont montré que les chocs d'incertitude pouvaient être à l'origine d'importantes fluctuations macroéconomiques. S'agissant du marché du travail, il apparait qu'une augmentation inattendue de l'incertitude exerce une pression à la hausse sur le taux de chômage (Caggiano et al. (2014)). D'un point de vue théorique, Leduc and Liu (2016) montrent que l'incorporation d'un marché du travail frictionnel à un modèle DSGE fournit un mécanisme de transmission additionnel du choc d'incertitude car un emploi apparié est assimilable à un investissement (partiellement) irréversible. En période d'incertitude, la va-

22. En toute généralité, l'incertitude peut être définie comme l'imprévisibilité quant à l'état futur de l'économie.

leur d'option de "l'attentisme" [23] augmente et la valeur de l'appariement diminue. Comme les firmes ouvrent moins de postes vacants, le chômage augmente. De manière surprenante, que ce soit d'un point de vue empirique ou théorique, la littérature actuelle reste muette sur les effets éventuels de l'incertitude sur la participation au marché du travail [24]. Ce papier se propose d'envisager cette possibilité aussi bien empiriquement que théoriquement.

Par le biais d'un modèle VAR structurel, le papier montre qu'un choc d'incertitude diminue de manière significative la participation au marché du travail. En effet, la réponse de la participation est relativement persistante, négative et en forme de "u". Sur le plan théorique, le papier modélise de manière explicite une marge de participation à un marché du travail *à la* Mortensen and Pissarides (1994) intégré dans un modèle DSGE Néo-Keynésien. Il en ressort que l'effet mis en avant par Leduc and Liu (2016), selon lequel la présence d'un marché du travail frictionnel suffit pour avoir des effets négatifs du choc d'incertitude, est contrebalancé par un surplus d'offre de travail de la part des ménages. Ainsi, dans une économie caractérisée par des frictions sur le marché du travail mais sans rigidités nominales, je trouve que l'incertitude augmente la participation et diminue le chômage. En revanche, lorsque l'économie est soumise à des rigidités nominales (sur les prix et/ou les salaires), les effets négatifs de l'incertitude sur l'économie sont retrouvés. Comme les firmes sont incapables d'ajuster leurs prix alors que la demande est comprimée, le profit espéré retiré d'un appariement diminue. Les firmes proposent moins de postes vacants, ce qui fait diminuer le taux de retour à l'emploi. Les opportunités sur le marché du travail étant moins bonnes, les ménages choisissent de transférer moins d'individus de la non-participation vers la participation. Au global, mes résultats sont robustes à plusieurs alternatives de calibration. En particulier, les analyses de sensibilité montrent que les rigidités salariales constituent également un canal de transmission important du choc d'incertitude.

0.3.4 L'effet causal de la taille de la famille sur l'offre de travail des mères : le cas de La Réunion et de la France métropolitaine

Le dernier chapitre de cette thèse s'écarte quelques peu des problématiques macroéconomiques étayées plus haut. Il propose un essai sur l'estimation de l'effet causal du nombre d'enfants sur l'offre de travail féminine. Il s'agit de la seule contribution de cette thèse portant attention au cas de La Réunion. L'étude de l'évaluation de l'effet causal de la fertilité sur l'activité féminine est d'autant plus intéressante que La Réunion a connu des

23. Le terme anglais correspondant est "*the wait and see*".

24. Or, depuis 2008 le taux d'activité américain a diminué de 2,5 points. Les travaux de Erceg and Levin (2014), Aaronson et al. (2012) et de Fujita (2014) montrent que les trois quarts des variations de la participation sont dus à des facteurs cycliques et non démographiques

bouleversements économiques et sociaux importants depuis les années 1970. En 4 décennies, l'offre de travail des femmes (approximée par le taux d'activité) a doublé dans ce département d'Outre-mer, passant de 30% en 1970 à 60% en 2012. Dans le même temps, on a pu constater une diminution spectaculaire du taux de fertilité. En effet, au début des années 1970 une mère réunionnaise avait en moyenne 6 enfants. Début 2010, le nombre moyen d'enfants par femme s'élevait à 2,3. Une comparaison de la situation des femmes vivant en France métropolitaine avec celles vivant à La Réunion montre que les différences entre les territoires restent importantes. Ainsi, le taux d'activité est de 10 points inférieur à La Réunion et une mère vivant dans ce département a en moyenne plus d'enfants que son homologue métropolitaine. L'objet de ce chapitre est d'évaluer l'ampleur de l'effet causal du nombre d'enfants sur l'offre de travail féminine dans deux régions qui, bien que différentes, partagent les mêmes institutions et les mêmes politiques familiales.

D'un point de vue empirique, utiliser une régression standard pour mesurer l'impact du nombre d'enfants sur l'activité des mères pose problème. En effet, les coefficients d'un tel modèle risquent d'être entacher d'un biais d'endogénéité. Pour résoudre ce problème, il est nécessaire d'utiliser la méthode des variables instrumentales. A l'instar de Rosenzweig and Wolpin (1980), Angrist and Evans (1998) et Angrist et al. (2010), la variable endogène de fertilité sera instrumentée par une indicatrice de naissances gémellaires et une indicatrice de sexe des aînés. Pour mener à bien cette étude, les données du Recensement Rénové de la Population sont mobilisées. Sa richesse en matière de variables observées et la taille de son échantillon me permettent d'obtenir un nombre conséquent d'observations dans le cas de La Réunion. Par ailleurs, il me permet d'affiner mon analyse en étudiant des aspects plus spécifiques (disparités selon le niveau de diplôme, selon l'âge du plus jeune enfant, les régions françaises).

Mes résultats empiriques indiquent que l'effet causal du nombre d'enfants sur l'offre de travail des femmes est plus fort à La Réunion qu'en France métropolitaine. Par exemple, pour les mères d'au moins 2 enfants, avoir au moins un troisième enfant réduit leur probabilité d'activité de 13 points dans le département d'Outre-mer contre 8 points en France métropolitaine. Mes estimations montrent également que l'ampleur de l'effet causal est croissante (en valeur absolue) avec le nombre d'enfants à La Réunion alors qu'elle est décroissante en France métropolitaine. Les estimations sur des segments plus fins montrent que i) l'impact causal de la présence des enfants est bien plus fort lorsque les enfants sont jeunes (moins de 4 ans), ii) les mères les moins diplômées sont plus enclines à se retirer du marché du travail lorsqu'elles ont des enfants que les mères diplômées, iii) l'effet causal est différent selon les régions françaises. Au global, mes estimations confirment l'idée d'une spécificité en matière d'arbitrage entre offre de travail et éducation parentale à La Réunion. Elles suggèrent également que les politiques familiales ont encore une marge de manœuvre importante afin de faciliter la conciliation entre vie professionnelle et vie familiale dans ce département.

Cette thèse utilise un éventail assez large de méthodes de recherche. Les chapitres 1 et 4 exploitent directement des données d'enquête afin d'apporter des réponses empiriques à des problématiques bien précises. De plus, le premier chapitre contient des aspects méthodologiques liés à la théorie des sondages, et en particulier, aux méthodes dites de calage sur marge. Dans ce chapitre, l'objectif est de fournir une mesure des flux de travailleurs en France la plus robuste possible. Les chapitres 2 et 3 utilisent les modèles macroéconomiques de type DSGE pour émettre des conclusions positives sur leurs aptitudes à reproduire certains faits empiriques. Ces mêmes chapitres utilisent également une approche macro-économétrique structurelle de type VAR. Enfin, le dernier chapitre de cette thèse mobilise des outils micro-économétriques appliqués notamment au cas du département de La Réunion. La plupart des conclusions tirées dans les chapitres de cette thèse sont positives. Ces dernières doivent servir de guide aux décideurs politiques. Chacun de ces chapitres peut être lu de manière autonome. Les notations mathématiques utilisées sont indépendantes d'un chapitre à l'autre. Par ailleurs, les termes "papier" ou "article" sont utilisés indistinctement du terme "chapitre". Chacun des chapitres contient une introduction détaillée mettant en avant sa contribution et les enjeux actuels de la littérature. Les conclusions de chaque chapitre fournissent un rappel des principaux résultats, et dans la mesure du possible, une ouverture sur d'éventuelles futures pistes de recherche.

Chapitre 1

French Unemployment Dynamics : a "Three State" Approach

1.1 Introduction

Changes in labor market aggregates, as the unemployment rate, hide perpetual movements of worker flows between employment, unemployment and non-participation. These background movements, which remain long disregarded, should attract a great deal of attention since they are at the origins of labor market dynamics. How do labor market flows shape cyclical fluctuations in the unemployment rate ? Do inflows or outflows from unemployment drive unemployment fluctuations ? Answers to these questions are at the heart of an active debate revived by Shimer (2012). Starting from the study of the U.S. labor market, Shimer identifies the job finding process as the first determinant of U.S. unemployment variations. However, other empirical studies, as Fujita and Ramey (2009) and Elsby et al. (2009), challenge Shimer's results by showing that both the job separation and the job finding margins are important in explaining unemployment variations. More recently, Elsby et al. (2015) shed light on the non-negligible role of non-participation in this mechanism.

Despite an important line of research on the U.S. labor market, the specific case of France is relatively understudied. Elsby et al. (2013) conclude that both the job separation and the job finding margins have a balanced contribution in accounting for unemployment variations. In contrast, Petrongolo and Pissarides (2008) indicate that the job finding rate explains 80% of unemployment variations. A recent paper of Hairault et al. (2015) is in line with the last conclusion and provides new evidence. By accounting for 65% of unemployment changes, they show that the job finding rate is the first driver of French unemployment during the 2000 decade. Conclusions of these three studies do not converge and French unemployment dynamics remain opaque. Furthermore, all these papers adopt a "two-state" view [1] of the labor market. This paper studies the origins of French unemployment in terms of worker flows dynamics by adding the non-participation margin to the analysis. As suggested in Elsby et al. (2015), and in contrast to Hairault's paper, I show that the entries and exists from the labor force are not negligible in accounting for unemployment variations.

My paper departs from the aforementioned works in the extent to which I propose a new measure of French gross worker flows and transition rates [2] based on the French Labor Force Survey (FLFS, henceforth). Since its redesign in 2003, the FLFS allows to recover flows between employment, unemployment and not-in-the labor force at a quarterly frequency. This is of main interest since the definitions of the labor market states used in this dataset are consistent with the standards of the International Labour Organization (ILO, henceforth) and allow international comparisons. Furthermore, the use of the ILO's standards is crucial to make the distinction between participant and non-participant workers. First, because the non-participation margin is not reported in administrative data used in Petrongolo and Pissarides (2008) or Hairault et al. (2015). Second, the retrospective calendar of the FLFS [3], used by Hairault et al. (2015), gives only a partial information on labor supply decisions. Indeed, the latter is exclusively based on individual's declarations. I tackle the main shortcomings of previous works by building my empirical analysis on the FLFS.

With transition rate series in hand, a widely used approach is to gauge their role in shaping unemployment. The preliminary analysis suggest that, in contrast to flows implying non-participation, flows jointly implying employment and unemployment are the most correlated to the business cycle. However, it is necessary to go one step further and to quantify the relative contributions of transition rates in unemployment fluctuations concretely. In this respect, the first works of the literature assume that the steady state unemployment rate is a good approximation for current unemployment rate [4]. Along the lines of Smith (2011) and Elsby et al. (2013), I argue that this approach can lead to misleading results in the case of the French labor market. The reason is that the overall level of transition rates is too weak in France (comparatively to the U.S. for example) implying that the French steady state unem-

1. The term "two-state" view refers to an analysis in which only the employment and the unemployment labor market states are taken into account.

2. At this stage, it is important to note that gross worker flows and transition rates are two different concepts. The former refers to the numbers of workers who move from one state to another within a reference period. The latter mirrors the probability that a worker being in some state can move into another state within a reference period. Throughout this article the reference period is a quarter.

3. Hairault et al. (2015) construct two measures of transition rates. The first one starting from administrative data of the French Public Employment Survey ("Pole Emploi"). The second one starting from the retrospective calendar of the FLFS.

4. The steady state approximation is used for instance by Shimer (2012), Elsby et al. (2009) Petrongolo and Pissarides (2008)

ployment rate is only a poor proxy of current unemployment. In this respect, and in order to capture the sluggishness of the French labor market, I show that a decomposition allowing deviations of current unemployment from its steady state counterpart is more appropriate.

The quantitative results of my paper are the following. Along the lines of Hairault et al. (2015), I find that the job finding rate has a dominant influence since it generates 50% of unemployment variations. However, the non-abstraction from the participation margin reduces the relative contribution of the job separation rate. In this framework, it accounts for 23% of cyclical fluctuations in the unemployment rate. Although transition rates implying inactivity appears to be less correlated with the business cycle, their role in explaining unemployment is not negligible. In particular, 27% of unemployment variations can be attributed to transition rates implying participation and non-participation. This finding is in line with those of Elsby et al. (2015) on U.S. data and justifies the consideration of a complete labor market for the French economy.

An additional contribution of this article is to conduct an analysis of particular categories of the French population. This closer look on a disaggregate analysis of worker flows and transition rates is a first attempt for the French case. Specifically, I split the overall population according to three variables : gender, age and education level. This study reveals that female unemployment rate is more relied on the outflow process than what it is for their male counterparts. Moreover, young workers are much more likely to move into the labor market, and their unemployment rate is mainly explained by the job finding margin. In contrast, for senior workers flows between participation and non-participation play a prominent role in unemployment variations. Finally, my empirical estimations stress that unskilled workers accumulate difficulties on the labor market. Their chances to take a job are the lowest, and when in employment, their probabilities to be separated are the highest. Furthermore, they move more often into inactivity, and once inactive, they are less likely to rejoin the labor force.

The remainder of this article is organized as follows. Section 1.2 documents the main stylized facts about labor market flows in France. In section 1.3, I quantify the contribution of each flow in cyclical fluctuations in the unemployment rate. Section 1.4 relaxes the homogeneity hypothesis and replicates the dynamic decomposition on different categories of workers. Section 1.5 compares my results to the recent literature. Finally, section 1.6 concludes.

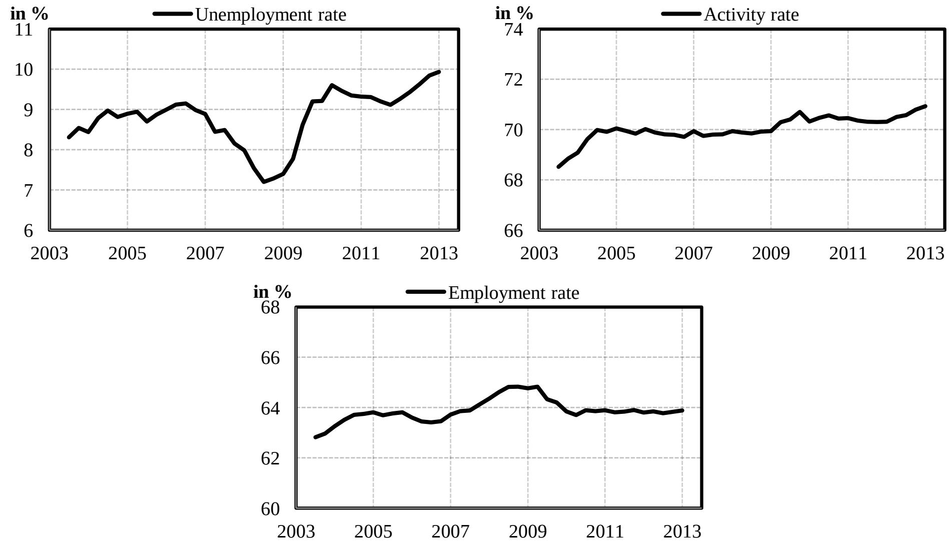

FIG. 1.1 – Labor market stocks in France
Sources : FLFS (2003-2012), author's own calculations.
Notes : Working-age population between 15 and 64 years old. Series are seasonally adjusted with x12 ARIMA process

1.2 Labor market flows in France

1.2.1 Data and main concepts

The starting point of my empirics relies on the exploitation of the FLFS's microdata over the period 2003-2012. The choice of this database is guided by the fact that it is the sole allowing an identification of the individual labor market position based on the ILO's definitions. Each individual is classified into one of the three following states : employed (E), unemployed (U) and inactive (I). The longitudinal link between the quarterly FLFS microdata is an imperative condition allowing the matching of interviewed who belong to two consecutive surveys. Thus, I obtain information about the position on the labor market at two different periods. Therefore, I can construct individual transitions, and by aggregation, gross worker flows and transition rates between the three main labor market states. It should be mentioned that after the initial step of matching, several cumbersome tasks (non-response correction, reduction of sample fluctuations and temporal aggregation correction) are necessary to reduce measurement bias and to infer gross worker flows and transition rates associated. In order to leave the presentation of this article as simple as possible, the different treatments applied and further definitions are described in the appendices 1.A and 1.B.

The ILO's definitions are crucial to distinguish active workers from inactive workers,

	Gross Flows		
From...	E	U	I
...To			
E	–	544	437
U	452	–	458
I	521	400	–

Tab. 1.1 – Average transition matrix
Sources : FLFS (2003-2012), author's own calculations.
Notes : Working-age population between 15 and 64 years old. Worker flows are expressed in thousand.

and therefore, to measure worker flows between labor force and not-in-the labor force. Up to now, researches conducted on French data implicitly assume that movements of individuals in and out of participation have only a marginal influence in shaping unemployment and can be ignored. The database of departure may explain this choice. Petrongolo and Pissarides (2008) and Hairault et al. (2015) compute individual worker flows from administrative data. This database imply the abstraction from the non-participation margin since information about the degree of search effort are not reported [5]. Furthermore, Hairault et al. (2015) also use the FLFS, but, they compute worker flows from the retrospective calendar. In this calendar each individual recalls his labor market position during the last eleven months before the first interview. This information provides relatively long series of worker flows since the retrospective calendar is available since 1990. However, the use of the retrospective calendar has two major drawbacks. Firstly, concepts of employed, unemployed and inactive are based on individual own declarations. As a result, these labor market states are close to the census concept [6]. It is well known that individuals can easily distinguish employment spells and "non-employment" spells, but they are less able to differentiate unemployment spells and inactivity spells. This can be potentially problematic to construct worker flows between these two states. Secondly, the retrospective calendar is biased by recall errors. As detailed in Hairault et al. (2015), respondents under-report unemployment spells when they recall their labor market position. This under-estimation is not necessary voluntary, but after a long period there is some psychological effect inducing omission of "negative" spells. Hairault et al. (2015) propose an original strategy to correct for recall error bias. Nonetheless, they cannot overcome the first problem while I do by using the ILO's standards.

Finally, ILO's definitions are widely used in international studies. In this respect, my

5. According to the ILO's standards a worker is inactive if i) he does not work ii) he looks for a job actively iii) he is available for take a job in a short time (usually two weeks). The two last criterions are crucial for the distinction between unemployed and inactive workers.

6. In the French census, respondents have to choice their position relative to the labor market status.

	Flows	p^{EU}	p^{EI}	p^{UE}	p^{UI}	p^{IE}	p^{IU}	**Total**
France	Transition rates	1,79	2,06	22,35	16,48	3,68	3,86	–
	% WAP	1,14	1,31	1,37	1,01	1,10	1,15	7,08
United-States	Transition rates	1,43	2,72	22,29	21,68	4,61	2,91	–
	% WAP	0,87	1,66	0,94	0,94	1,59	1,01	7,01

TAB. 1.2 – Transition rates in France and in U.S.
Sources : FLFS (2003-2012), author's own calculations for France, and, Elsby et al. (2015) for the U.S..
Notes : For the U.S., monthly average of transition rates are reported. For France, quarterly average of transition rates are reported. WAP refers to the working-age population between 15 and 64 years old, E to employment, U to unemployment and I to inactivity. Transition rates are defined in (1.10) and they are expressed in percentage.

estimation of French transition rates can be compared to studies conducted in the U.S. from the Current Population Survey (for example Elsby et al. (2015), Shimer (2012)) or to those conducted from other European Labor Force Survey (for example Gomes (2012), Silva and Vázquez-Grenno (2013)).

1.2.2 The raw series

This subsection establishes some key stylized facts about the properties of worker flows obtained with my estimations of French worker flows.

Figure 1.1 displays the evolution of the three main labor market indicators over the period 2003-2012. The French unemployment rate is characterized by a trend break beginning with the recession of 2008. Between 2006 and 2008, the unemployment rate decreased by two percentage points. Since 2008, the unemployment rate has continuously increased until it approached 10% at the end of 2012. The participation rate and the employment rate have been relatively constant over the last decade. Clearly, the unemployment rate is more sensitive to economic fluctuations than the two other indicators.

Table 1.1 displays the average gross worker flows over the period 2003-2012. Gross worker flows are denoted by the succession of two capital letters. The first one represents the origin of the flow, the second one its destination. Each quarter, 544 thousand unemployed workers return to job (the UE gross flow) while 452 thousand are separated from their job and become unemployed (the EU gross flow). The first destination when a worker leaves his job is the inactivity state. Furthermore, it appears that gross flows between participation and non-participation are high. Approximately 50% of these transitions imply flows between the two states of "non-employment".

In order to have an idea about the level of "flexibility" on the French labor market, table 1.2 compares French and U.S. transition rates. Note that, transition rates are denoted by

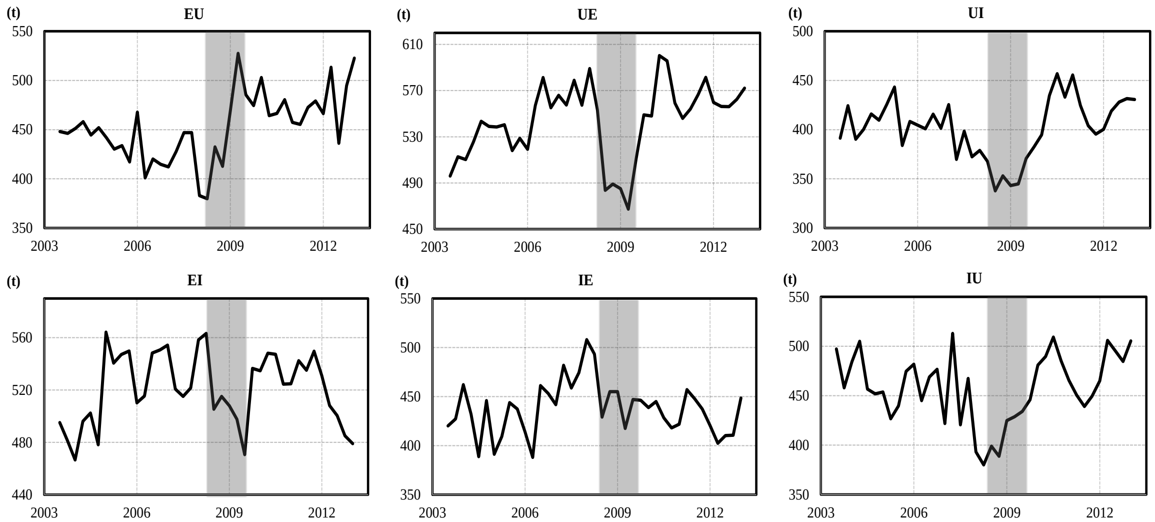

FIG. 1.2 – Gross worker flows in France.
Sources : FLFS (2003-2012), author's own calculations.
Notes : Working-age population between 15 and 64 years old. Gross worker flows are expressed in thousand (t). Series are seasonally adjusted with x12 ARIMA process. Shaded areas indicate a period of recession.

p^{AB} [7] and reflect the probability that being in such state a worker can be in another state one quarter after. Institutions governing these two labor markets are different for some important dimensions : minimum wages, employment protection, level of unemployment benefits, taxes etc. [8]. Thus, their different labor market functioning can be apparent in the overall level of transition rates. On average 7% of the working-age population moves each month in the U.S. labor market. In France, this figure is reached in one quarter [9]. Thus, a U.S. worker is much more likely to move on the labor market : its chances to find a job are higher, but, once in employment its' probabilities to be separated are also higher. On average an employment spell is about 6.5 years in France against 2 years in the U.S.. The necessary average time to find a job, for an unemployed worker, is about 13.5 months in France [10]. In the U.S. the same statistic amounts to 4.5 months. Finally, the return to participation of an inactive worker

7. With $A \in \{E, U, I\}$ and $B \in \{E, U, I\}$

8. The employment protection index constructed by OECD indicates, for all items, that employment protection is much higher in France than in the U.S.. Concerning the level of unemployment benefits, OECD shows that the average replacement rate amount to 60% in France against 30% in the U.S.. See OECD (2014) and OECD (2004) for further details. Finally, the shape and the level of minimum wages are sharply different between France and the United State. For an extensive study about the relationship between minimum wages and employment transition across these two countries, see Abowd et al. (2006).

9. Of course, time aggregation problem can bias the measurement, but the comparison remains useful to fix some order of magnitude.

10. This statistic is consistent with Hairault et al. (2015), and do not take into account transitions from non-participation to employment.

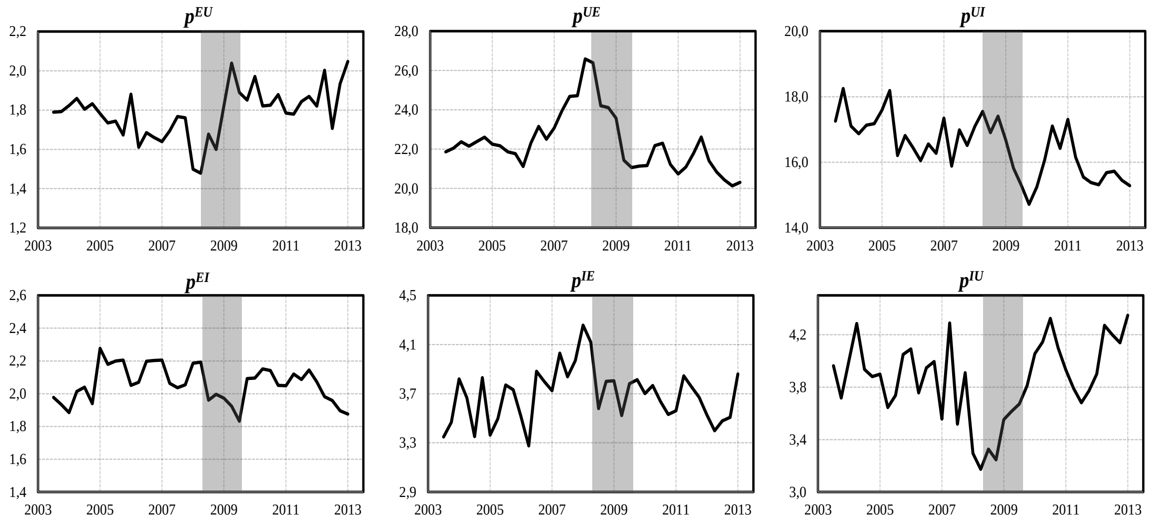

FIG. 1.3 – Transition rates in France.
Sources : FLFS (2003-2012), author's own calculations.
Notes : Working-age population between 15 and 64 years old. Transition rates are expressed in percentage. Series are seasonally adjusted with x12 ARIMA process. Shaded areas indicate a period of recession.

is also lower in France than in the U.S.. The message of my estimations of worker flows in France are in line with the comments of Elsby et al. (2013), and, as other Continental Europe economies, the French labor market can be qualified as sclerotic.

Figures 1.2 and 1.3 plot gross worker flows and transition rates evolutions over the 2003-2012 period. In each graph, periods of recession are depicted by shaded areas [11]. The job separation gross flows EU increased significantly in 2008. In the last quarter of 2007, 380 thousand workers separated from their job and became unemployed. One year later, 520 thousand workers have lost or quit their job. The 2008 recession is characterized by a sudden and persistent increase in job separations. Since 2009, there has been 480 thousand job separations on quarterly average. Before 2008 on average, job separations amounted to 430 thousand. The same cyclical features are perceptible for the job separation transition rate. From the 2008 recession, the level of job separations has remained persistently high. Both gross flows and transition rates EU seem to be counter-cyclical.

Gross worker flows from unemployment to employment UE exhibit another cyclical feature. During the recession, the job finding sharply decreased. In the third quarter of 2007, 590 thousand unemployed workers found a new job. Two quarters later, only 490 thousand unemployed workers returned to employment. However, the decrease in job finding was not

11. The French National Institute of Statistics and Economic Studies defines recessions as period of two consecutive quarters of decline in real GDP.

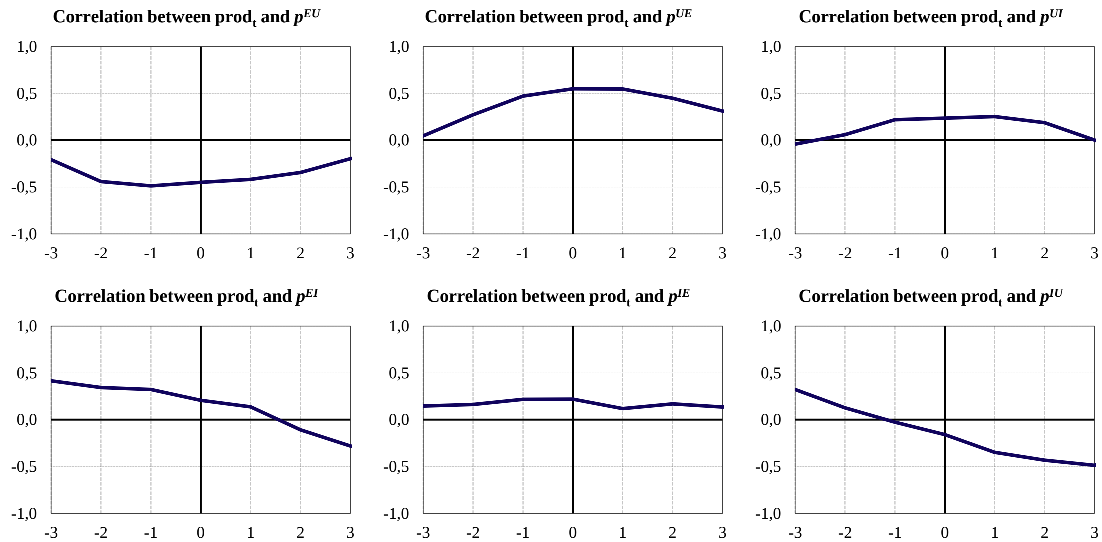

Fig. 1.4 – Cross correlation between aggregate productivity and transition rates.
Sources : FLFS (2003-2012), author's own calculations.
Notes : Series are detrended with HP filter with standard smoothing parameter $\lambda = 1600$. Transition rate series are adjusted for time aggregation error.

persistent. Since 2009, the level of job finding gross flow has been rising again, and it has recovered its pre-recession level. While job separations gross flow have remained high since 2009, job finding gross flow have regained its pre-recession level. However, the cyclical pattern of the job finding rate is different from its gross flow counterpart. The job finding rate p^{UE} increased before 2008 but the beginning of the recession reduced it by five percentage points. The probability for an unemployed worker to find a new job drops sharply in recession. Notice that the transition rate and the job finding gross flow do not have the same cyclical pattern. Firstly, the job finding rate appears to be pro-cyclical, while, the cyclical feature of job finding gross flow seems more ambiguous. Secondly, in contrast to the job finding gross flow, the decrease in the job finding rate was persistent.

Gross worker flows between employment and non-participation are less sensitive to business cycles, while those jointly involving unemployment and inactivity show an interesting feature. One year after the recession, more unemployed workers stopped searching for a job and, in the same time, more inactive workers started searching actively for a new job. The first phenomenon can be assimilated to a "discouraged worker effect". It reflects the fact that, due to the decrease of the opportunity to find a job, some unemployed withdraw from the labor force. The finding about the potential existence of this effect is reinforced by the figures of the French National Institute of Statistics and Economic Studies. Indeed, during the first quarter of 2009 and the last quarter of 2011, the unemployment halo increased of 11% [12]. The second phenomenon resembles to the so-called "added-worker effect". The main mechanism governing this effect is as follow : in a household, after a job separation of the primary earner (typically the husband), if the secondary earner (typically the wife) is inactive, she is more likely to join the labor force to offset the lost income induced by the job loss. It appears difficult to provide robust evidence of an added-worker channel with aggregate worker flows data [13]. However, some elements suggest its existence. Thus, according to my estimations, the number of women who leaved inactivity for unemployment has increased of 44% between the second quarter of 2008 and the first quarter of 2010. At the same time, the number of men who have experienced such transitions increased of 20%. These simple descriptive statistics are corroborated by the work of Riedl and Schoiswohl (2015). Indeed, they find a significant female added worker effect in France over the period 2002-2012.

1.2.3 Cyclical properties of flows

The goal of this subsection is to shed light on the cyclical properties of gross worker flows and transition rates. As Fujita and Ramey (2009), I compute correlations between an indicator of economic activity and flows for some leads and lags. I use the aggregate productivity as a proxy for business cycles. The latter is defined as the real GDP divided by the number of employed workers. The trend components of the series are extracted by a Hodrick-Prescott (HP, henceforth) filter with a standard smoothing parameter. The transition rate series are adjusted for time aggregation error.

Figure 1.4 displays cross correlations between aggregate productivity and transition rates for lags from -3 to +3. The job separation rate p^{EU} is clearly counter-cyclical. This property means that during recessions the probability to move from employment to unemployed is higher. The job finding rate p^{UE} is pro-cyclical and moves contemporaneously with the cycles. Others transitions rates show less cyclical properties because their contemporaneous correlation coefficients are weak. Transition rates p^{EI}, p^{IE} and p^{UI} are moderately pro-cyclical, while p^{IU} is moderately counter-cyclical.

In figure 1.5 I repeat the exercise for gross worker flows. The job separation gross flow is counter-cyclical. More employed workers loose or quit their job during economic downturns. The second plot of the first column reveals that the cyclical characteristics of job finding

12. According to the French National Institute of Statistics and Economic Studies, the unemployment halo refers to non-participant workers who are not available to take a job in a short time or who do not look for a job actively.

13. Elsby et al. (2015) emphasize that aggregate worker flows may erase the added worker effect. The reason is that husband workers who lose their job and wives who join the labor force subsequently, represent only a small proportion of the aggregate population.

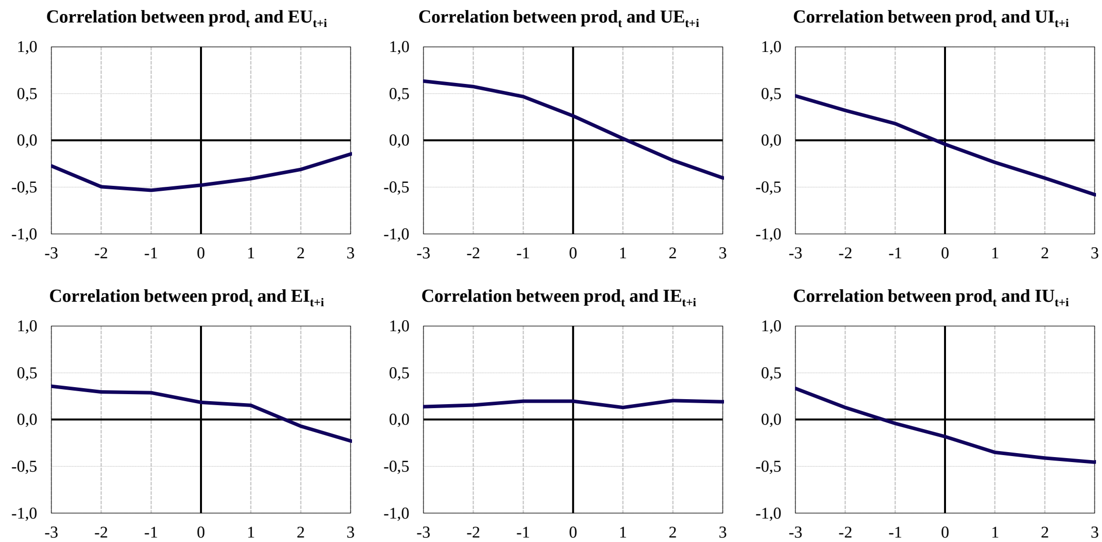

FIG. 1.5 – Cross correlation between aggregate productivity and gross worker flows.
Sources : FLFS (2003-2012), author's own calculations.
Notes : Series are detrended with HP filter with standard smoothing parameter $\lambda = 1600$.

gross flows are less obvious. It seems that the job finding gross flow is contemporaneously pro-cyclical. However, this cyclical pattern is not verified for two leads, since the correlation between UE and aggregate productivity is negative. Some quarters after the recession, job findings (re)increase. Gross worker flows jointly involving employment and inactivity are less correlated with the business cycle. Gross worker flows UI and IU do not adjust contemporaneously with the cycle. Their correlations with aggregate productivity are negative and higher for two leads. Some quarters after the recession, worker flows between the two "non-employment" states escalate.

The table 1.9 in appendix 1.C indicates that the results of this subsection are not sensitive to the use of a higher smoothing parameter in the HP filter. However, and naturally, when a first order difference (FOD, henceforth) filter is used, the level of correlation coefficients is reduced. The poor properties of the FOD filter may explain this phenomenon.

The descriptive approach of this section suggests three main comments. Firstly, in comparison to the U.S., the level of labor market flows is relatively low in France. Secondly, flows and transition rates between employment and unemployment are the most correlated to business cycle. Within these transitions, it appears that the level of the job finding rate has decreased sharply after the Great Recession. Thirdly, worker flows involving non-participation are less sensitive to economic conditions. Does this fact mean that transitions implying inactivity do not matter in shaping unemployment changes ? In the next section, I aim to quantify the role of each flow in unemployment variability.

1.3 Decomposing unemployment fluctuations

The previous section gives the first useful elements to understand French labor market dynamics over the last decade. The purpose of this section is more ambitious : quantify the contributions of transition rates to unemployment variations. Several studies (Shimer (2012), Fujita and Ramey (2009), Elsby et al. (2009), etc.) measure these contributions by assuming that the steady state unemployment is a good approximation for the actual unemployment. Nonetheless, due to the low level of transition rates on the French labor market, there are some reasons to hesitate in applying only the steady state decomposition. In this section, I address this issue by applying a steady state and a non-steady state decomposition.

1.3.1 The steady state approach

With a "three-state" view of the labor market, I can write stock dynamics as :

$$\Delta E_{t+1} = \lambda_t^{UE} U_t + \lambda_t^{IE} I_t - \left(\lambda_t^{EU} + \lambda_t^{EI}\right) E_t$$

$$\Delta U_{t+1} = \lambda_t^{EU} U_t + \lambda_t^{IU} I_t - \left(\lambda_t^{UE} + \lambda_t^{UI}\right) U_t$$

$$\Delta I_{t+1} = \lambda_t^{EI} E_t + \lambda_t^{UI} U_t - \left(\lambda_t^{IE} + \lambda_t^{IU}\right) I_t$$

In equilibrium $\Delta E_{t+1} = \Delta U_{t+1} = 0$, by rearranging these equations, I express the steady state unemployment rate as a function of all transition rates :

$$u_t^* = \frac{\lambda_t^{EU} + \frac{\lambda_t^{IU}}{\lambda_t^{IU} + \lambda_t^{IE}} \lambda_t^{EI}}{\lambda_t^{EU} + \frac{\lambda_t^{IU}}{\lambda_t^{IU} + \lambda_t^{IE}} \lambda_t^{EI} + \lambda_t^{UE} + \frac{\lambda_t^{IE}}{\lambda_t^{IU} + \lambda_t^{IE}} \lambda_t^{UI}} \equiv \frac{s_t}{s_t + f_t} \tag{1.1}$$

Remember that λ_t^{AB} with $A \in \{E, U, I\}$ and $B \neq A$ are the instantaneous transition rates [14]. The overall inflow into unemployment s_t is divided by the sum of two terms. The first one has a direct interpretation since it refers to the job separation to unemployment λ_t^{EU}. The second one $\frac{\lambda_t^{IU}}{\lambda_t^{IU}+\lambda_t^{IE}} \lambda_t^{EI}$ has a less obvious interpretation. This term multiplies the job separation to inactivity λ_t^{EI} by the part of outflows from inactivity towards unemployment. It captures the possibility of transiting from employment to inactivity (which influences the unemployment rate via the size of labor force) and from inactivity to unemployment (which influences the unemployment rate via the stock of unemployed). To sum up, this term can be seen as the indirect inflow rate from employment to unemployment via inactivity. The second term in denominator f_t has a similar interpretation.

14. See also appendix 1.A.3.

Following Petrongolo and Pissarides (2008) and Smith (2011), I can decompose steady state unemployment rate fluctuations into separable terms, attributable to the contributions of inflows and outflows. To do this decomposition I have to differentiate equation (1.1) :

$$u_t^* - u_{t-1}^* = \frac{s_t}{s_t + f_t} - \frac{s_{t-1}}{s_{t-1} + f_{t-1}}$$

$$\Delta u_t^* = (1 - u_t^*)u_{t-1}^* \frac{\Delta s_t}{s_{t-1}} - u_t^*(1 - u_{t-1}^*)\frac{\Delta f_t}{f_{t-1}}$$

$$\Delta \frac{u_t^*}{u_{t-1}^*} = \underbrace{(1 - u_t^*)\frac{\Delta s_t}{s_{t-1}}}_{C^*_{s_t}} - \underbrace{\left(\frac{u_t^*}{u_{t-1}^*}\right)(1 - u_{t-1}^*)\frac{\Delta f_t}{f_{t-1}}}_{C^*_{f_t}} \tag{1.2}$$

$C^*_{s_t}$ assesses the contribution of variations in the inflow rate to fluctuations in the steady state unemployment rate. $C^*_{f_t}$ assesses the contribution of variations in the outflow rate to fluctuations in the steady state unemployment rate. Notice that, in equation (1.1) s_t and f_t are subdivided into two terms. Without loss of generality, I can separate each of these contributions into two sub-terms. The first one corresponds to the direct transition which implies jointly employment and unemployment. The second one is the indirect transition rate through inactivity. So :

$$\Delta s_t = \Delta \lambda_t^{EU} + \Delta \left(\frac{\lambda_t^{IU}\lambda_t^{EI}}{\lambda_t^{IU} + \lambda_t^{IE}}\right)$$

$$\Delta f_t = \Delta \lambda_t^{UE} + \Delta \left(\frac{\lambda_t^{IE}\lambda_t^{UI}}{\lambda_t^{IU} + \lambda_t^{IE}}\right)$$

I can now express the contribution of inflows to unemployment $C^*_{s_t}$ as :

$$C_t^{*EU} = (1 - u_t^*)\frac{\Delta \lambda_t^{EU}}{s_{t-1}} \text{ , } C_t^{*EIU} = \frac{(1 - u_t^*)}{s_{t-1}}\Delta \left(\frac{\lambda_t^{IU}\lambda_t^{EI}}{\lambda_t^{IU} + \lambda_t^{IE}}\right) \tag{1.3}$$

Similarly, I can write the contribution of outflows from unemployment $C^*_{f_t}$ as :

$$C_t^{*UE} = -\left(\frac{u_t^*}{u_{t-1}^*}\right)(1 - u_{t-1}^*)\frac{\Delta \lambda_t^{UE}}{f_{t-1}} \text{ , } C_t^{*UIE} = -\left(\frac{u_t^*}{u_{t-1}^*}\right)\frac{(1 - u_{t-1}^*)}{f_{t-1}}\Delta \left(\frac{\lambda_t^{IE}\lambda_t^{UI}}{\lambda_t^{IU} + \lambda_t^{IE}}\right) \tag{1.4}$$

As presented in equations (1.3) and (1.4), the contributions do not provide an intuitive interpretation of unemployment driving forces. Fujita and Ramey (2009) demonstrate that equation (1.2) can provide a quantitative assessment of the contributions by an exact decomposition of variance of u^*. They notice that equation (1.2) is a linear decomposition of u^* variations :

$$var(\Delta u_t^*) \approx cov(\Delta u_t^*, C^*_{st}) + cov(\Delta u_t^*, C^*_{ft}) \tag{1.5}$$

	Contributions
Inflows	0,35
Outflows	0,65
β^{EU}	0,31
β^{EIU}	0,04
β^{UE}	0,46
β^{UIE}	0,19

TAB. 1.3 – Unemployment decomposition under steady state approximation
Sources : FLFS (2003-2012), author's own calculations.
Notes : "Betas" are defined as the contribution of changes in transition rates to the variance of steady state unemployment (see also equation (1.6)).

By dividing each covariance by the variance of Δu_t^*, I obtain a single statistic assessment of the contributions to unemployment fluctuations. This assessment, denoted β, can be interpreted as the proportion of the steady state unemployment rate variance generated by a contribution. For instance, the part of steady state unemployment rate attributable to the job separation rate is given by :

$$\beta^{EU} = \frac{cov(\Delta u_t^*, C_t^{*EU})}{var(\Delta u_t^*)} \tag{1.6}$$

Other "betas" are obtained in the same way. It follows that $\beta^s + \beta^f = \beta^{EU} + \beta^{EIU} + \beta^{UE} + \beta^{UIE} \simeq 1$ [15].

The steady state decomposition applied to my series of transition rates are reported in table 1.3. Overall inflows to unemployment explain 35% of steady state unemployment variations. Overall outflows from unemployment account for 65% of steady state variability. Thus, in the last decade outflows from unemployment are the most important determinants of unemployment variations.

Now, I turn to the decomposition of the overall inflows and outflows. The job finding rate is the first driver of unemployment dynamics since it generates 46% of steady state unemployment variations. The second driver of unemployment dynamics in France is the job separation rate. 31% of steady state variance is explained by job separation. In sum, approximately 77% of fluctuations in the unemployment steady state can be attributed to transitions between employment and unemployment. These results are in line with the preliminary analysis of section 1.2. However, the role of flows between inactivity and labor force in explaining unemployment fluctuations is not marginal. Transition rates via inactivity explain 23% of unemployment fluctuations. Within these transitions, the indirect transition from unemploy-

15. All differences of the sum of betas to one in the empirical results are considered as residual approximation errors.

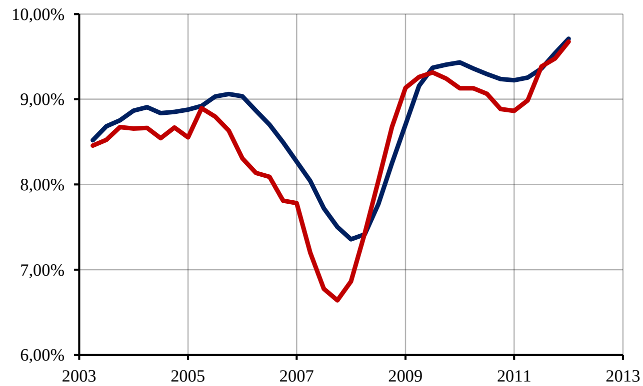

Fig. 1.6 – Comparison between current unemployment rate (in blue) and steady state (in red).
Sources : FLFS (2003-2012), author's own calculations.
Notes : Series are seasonally adjusted with x12 ARIMA process. The two series are a four-quarters moving average

ment to employment, via inactivity, is dominant in shaping steady state unemployment rate.

1.3.2 Is the steady state approach justified for the French economy ?

The decomposition of the previous sub-section is based on the assumption that the current unemployment rate does not deviate from its steady state counterpart. This strong assumption can induce misleading results. If the steady state unemployment is the target of the actual unemployment, nothing ensures that the rate of convergence between them is high. Initially, the first decompositions of unemployment rate fluctuations consider the U.S. labor market. Authors as Shimer (2012), Fujita and Ramey (2009) or Elsby et al. (2009), among others, make the assumption that the steady state unemployment rate is a very good approximation to the unemployment rate. For the U.S. economy this hypothesis is not problematic, since the level of worker flows and transition rates associated is high. Indeed, the higher the level of transition rates is, the faster the convergence between unemployment rate and its steady state value is. However, along the lines of Elsby et al. (2013) one can anticipate that the steady state approximation may be inaccurate for a labor market with low transition rates, as the French one.

Figure 1.6 compares my estimations of the French unemployment rate with its steady state value over the last decade. The current unemployment rate tends to co-move with the steady state. However, for some points, there is substantial difference between the two series. The steady state unemployment is the target of actual unemployment and guides its variations. However, this target is not necessarily reached within a quarter. According to my estimations, the half life time, which indicates the necessary duration for the current unemployment to offset the half of its delay with its equilibrium value, is about 5 months. Furthermore, the average logarithm deviation between the two unemployment rates is 3%, with a standard error of 5,1%. As mentioned above, the deviations between actual unemployment and steady state are essentially explained by the relatively low level of transition rates in the French labor market. Thus, contemporaneous variations in inflows/outflows rates influence not only current unemployment variations but also its future changes. This indicates that the use of steady state unemployment as a proxy for its current level is a strong assumption that should be removed. That is why, in the next sub-section I present the results of a decomposition which allows for deviations of actual unemployment from its steady state value.

1.3.3 Beyond the steady state aprroach

Smith (2011) develops a dynamic framework allowing current unemployment to deviate from its steady state. For the sake of simplicity, the technical developments of the non-steady state are reported in appendix 1.D and I focus on the results. This decomposition expresses the unemployment fluctuations as the sum of the contemporaneous and past changes in rates of inflows and outflows from unemployment. The following equation describes the general mechanism :

$$\frac{\Delta u_t}{u^*_{t-1}} = \frac{(s_t + f_t)s_{t-1}}{s_{t-1} + f_{t-1} + (s_t + f_t)^2}\Delta u^*_t + \frac{(s_t + f_t)}{s_{t-1} + f_{t-1} + (s_t + f_t)^2}\Delta u_{t-1} + \epsilon_t \qquad (1.7)$$

According to equation (1.7) current unemployment variations are expressed as the sum of three terms. The first one corresponds to contemporaneous (percentage) variations in steady state unemployment weighted by the rate of convergence between u and u^*. The second one represents the past changes in actual unemployment. The importance of this term is much stronger if transitions rates on the labor market are low. Finally, the third term captures residual approximations due to violations of maintained assumptions. Along the lines of Hertweck and Sigrist (2015), I compute the relative contributions of inflows/outflows to unemployment variations in two stages. In a first step, I compute the contribution of the unemployment rate fluctuations generated by the dynamic decomposition [16] u^{dd}_t in current

16. The unemployment rate variations generated by the model correspond to the right-hand side of equation (1.7).

unemployment rate fluctuations. This contribution is denoted by β^U.

$$\beta^U = \frac{cov(\Delta u_t, \Delta u_t^{dd})}{var(\Delta u_t)},\ \beta^\epsilon = \frac{cov(\Delta u_t, \epsilon)}{var(\Delta u_t)} \tag{1.8}$$

with β^ϵ the share of unemployment rate fluctuations non-explained by the dynamic decomposition. In a second step, I quantify the "betas" between unemployment variations generated by the dynamic decomposition and inflows/outflows variations as expressed in (1.16) and (1.17)[17] :

$$\beta^i = \frac{cov(\Delta u^{dd}, C_t^i)}{var(\Delta u_t^{dd})} \text{ with } i \in \{s, f, EU, EIU, UE, UIE\} \tag{1.9}$$

In this framework, the sum of the contributions of the total inflow rate and the total outflow rate is equal to 1.

The "beta-values" obtained with the dynamic decomposition are reported in table 1.4. First, note that for the overall model β^U accounts for 74% of unemployment fluctuations. In other words, the non-steady state decomposition fails to explain 26% of unemployment changes. According to Hertweck and Sigrist (2015), this gap can be explained by the initial condition, sampling errors and the violation of implicit maintained hypothesis (constant transition rates within a quarter, no labor force growth, linearity etc.)[18]. The bottom panel of figure 1.7 shows that the overall unemployment fluctuations fit by the dynamic decomposition tracks very well unemployment rate changes. So, I consider that changes in unemployment are sufficiently explained by the non-steady state decomposition.

The "beta-values" obtained by the second step are close to those obtained by the steady state decomposition described in table 1.3. The overall inflows/outflows contributions indicate that the outflows from unemployment dominate in explaining French unemployment rate fluctuations (approximately 70%). Although the role of inflows is not marginal, the dynamic decomposition confirms the importance of the outflow process in shaping unemployment.

The detailed analysis of transition rates reiterates the conclusions of the decomposition under the steady state approximation. The job finding rate is the first determinant of French unemployment and explains half of its fluctuations. Comparatively to the steady state decomposition, the role of the job separation rate is reduced with the dynamic decomposition, since now, it accounts for 22% of unemployment rate variations. Finally, transitions between participation and non-participation, measured by the sum of β^{EIU} and β^{UIE}, are not negligible and generate 27% of unemployment variations. Within these relative contributions,

17. See appendix 1.D for the complete expression of the dynamic contribution of inflows/outflows.
18. In a robustness check, I have also applied a non-steady-state decomposition based on the method of Shimer (2012). In this framework, 99% of unemployment variations are generated by the dynamic decomposition and the final interpretation of the "beta-values" is the same as the one provided here.

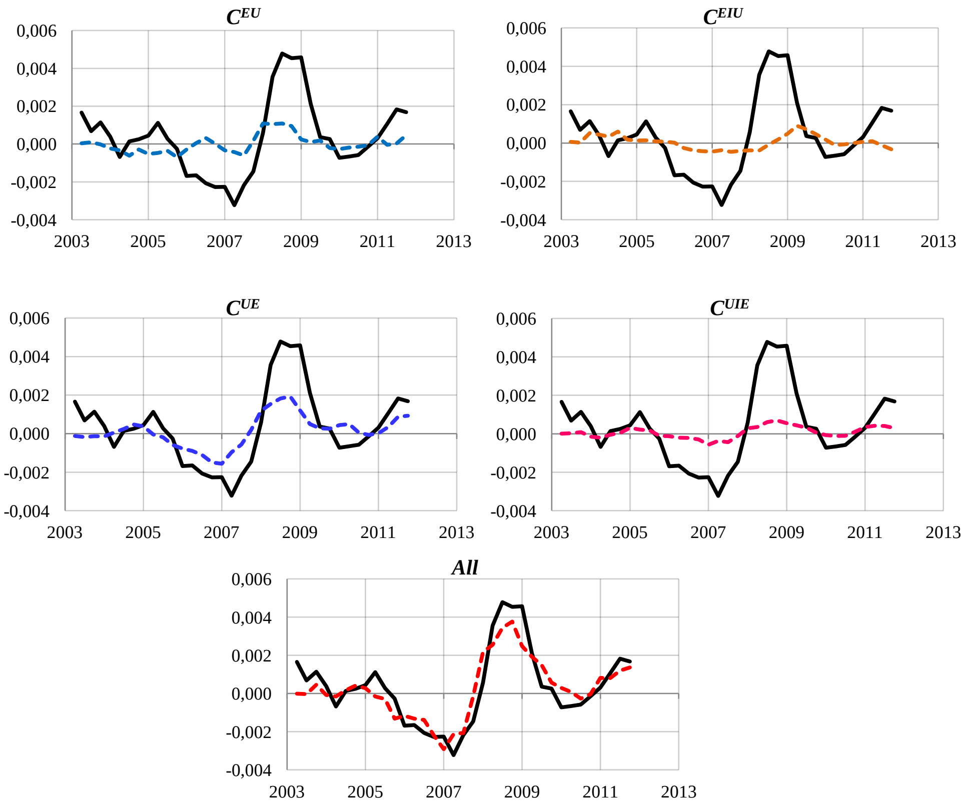

FIG. 1.7 – Contribution of transition rates in unemployment variation Δu_t (in black).
Sources : FLFS (2003-2012), author's own calculations.
Notes : In the first four panels, colored dashed lines correspond to a contribution C^{EU}, C^{EIU}, C^{UE} and C^{UIE}, respectively. The red dashed line of the last panel corresponds to the sum of all contributions. The relative contributions are defined in appendix 1.D.

transition between unemployment to employment via inactivity is dominant, by accounting for 18%.

As mentioned previously, the non-steady state decomposition allows changes in the transition rates to impact current, but also, future cyclical fluctuations in unemployment rate. Between the two methods of decomposition, the relative contribution of the job separation falls from 31% to 22%. At the same time, the relative contribution of the indirect transitions through inactivity increases from 23% to 27%. A similar evolution is shared by the contribution of the job finding rate. These facts are also apparent in figure 1.7. Thus, the contribution of the job separation rate varies with unemployment variations. In contrast, the relative influence of flows implying inactivity does not track unemployment evolutions. For instance, the highest relative contribution of C^{EIU} is reached in 2009, approximately one year after the largest increase in unemployment. These features indicate that the contribu-

	β^U	β^s	β^f	β^{EU}	β^{EIU}	β^{UE}	β^{UIE}
All	0,74	0,31	0,69	0,22	0,09	0,51	0,18
Women	0,74	0,21	0,79	0,06	0,15	0,64	0,15
Men	0,73	0,41	0,58	0,32	0,09	0,42	0,16
15-24 y.o	0,66	0,31	0,70	0,26	0,05	0,56	0,14
25-49 y.o	0,60	0,32	0,68	0,22	0,10	0,55	0,13
50-64 y.o	0,59	0,37	0,63	0,19	0,18	0,28	0,35
Education 1	0,50	0,42	0,58	0,34	0,08	0,36	0,22
Education 2	0,82	0,35	0,63	0,26	0,11	0,48	0,15
Education 3	0,41	0,33	0,67	0,04	0,29	0,51	0,16

TAB. 1.4 – Non-steady state decomposition
Sources : FLFS (2003-2012), author's own calculations.
Notes : "Betas" are defined in equation (1.6)

tions of the job separation is mainly contemporaneous, whereas those of the job finding rate and indirect transitions through inactivity act with some lags. On the overall, this finding is in line with the cyclical properties of transition rates described in subsection 1.2.3. Finally, dynamic decompositions suggest that the steady state approximation used in the calibration of theoretical models may lead to errors of appreciation. Indeed, as the steady state approximation tends to capture contemporaneous evolutions, it is more likely to attribute too much important role to the job separation margin, and too little role to flows implying non-participation.

Two key facts emerge from the unemployment decompositions of this section. First, the job finding is the margin which has the larger contribution for unemployment changes. Second, the entries in and exits from the labor force explain a non-marginal proportion of unemployment variations. To what extent, these findings are robust to the heterogeneity of the overall population ? The next section deals with this issue.

1.4 Unemployment dynamics across sub-groups

Up to now I have taken into account the labor market at the aggregate level of the economy. This assumption may hide substantial differences between workers, since, in this approach workers are considered homogeneous. In this section, I relax this assumption by dividing the overall population into sub-groups according to gender, age and qualification. I replicate the dynamic decomposition developed in the previous section.

1.4.1 Gender

The first column of the table 1.5 reveals that female unemployment rate is higher than men unemployment rate. French women are more likely to leave the labor force. Note that the job finding rate and the job separation rate are broadly similar for these two sub-groups. Finally, my estimations of worker flows for men and women reveal that their probabilities to leave inactivity are not significantly different.

Let me now turn to an analysis of their unemployment driving forces (see table 1.4). The dynamic decompositions in each sub-group account for approximately three quarter of unemployment variations as for the overall population. Once again, I consider that the overall unemployment variations fitted by the decomposition are satisfying. The sharing between inflows to and outflows from unemployment is more balanced for men than women. By accounting for 79% of unemployment changes, the role of outflows in the driving force of female unemployment rate is sharply dominant. The job separation rate explains only 6% of female unemployment dynamics. For men, the relative contribution of the job separation accounts for 32%. For both, men and women, the first determinant of unemployment variations is the job finding rate. Nonetheless, for men it explains 42% of unemployment variability, whereas, for women it explains 65%. Surprisingly, the relative importance of inflows/outflows from inactivity is only slightly more important for women than for men. The proportion of female unemployment variance generated by these transitions is equal to 30%. For men transitions between participation and non-participation account for 25%. Based on these two sub-groups, the dynamic decomposition reveals that the origins of unemployment are not the same.

1.4.2 Age

Table 1.5 reveals substantial heterogeneity when the French population is divided according to the age. Young workers are the most atypical. Their unemployment rate is the highest and their transition rates are uncommon. For them, the job separation rate to unemployment or inactivity is three times higher than the average. Young workers are much more likely to move on the labor market than their counterparts. In contrast, senior workers are broadly less likely to move. On average, their probabilities to return to job are weak. When they leave employment or unemployment, they move more frequently into non-participation. However, once inactive, their chances to return to the labor force are very small. Finally, for middle-age workers, the outflows from inactivity are highest. For the remainder, their transition rates are close to the average.

The non-steady state decomposition provides less satisfying results, since for any sub-groups, no more than 66% of unemployment variations are explained by the model. Senior workers are the most atypical. Most prominently, indirect transitions via inactivity have a dominant role and explain 53% of their unemployment rate changes. In contrast, the young and middle-age unemployment rates are essentially affected by direct transitions between employment and unemployment, the job finding process being each time the most important. However, young workers are more sensitive to the cyclicality of the job separation rate. Only 19% of changes in young unemployment rate are explained by inflows to and outflows from inactivity. Finally, middle-age workers exhibit unemployment dynamics which are similar to the average.

1.4.3 Qualification

Let me first explicit the three levels of education used in table 1.4 and 1.5. Education 1 corresponds to individuals who completed their studies without graduating (unskilled). Education 2 refers to individuals who obtain, for the best, a degree of "baccalaureat" level [19] (low-skilled). Finally, Education 3 represents people who have graduated at a superior level than the "baccalaureat" (skilled).

The last three lines of table 1.5 give the main stylized facts about the labor market for these sub-groups. It appears that the unemployment rate decreases with the higher level of education. For transition rates the picture is the same, and, the best paths are followed by the skilled workers. Thus, the probability to separate from a job to unemployment or inactivity decreases with the level of qualification. In contrast, the higher the level of qualification is, the higher the probability to find a job is. Note that, the outflows from inactivity are more frequent for skilled workers. The sub-division of the overall population according to qualification reveals that unskilled workers experience the most complicated paths on the labor market. They leave unemployment for employment less frequently and once employed their chances to return to unemployment or inactivity are the highest. Finally, once unskilled workers are inactive, they are less likely to return to labor force.

The proportion of unemployment variations unexplained by the dynamic decomposition is very important for the unskilled and the skilled workers. Respectively, 50% and 59% of unemployment changes remain unexplained. The decomposition should be interpreted with some caution. However, for low-skilled workers, only 18% of their unemployment rate fluctuations is unexplained by the non-steady state decomposition (see table 1.4). On the overall, the influence of the job finding margin is increasing, while the contribution of the job separation margin is decreasing with the level of qualification. The sharing between outflows from and inflows to unemployment is more balanced for the unskilled workers. Thus, the job separation

19. The French equivalent to the A-level.

rate accounts for 34% of unemployment variance and the job finding rate for 36%. Transition rates implying inactivity explain 30% of unskilled unemployment changes. The driving forces of unemployment are close to the average for low-skilled workers. Surprisingly, the role of inactivity in shaping skilled unemployment variations is important since it accounts for 45%. Finally, the contribution of the job separation rate to unemployment fluctuations of skilled workers is relatively unimportant (4%).

1.5 Discussion

1.5.1 The non-participation margin matters

Previous papers (e.g. Petrongolo and Pissarides (2008) or Elsby et al. (2013)) provided an analysis of French data under the assumption that movements between participation and non-participation do not matter for unemployment changes. As a consequence, they analyze the labor market through the lens of a "two-state" view. Hairault et al. (2015) argue [20] that unemployment variations are not significantly affected by transition rates involving inactivity. Their decomposition leads to the result that only 7% of unemployment variability can be explained by these flows. In contrast, my empirical evidence indicates that transition rates implying inactivity are not as negligible and account for more than one quarter of unemployment variance. The different databases and concepts, used between my analysis and the study of Hairault et al. (2015), probably explain this discrepancy. When workers recall their labor market status, with unclear definitions of unemployment and inactivity in head, the role of transitions between participation and non-participation appears marginal. However, when non-participation is defined according to the ILO's standards - a clear concept - the contribution of inactivity in shaping unemployment rate is higher. The ILO's standards used throughout this article are more able to capture flows between participation and non-participation, and therefore, their influences in explaining unemployment are measured with more precision.

My empirical evidence is corroborated by other empirical works using the ILO's standards to compute worker flows. Based on the UK Labor Force Survey, Gomes (2012) shows that 20% of unemployment variations are generated by flows between the labor force and not-in-the labor force. From the Current Population Survey, Elsby et al. (2015) find that the role played by the entries/exits from non-participation is not negligible and accounts for one third of cyclical fluctuations in the U.S. unemployment rate.

20. Hairault et al. (2015) consider the participation margin in their appendix E.

	Unemployment rate	p^{EU}	p^{EI}	p^{UE}	p^{UI}	p^{IE}	p^{IU}
All	8,80	1,79	2,06	22,35	16,48	3,68	3,86
Women	9,42	1,81	2,43	22,34	18,52	3,52	3,83
Men	8,24	1,77	1,73	22,40	14,37	3,93	3,90
15-24 y.o	21,00	5,82	7,15	27,64	18,59	4,84	3,42
25-49 y.o	7,89	1,59	1,14	22,64	14,55	6,90	9,98
50-64 y.o	6,07	0,85	2,75	13,33	20,40	1,10	1,42
Education 1	14,38	2,41	2,59	15,97	17,97	1,93	3,56
Education 2	8,67	1,90	2,20	23,86	16,57	3,96	3,70
Education 3	5,67	1,25	1,52	28,33	13,90	7,11	5,40

TAB. 1.5 – Average unemployment rate and transition rates across sub-groups (2003-2012).
Sources : FLFS (2003-2012), author's own calculations.
Notes : E refers to employment, U to unemployment and I to inactivity. Transition rates are defined in (1.10) and they are expressed in percentage.

1.5.2 The prevailing role of the job finding

According to my estimations, the job finding process is predominant for the dynamics of French unemployment during the Great Recession. This result is consistent with those of Hairault et al. (2015) [21], even if the order of magnitude is slightly different. With a "two-state" view of the labor market, they find that [22] the job finding rate explains 65% of unemployment variations [23]. The relative contribution of the job finding amounts to 50% with my decomposition. The prominent role of the job finding is a striking feature, even if the population is divided into sub-groups. However its magnitude varies. Changes in female unemployment are more relied on the job finding than changes in male unemployment. For young and middle-age workers, the job finding explains more than 50% of cyclical changes in unemployment. Furthermore, its contribution is increasing with the level of qualification.

Shimer (2012) [24] is the first to show the important empirical role of the job finding dimension in accounting for U.S. unemployment variations. However, Elsby et al. (2009) or Fujita and Ramey (2009) soften these results and indicate that the role of the job separation rate is also important. Studies conducted in other developed economies (for instance Smith (2011)

21. Petrongolo and Pissarides (2008) also find that the job finding is the first determinant of French unemployment fluctuations.
22. See Hairault et al. (2015), table 7.
23. This result is robust to the specification of the labor market. With a "three-state" approach, and under the steady state approximation, (See Hairault et al. (2015), Table 11, appendix E) the relative contribution of the job finding is estimated to 62%.
24. The first version of Shimer's paper circulated in 2005

for the UK, Hertweck and Sigrist (2015) for Germany, Silva and Vázquez-Grenno (2013) for Spain) also come to this conclusion[25]. In contrast, my analysis and those of Hairault et al. (2015) indicate that French unemployment dynamics stands out from other European economies, in the extent to which the job finding plays a prominent role for unemployment variations. This key salient feature is verified, especially during the recent downturn induced by the Great Recession.

1.5.3 What about economic policies ?

As unemployment fluctuations are mainly dictated by outflows processes, my analyses suggest paying attention to the return to job and the exits from the labor force in order to reduce unemployment. Economic policies should improve employability of unemployed workers. These policies may take two forms. First, in the supply side the unemployed workers need to be helped when they are searching for a job. Second, in the demand side, incentive measures should be taken in order to increase hiring and reduce labor cost. However, for some categories the overall message has to be softened. In particular, decompositions of unemployment show some differences among sub-groups. Therefore, solutions to reduce unemployment should take into account these specificities. The female unemployment rate is more sensitive to the job finding process than their male counterpart. To reduce women unemployment, it is necessary to take into account this mechanism and to improve their abilities to access a job. The unemployment driving forces of senior workers are really specific since the non-participation margin is prevailing in shaping their unemployment rate. The proximity to retirement may explain this fact. This category of workers faces several difficulties to rejoin the labor force (and even more to take a new job). Thus, it seems important to prevent their exit from the labor force. In contrast, a focus on the job finding margin of young employed workers should be provided. Finally, note that it is difficult to establish the main channel of unemployment variations for unskilled workers. This population is the first to suffer from job separations. Once unemployed, their chances to find a job are the lowest, and they often withdraw from the labor force. My empirical evidence confirms that their difficulties should attract a great deal of attention.

1.6 Conclusion

This paper is the first to use the FLFS to analyze worker flows according to ILO's standards. I argue that this dataset is crucial to measure worker flows between participation

25. In all studies quoted here, the contribution of the job separation to unemployment variations ranges from 40% to 50%.

and non-participation. After the initial step of measurement, the fist descriptive elements suggest that flows jointly involving employment and unemployment are the most sensitive to economic conditions. Job separations (gross flow and transition rate) have sharply increased during the Great Recession and are counter-cyclical. In contrast, the job finding probability is clearly pro-cyclical and its level is relatively low since 2008. The cyclical characteristics of flows between labor force and not-in-the labor force are lower.

I also evaluate the relative contributions of each transition rate on unemployment fluctuations. I find that inflows and outflows from unemployment do not contribute equally to French unemployment dynamics. The outflows process is clearly dominant in shaping French unemployment. The detailed analysis reveals that the job finding rate is the main driver of unemployment fluctuations (51%) and the job separation rate is the second (23%). This decomposition also demonstrates that the role of movements between participation and non-participation is not negligible and accounts for 27% of unemployment fluctuations. Then, I show that it is important to take into account the heterogeneity of the population. By dividing the overall French population into sub-groups according to gender, age and qualification, I illustrate that for some sub-groups the origins of unemployment variations are different. Thus, women are more affected by the job finding process than men. Flows between participation and non-participation explain a large proportion of senior unemployment variations. Finally, the dynamic decomposition demonstrates that the unemployment rate of unskilled workers are explained equally by the job separation and the job finding rate. In most cases, the dynamic decompositions on these sub-groups reiterate the main conclusions of this article : movements between participation and non-participation matter and the job finding is the first driver of unemployment variations.

This study contributes to the debate on the determinants of French unemployment dynamics by focusing on unconditional analysis. However, depending on the availability of the data, I share the idea that future researches should investigate the role of well-identified structural shocks on the French labor market dynamics. Since the French economy is relatively specific, the propagation mechanisms could be different i) from those well-documented for the U.S. economy, and ii) depending on the source of structural shocks. This structural approach is probably also enlightening. However, these problematics are beyond the scope of this paper, but they are on my agenda for future researches.

Annexe 1.A Measuring gross worker flows from the FLFS

1.A.1 Data

To construct gross worker flows on the labor market, I use the FLFS over the period 2003-2012. At the end of 2012, the size of the survey sample is around 60000 households. The FLFS's sample is a rotating panel in which each household is interviewed six times, once each quarter [26]. The sample is divided into six waves. Every quarter one sixth of the sample is renewed, one wave leaves the sample while a new wave integrates it. The survey gives a set of informations about individuals' characteristics (gender, age, qualification etc.), but its main advantage is the individual labor market state classification according to the International Labour Office definitions (ILO). An individual is classified into three states : employed (E), unemployed (U) and inactive (I). I construct labor market flows by matching workers between two consecutive quarters. Nonetheless, this match is not perfect. Between two consecutive surveys the incompressible loss, consequence of the panel structure of the sample, is one sixth of the sample size. To this first loss, I have to add the non-response. The non-response phenomena is problematic because it introduces a bias in the estimation. On average, 80% of the individual are common between two consecutive surveys. To reduce the non-response bias and the sample fluctuations, I reweight the part of the common sample between two surveys with a calibration. The purpose of this step is to equalize the longitudinal sample structure with the population structure in period t for some important variables. Moreover, if calibration variables are relevant, an unique step of calibration can reduce the non-response bias. The technical details about the calibration and the calculation of the new weight are provided in appendix B.

1.A.2 Fundamental equations

Three states are considered on the labor market : employment (E), unemployment (U) and inactivity (I). Gross worker flows are denoted by two consecutive capital letters. The first one is the origin of the flow, the second one its destination. Quarterly transition rates p^{AB} are the number of individuals who move from the state $A \in \{E, U, I\}$ to the state $B \in \{E, U, I\}$ between t and $t+1$ divided by the stock of state A in period t. For instance, the separation rate to unemployment is :

$$p_t^{EU} = \frac{EU_{t,t+1}}{E_t} \tag{1.10}$$

26. Before 2003, the FLFS had an annual frequency

Variables	Levels
Age Pyramid/gender	five-year classes from 15 to 75 y.o.
Household type	5 classes : household of one person, single-parent families, couple without and with children
Labor market states in t	3 states : employment, unemployment, inactivity
Degree	5 levels : no graduate, - than "Bac", "Bac", "Bac + 2", ">Bac + 2"

Tab. 1.6 – The calibration variables

This transition rate mirrors the probability that an employed worker in period t looses his job to be unemployed in $t+1$. This interpretation implies two implicit assumptions. Firstly, I assume that transition rates are constant during the period $\{t, t+1\}$. Secondly, I suppose that on average all employed workers have the same probability to loose their job and to become unemployed. The logic is the same for the other transition rates.

Stocks dynamics depend on gross flow evolutions. For example, unemployment dynamics are related to inflows and outflows of unemployment, and evolve according to the following law of motion :

$$\Delta U_{t+1} = U_{t+1} - U_t = EU_{t,t+1} + IU_{t,t+1} - UE_{t,t+1} - UI_{t,t+1} \tag{1.11}$$

Unemployment decreases when outflows exceed inflows. This decrease can be the result of two mechanisms : a rise in job finding or an increase of outflows from unemployment to inactivity. Equation (1.11) demonstrates that a diminution of unemployment does not mean necessarily that conditions for access to employment have improved. In contrast, a rise in unemployment is not systematically the sign of an increase in job separation. If during a period more inactive workers begin to search for a job, unemployment stock increases. In order to assess the role of inactivity in the unemployment evolutions, one has to use a model with three labor market states.

By rearranging (1.11), I can express the law of motion for unemployment as a function of the transition rates :

$$\Delta U_{t+1} = p_t^{EU} E_t + p_t^{IU} I_t - (p_t^{UE} + p_t^{UI}) U_t \tag{1.12}$$

	Official Stocks		MAR weight				Calibrated weight			
	Stocks (A)	%	Stocks (B)	%	$A-B$	$\frac{A-B}{A}$	Stocks (C)	%	$A-C$	$\frac{A-C}{A}$
E	25 868 747	51,0	25 378 088	50,4	490 659	1,90	25 901 507	51,0	-32760	-0,13
U	2 465 530	4,9	2 296 777	4,6	168753	6,84	2 469 688	4,9	-4158	-0,17
I	22 340 773	44,1	22 674 929	45,0	-334 156	1,50	22 362 011	44,1	-21238	-0,10

TAB. 1.7 – Comparison of the official stocks with longitudinal sample totals from the MAR and the calibrated weights

Sources : FLFS (2003-2012), author's own calculations.

Notes : Working-age population between 15 and 64 years old. E refers to employment, U to unemployment and I to inactivity.

Similarly, it is possible write the law of motion for employment or inactivity.

1.A.3 Temporal aggregation bias

The FLFS gives individual labor market positions at a quarterly frequency. This discrete time representation of labor market dynamics can miss important worker flows. In discrete time all infra-period transitions are not taken into account. The problem is that, within a quarter an individual can make multiple transitions and the FLFS matching will catch at most one. So, transition rates as in (1.10) suffer from "temporal aggregation bias" because they under-estimate mechanically the level of flows. Consequently, I correct the transition rates series of temporal aggregation bias by applying the Shimer's pioneering method, and compute the instantaneous transition rates λ_t^{AB}. To apply this correction, I model a continuous time representation of labor market transitions.

Annexe 1.B Computing the longitudinal weights

This appendix focus on the treatment leading to a new longitudinal weight. As mentioned in 1.A.1, the rotating property of the sample, the non-response and the sample fluctuation make impossible the use of the survey weights.

The non-response correction and the calibration in the FLFS since 2003

Classically, in random survey after the sample selection and the interview step, there are two steps of adjustment : i) the non-response correction which aims at reducing the bias introduced by the non-response phenomena, ii) the calibration which aims at reducing sample fluctuations for some important variables of the survey.

Each of these adjustments uses specific tools. The non-response bias is corrected by re-weighting techniques assuming a uniform response mechanism. The calibration has another goal : re-weight the sample to equalize the structure of the weighted sample with the known structure of the population for some important variables (for example the age pyramid).

Note that these two adjustments consist in a re-weight of the sample. Thus, it is possible to assume that an unique step of calibration replaces the separate treatments for non-response correction and sample fluctuation adjustments. Lundström and Särndal (1999) demonstrate that an unique step of calibration can reduce the non-response bias if calibration variables can explain the non-response phenomena. This method is applied for the non-response correction and the sample fluctuation adjustments for the FLFS. This is also the process that I favor for re-weighting the longitudinal samples.

Theoretical framework of calibration

Let the population $P = \{1, \ldots, i, \ldots, N\}$ in which I select by simple random sampling a sample s of size n. I aim to have an estimation of the total of a certain variable of interest $T(Y)$:

$$T(Y) = \sum_{i \in P} y_i \tag{1.13}$$

In this simple case, the classical Horvitz-Thompson estimator of the total is :

$$\hat{T}(Y) = \sum_{i \in s} \frac{y_i}{p_i} = \sum_{i \in s} \frac{N}{n} y_i = \sum_{i \in s} d.y_i$$

With d the initial weights. This theoretical estimator although unbiased is not efficient if I dispose of a set of auxiliary variables correlated with Y. The total of exogenous variables J are known on the overall population :

$$T(X_j) = \sum_{i \in P} x_{ij}$$

The main objective is to deform the initial weights to have new weights which perfectly estimate the totals of the auxiliary variables X_j. However, changes on the initial weights must be as low as possible to have unbiased new weights. So, the first constraint is to perfectly estimate $T(X_j)$. The second constraint consist in being close to the initial weights which are unbiased. So I have :

$$\sum_{i \in s} d.x_{ij} \neq T(X_j)$$

There is no reason to have an equality between the totals of the sample weighted by the initial weights and the overall population for the auxiliary variables. I aim to have a new weight w_i which satisfy the following calibration equation :

$$\sum_{i \in s} w_i x_{ij} = T(X_j), \forall j = 1, ..., J$$

The weights w_i is the final weight also called calibration weights. The main objective is to find the new weights which ensure the equalization of the totals for the calibration variables and minimize the sum of the distances between the initial and the calibrated weights. This last condition implies the choice (arbitrary) of a distance function denoted G which have for argument the distance between d_i and w_i $x = \frac{w_i}{d_i}$. The solving of this problem consists in a minimization program under constraints written as :

$$Min \sum_{i \in s} d_i G\left(\frac{w_i}{d_i}\right)$$

$$s.c \sum_{i \in s} = w_i x_i = X$$

With $x_i = (x_{1i}, \ldots, x_{ji})'$ and $X = (T(X_1), \ldots, T(X_J))'$ This optimization problem can be solve by writing the following Lagrangian :

$$\varphi = \sum_{i \in s} d_i G\left(\frac{w_i}{w_i}\right) - \lambda' \left(\sum_{i \in s} w_i x_i - X\right)$$

Now, I identify this theoretical framework to my re-weight problem. The overall population in which the longitudinal sample is "selected" is the FLFS sample in period t. The initial weights correspond to the weights provide in the raw microdata. The totals of the auxiliary variables X_j is directly deduced from the FLFS's sample weighted by the initial weights [27]. Finally, the final weights w_i is the calibrated longitudinal weights. This step of calibration is repeated 39 times for each longitudinal sample.

Calibration variables

The choice of the calibration variables is crucial. In my procedure they must be sufficient to correct the bias introduce by the non-response and to reduce the sample fluctuations. The calibration variables used in the calibration are reported in table 1.6.

Jeauneau and Nouël (2011) choose a variable which indicates the marital status, I opt for a more informative variable the household type. From my point of view, this choice is important notably for the non-response correction. In the calibration used here, I introduce the gender from the age pyramid. This is equivalent to introduce two age pyramids, one for men and one women. To my mind, it is crucial to have the labor market state as a calibration variable. I may imagine that individual transitions are relied on labor market states in period t. The better the estimations of stocks are, the better the estimation of worker flows are. Finally, I also add a variable who indicates the education level. I assume that all these

27. Implicitly, I assume that these estimations correspond to that of the French population

Gross worker flows	Calibrated weight (A)	MAR weight (B)	$A - B$
EU	483 892	462 062	-21 830
EI	612 456	601 584	-10 872
UE	546 959	502 097	-44 862
UI	430 376	403 805	-26 571
IE	613 789	567 039	-46 749
IU	475 146	457 180	-17 966

TAB. 1.8 – Comparison of gross worker flows obtained according to the MAR and calibrated weights.

variables are sufficient to correct for the non-response bias and to provide good estimations of worker flows in France. All the stocks come from the FLFS in period t weighted by the initial weight provided by the French National Institute of Statistics and Economic Studies. Finally, note that 41 constraints are introduced in each calibration procedure.

An illustrative example

The example deals with the survey of the second and third quarter of 2011. I compare the officials stocks for the labor market states with the totals obtained from the longitudinal sample by applying two re-weights. The first one is that I have developed in the previous paragraphs. The second one is the "Missing At Random" (MAR henceforth) approach deliberately left out up to now. The MAR correction drops missing observations between two quarters and re-weight the elements of the longitudinal sample by the inverse of the response probability. However, this method have two restrictive assumptions. On the one hand, the "non-response" in survey $t + 1$ of individuals interviewed in t is considered as random. On the other hand, it supposes that the average behavior of the "non-respondents" is the same of the "respondents". Clearly, this procedure may lead to bias the estimations in particular if types of transitions are different among "respondents" and "non-respondents". The MAR procedure was used by Shimer (2012), justifying the comparison in this paragraph.

The table 1.7 compares the official stocks of employed, unemployed and inactive workers with the totals obtained by the two re-weights. Not surprisingly, the totals obtained by the MAR weights differ the most from the official numbers provided by the institute. Thus, with this re-weight, the employed stock is under-estimated of 1/2 millions people. In term of relative errors, the unemployed stock is under-estimates of about 7%. This finding may not be treated as negligible. Note that, the MAR weight tends to underestimate the size of the labor force and overestimate the size of not-in-the labor force. The calibrated weight provide more satisfying results. The differences between the official stocks are sharply less important. The employment stock is under-estimated of about 0,13%, the unemployment stock of about

0,17% and the inactivity stock of about 0,09%. This demonstrates that the calibrated longitudinal sample provides better estimations of the stocks of the labor market states.

The table 1.8 displays the estimation of gross worker flows according to the two treatments. The MAR method tends to under-estimate the level of worker flows on the French labor market. Furthermore, with the MAR weight, the longitudinal sample contains on average less individuals who are likely to move on the labor market.

Annexe 1.C Robustness of the cross correlation to the use of various filters

The table 1.9 reveals that the cyclical properties of the series are not sensitive to the use of a higher smoothing parameter in the HP filter. However, when a first-order difference filter is used, the correlations are modified. This phenomenon is perceptible in most studies evaluating the cyclical properties of flows and may be explained by the weak properties of this filter method.

Annexe 1.D The non-steady state decomposition : mathematical details

This technical appendix presents the technical derivation of the dynamic decomposition initially developed by Smith (2011). By using s_t and f_t as in the sub-section 1.3.1, it is possible to express the law of motion of unemployment rate :

$$\dot{u}_t = s_t(1 - u_t) - f_t u_t$$

By rearranging this last equation, the unemployment rate can be defined as :

$$u_t = \frac{s_t}{s_t + f_t} - \frac{du_t}{d_t}\frac{1}{s_t + f_t} \tag{1.14}$$

Equation (1.14) shows how the the level of transition rates can influence contemporaneous unemployment rate. If transition rates are high, the second term of the right hand side of (1.14) tends to 0. In this case, the actual and the steady state unemployment are similar, and, the latter is a good approximation of the former. By differentiating and rearranging

	HP $\lambda = 100000$					First order difference				
	-2	-1	0	1	2	-2	-1	0	1	2
p^{EU}	-0,46	-0,55	-0,55	-0,54	-0,50	-0,25	-0,11	-0,09	-0,07	-0,15
p^{EI}	0,41	0,41	0,33	0,27	0,06	-0,08	0,19	-0,03	0,28	-0,15
p^{UE}	0,25	0,46	0,57	0,60	0,57	0,04	0,33	0,30	0,30	0,19
p^{IE}	0,18	0,28	0,34	0,28	0,33	-0,02	0,12	0,11	-0,16	0,22
p^{UI}	0,01	0,14	0,16	0,17	0,16	-0,10	0,21	0,00	0,25	0,08
p^{IU}	0,11	-0,08	-0,23	-0,39	-0,50	-0,06	-0,00	0,05	-0,25	0,08
EU	-0,53	-0,60	-0,58	-0,53	-0,46	-0,26	-0,12	-0,11	-0,06	-0,14
EI	0,34	0,37	0,31	0,29	0,12	-0,09	0,17	-0,05	0,28	-0,14
UE	0,59	0,49	0,31	0,08	-0,13	0,15	0,29	0,06	0,04	-0,12
IE	0,14	0,23	0,28	0,27	0,35	-0,04	0,10	0,10	-0,17	0,22
UI	0,26	0,08	-0,14	-0,33	-0,47	0,02	0,18	-0,13	0,04	-0,14
IU	0,07	-0,12	-0,28	-0,41	-0,49	-0,08	-0,03	0,05	-0,28	0,00

TAB. 1.9 – Robustness of the cyclical properties of the series to the filer used

(1.14) I obtain a second order differential equation :

$$\frac{d^2u_t}{dt} = \frac{1}{s_t+f_t}\left(f_t\frac{ds_t}{dt} - s_t\frac{df_t}{dt}\right) + \frac{du_t}{dt}\left(\frac{1}{s_t+f_t}\frac{d}{dt}(s_t+f_t) - (s_t+f_t)\right)$$

The last equation can be treated as a first-order differential equation in $\frac{du_t}{dt}$. Returning to a discrete time specification and rearranging, I obtain a recursive expression for changes in current unemployment :

$$\Delta u_t = \frac{(s_t+f_t)(s_{t-1}+f_{t-1})}{s_{t-1}+f_{t-1}+(s_t+f_t)^2}\Delta u_t^* + \frac{(s_t+f_t)}{s_{t-1}+f_{t-1}+(s_t+f_t)^2}\Delta u_{t-1} + \epsilon$$

$$\frac{\Delta u_t}{u_{t-1}^*} = \frac{(s_t+f_t)s_{t-1}}{s_{t-1}+f_{t-1}+(s_t+f_t)^2}\Delta u_t^* + \frac{(s_t+f_t)}{s_{t-1}+f_{t-1}+(s_t+f_t)^2}\Delta u_{t-1} + \epsilon \tag{1.15}$$

The last equation is identical to the equation (1.7) of the main text.

The relative contributions of inflows to and outflows from unemployment are deduced from (1.7). The contribution of outflows from unemployment is :

$$C_t^f = \frac{(s_t+f_t)(s_{t-1}+f_{t-1})}{s_{t-1}+f_{t-1}+(s_t+f_t)^2}C_t^{*f} + \frac{(s_t+f_t)}{s_{t-1}+f_{t-1}+(s_t+f_t)^2}C_{t-1}^f \text{ with } C_0^f = 0 \tag{1.16}$$

and the contribution of inflows :

$$C_t^s = \frac{(s_t + f_t)(s_{t-1} + f_{t-1})}{s_{t-1} + f_{t-1} + (s_t + f_t)^2} C_t^{*s} + \frac{(s_t + f_t)}{s_{t-1} + f_{t-1} + (s_t + f_t)^2} C_{t-1}^s \text{ with } C_0^s = 0 \tag{1.17}$$

With C_t^{*f} and C_t^{*s} the relative contributions of inflows/outflows under the steady state approximation (defined in equation (1.3) and (1.4)). As in the steady state approximation, it is possible to divide the overall inflows/outflows contributions in two sub-terms corresponding to direct transitions between employment and unemployment, and indirect transitions working through inactivity.

C_t^f and C_t^s do not catch all unemployment rate fluctuations. There is a relative contribution due to the initial condition for period $t = 0$.

$$C_t^0 = \frac{(s_t + f_t)}{s_{t-1} + f_{t-1} + (s_t + f_t)^2} C_{t-1}^0 \text{ with } C_0^0 = \Delta u_0 - \Delta u_0^* \tag{1.18}$$

Chapitre 2

The conditional Ins and Outs of French Unemployment

2.1 Introduction

Conditional on structural shocks, what drives French labor market fluctuations in terms of worker flows into and out of unemployment ? This research question has both an empirical and a theoretical appeal. From the empirical point of view, it is at the heart of an active debate since empirical works are still inconclusive. When Shimer (2012) (for the U.S.) and Hairault et al. (2015) (for France) claim that the outflows win [1], Elsby et al. (2009) or Fujita and Ramey (2009) conclude that there is no winner because both inflows/outflows contribute equally to unemployment variations. From a theoretical point of view, such a question joins the literature, initiated by Shimer (2005), aiming at gauging the ability of the search and matching framework in replicating various observed comovements. Since this paper many articles modify the model environment to get rid of the puzzle. To the best of my knowledge, very few papers examine whether the conditional responses of transition rates unveiled by a model are in line with their empirical counterparts.

To explore the conditional Ins and Outs of French unemployment, two aggregate shocks are studied : a (neutral technology) supply shock and a (monetary) demand shock. The macroeconomic effects of these two shocks have been extensively studied both in the empirical and the theoretical literature. Since the seminal contribution of Kydland and Prescott (1982), technology shocks are often seen as one of the main source of economic fluctuations. Furthermore, by devoting attention to monetary non-neutrality, a parallel literature argues that monetary shocks have significant effects on the real side of the economy (e.g. Bernanke and

1. This terminology is taken from the Darby et al. (1986).

Blinder (1992), Walsh (2005), Trigari (2009) or Galí (2010)). In this paper, I investigate how these two shocks interact with the labor market and especially worker flows. More specifically, do technology and monetary shocks imply the same worker reallocation process ?

The theoretical framework used as a guide for the empirical analysis is a New-Keynesian model enriched by a frictional labor market and an endogenous job separation margin. This framework is particularly relevant for my study since price stickiness gives rise to monetary non-neutrality and frictions on the labor market introduce the extensive margin of unemployment. In the model, the two aggregate shocks modify the equilibrium conditions governing transition rates. A monetary shock is likely to reduce current and future expected profits of a match. Unambiguously, firms are likely to respond by opening fewer vacancies, which in turn reduce the job finding rate, and more job match is broken. By contrast, the labor market responses after a technology shock is the consequence of two opposite channels. On the one hand, the productivity increase is likely to push unemployment down by lowering the job separation rate and by increasing the job finding rate. On the other hand, as price rigidities prevent final demand to react strongly, firms are likely to take advantage of the productivity improvement by reducing labor inputs. The simulation of the model allows me to put in evidence which forces drive theoretical unemployment after the two aggregate shocks. In this respect, this paper follows Balleer (2012) by proposing a reappraisal of the performance of the matching model based on comovements conditional on structural shocks.

The empirical conditional responses of transition rates is estimated within a VAR containing five quarterly French time series : the growth rate of labor productivity, the inflation rate, the interest rate and the two main transition rates. Along the lines of Uhlig (2005), I disentangle shocks of interest by means of sign restrictions directly imposed to the impulse responses functions. This framework has a number of practical advantages. It is very convenient to identify shocks of different nature. Moreover, its flexibility allows an identification of structural shocks without imposing any restrictions on the behavior of transition rates. By doing so, I remain agnostic about transition rate responses, solely the data shape worker reallocation patterns conditional on aggregate shocks. Finally, using sign restrictions allows me to get rid of the concern about the inability of long run restrictions *à la* Gali (1999) in generating permanent effects of technology shocks [2].

After an empirical technology shock, the labor market turnover is reduced since both transition rates decline. However, the fall in the job finding is stronger leading ultimately to an increase in unemployment during the impact period. For the monetary demand shock (an increase in the level of the interest rate), the two transition rates move in opposite directions and the combined effect leads to an unambiguous rise in unemployment. Taken together,

2. For more details, see Faust and Leeper (1997) and Chari et al. (2008).

both shocks are followed by an impact increase in unemployment but the worker reallocation patterns are quite different. Conditional on a technology shock, French unemployment is explained mainly by cyclical fluctuations of the job finding process. For the tightening in monetary policy, the influence of the two transition rates is balanced.

Two main results emerge from the comparison between the data and model outputs. First, some parameters should be carefully chosen because they are keys to retrieve reliable volatility of labor market variables. Specifically, when the model incorporates standard share of endogenous separations, the value of total vacancy posting cost is of first importance. When it is set to a high value, as in Shimer (2005), the model yields too huge volatility of vacancies and job separations. By contrast, a low value of vacancy posting cost implies much more realistic theoretical moments. Second, even with such a careful calibration, the conditional Ins and Outs of the model are not totally in line with those unveiled by the empirical VAR. In particular, conditional on a technology shock the model predicts that around 60% of unemployment variations are generated by the job separation rate. In the data, only 28% of unemployment fluctuations are explained by this margin. The finding is very similar for the monetary shock and in the model the separation margin explains a larger proportion of unemployment dynamics. My general results hold for several perturbations of the empirical and theoretical models.

My paper is related to several empirical works examining the conditional dynamics of transition rates in shaping unemployment. However, it is the only one to propose a theoretical analysis of the contributions of the Ins and Outs. Canova et al. (2013) address this empirical issue with U.S. data. Following technology shocks, they show that most of U.S. unemployment changes are due to the response of the job separation [3]. By showing that the job finding matters more, my empirical evidence for France is at odds with theirs. Hairault et al. (2015) and Hairault and Zhutova (2014) study the French labor market and they show that conditional variations of unemployment are generated mainly by the outflow process. My empirical findings are in line with theirs. However, my paper extends their work by studying two different aggregate shocks, one arising from the supply side, another one arising from the demand side of the economy. It also complements their evidence with a theoretical analysis calibrated on the French labor market. Finally, by comparing the ability of the model to match conditional moments, my paper is closely related to Balleer (2012). However, she does not take into account an endogenous separation margin while I do it explicitly in this paper.

The plan of the paper is as follows. Section 2.2 develops the model economy, its calibration and its business cycle properties. Section 2.3 discusses the data, the empirical framework and

3. Focusing on an aggregate shock, Fujita (2011) finds that the role of the job separation margin cannot be ignored, since it is quantitatively equally important than the job finding.

the identification scheme chosen to recover the structural shocks. Section 2.4 presents the impulse response functions and studies the contribution of transition rates to unemployment variations. Section 2.5 discusses the results. Finally, section 2.6 concludes.

2.2 Theoretical framework

2.2.1 Model

The benchmark New-Keynesian DSGE model used in this paper is based on the reference framework of Trigari (2009). I simplify her model in several aspects and adapt it to my own purpose. In particular, a technology shock is added, forward looking retailers are not taken into account and the model is calibrated to replicate the cyclical properties of the French economy. As a result, the contribution of the paper does not rely on the technical development of the model. Instead, my objective is to focus on an understudied properties of the model, namely its ability in replicating the volatility and the responses of transition rate conditional on aggregate shocks.

The representative household

The representative household is composed of a continuum of members indexed by i on the unit interval. The members of the household could be either in employment or in unemployment. In order to avoid fluctuations in consumption due to its position on the labor market, it is assumed, as in Merz (1995) and Andolfatto (1996), that each member pools its income and insures each other. The representative utility function is as follows :

$$E_t \sum_{t=0}^{\infty} \beta^t \left(\ln(c_t - ec_{t-1}) - \kappa_h \frac{h_t^{1+\phi}}{1+\phi} - \chi_t a_t \right) \tag{2.1}$$

where the parameter e captures habit persistence in consumption c_t. If it is equal to 0, there is no habit persistence. The parameter β is the subjective discount factor. The disutility of supplying hours is represented by the two last members of (2.1), where κ_h is a scalar parameter, h_t the number of hours worked, ϕ the inverse of the Frisch elasticity and χ_t a binary indicating if the member is employed or unemployed. Finally, a_t is the idiosyncratic i.i.d preference shock used to model the endogenous separation. It is assumed that it follows a log-normal distribution with cumulative distribution function $F(a_t)$. The household maximizes its consumption level c_t and its holding of bonds B_t under the following budget constraint :

$$c_t + \frac{B_t}{p_t r_t^n} = d_t + \frac{B_{t-1}}{p_t} \tag{2.2}$$

with, d_t a compact term representing all household revenues (wages, unemployment benefits, profits from firm minus government lump-sum tax used to finance unemployment benefit), r_t^n the nominal interest rate and p_t the level of prices. The derivation of the Euler equation is standard.

The labor market

The labor market is frictional, intermediate firms and workers can not match instantaneously. Before production begins, both must engage in a costly search process. The number of new job matches during period t is given by the following Cobb-Douglas matching technology :

$$m_t = \varrho u_t^{\alpha} v_t^{1-\alpha}, \text{ with } 0 < \alpha < 1 \tag{2.3}$$

Here, v_t is the number of job vacancies posted by intermediate firms, u_t is the number of searching workers and α the elasticity of the matching function relative to searchers. The scalar parameter ϱ reflects the efficiency of the matching technology. It is convenient to derive some classical aggregate variables related to the matching framework. Thus, $s_t = \frac{m_t}{u_t}$ is the job finding rate of workers, $q_t = \frac{m_t}{v_t}$ the job filling rate of vacancies and $\theta_t = \frac{v_t}{u_t} = \frac{s_t}{q_t}$ the labor market tightness. If θ_t is above (below) 1, then the labor market is tighten from the firms (workers) side.

There are two sources of job separation in the model. At the beginning of each period, a fraction ψ^x of existing matches is broken for some exogenous reasons. The second source of separation is due to the idiosyncratic shock of disutility a_t. If the realization of the shock is greater than a threshold $\underline{a}_t$, the employment relationship becomes unprofitable for the firm/worker pair and the match is severed. The endogenous job separation probability is $\psi_t^n = Pr(a_t > \underline{a}_t) = 1 - F(a_t)$, implying an overall job separation rate equal to $\psi_t = \psi^x + (1-\psi^x)\psi_t^n$. Whenever a job separation takes place, there is no production. Given this framework, employment evolves as $n_t = (1-\psi_{t-1})n_{t-1} + m_{t-1}$, with n_t the level of employment in period t on the labor market. The participation decision is not taken into account and the labor force is normalized to one.

Wage setting and intermediate firms

Let $J_t(a_t)$, V_t, $W_t(a_t)$ and U_t be the present-discounted value of expected income from a filled job, a vacancy, employment and unemployment, respectively. The Bellman equation for a filled job can be written as :

$$J_t(a_t) = x_t f(h_t) - w_t(a_t)h_t + E_t\beta_{t,t+1}(1-\psi_{t+1})\int_0^{\underline{a}_{t+1}} J_{t+1}(a_{t+1})\frac{dF(a_{t+1})}{F(\underline{a}_{t+1})} \tag{2.4}$$

where x_t is the relative price of the intermediate good which is equivalent to the real marginal cost, $f(h_t)$ the production function and $w_t(a_t)h_t$ the wage rate. This equation states that for a filled job a firm receives a net return $x_t f(h_t) - w_t(a_t)$ plus the continuation value. In the following period, the match is not discontinued with a probability $1-\psi_{t+1}$ and the firm enjoys the expected value of a job. It is important to note that, with probability ψ_{t+1}, the match is severed and the firm is left with nothing. Analogously, the asset value of a vacancy is :

$$V_t = -\frac{\kappa}{\lambda_t} + E_t\beta_{t,t+1}\left[q_t(1-\psi_{t+1})\int_0^{\underline{a}_{t+1}} J_{t+1}(a_{t+1})\frac{dF(a_{t+1})}{F(\underline{a}_{t+1})} + (1-q_t)V_{t+1}\right] \tag{2.5}$$

with κ the vacancy posting cost and λ_t the marginal utility of consumption. Hence, an open vacancy yields a current negative return equal to the utility cost. In the future period, a vacancy is filled (and not destroyed in the same time) with probability $q_t(1-\psi_{t+1})$ and the firm obtains the future value of a job. In contrast, with probability $(1-q_t)$ the vacancy remains unfilled and the firm obtain the future value V_{t+1}.

From the worker side, the logic is similar. The present-discounted value of an employed worker is :

$$W_t(a_t) = w_t(a_t)h_t - \frac{\kappa_h h_t^{1+\phi}}{(1+\phi)\lambda_t} - \frac{a_t}{\lambda_t} + E_t\beta_{t,t+1}\left[(1-\psi_{t+1})\int_0^{\underline{a}_{t+1}} (W_{t+1}(a_{t+1}) - U_{t+1})\frac{dF(a_{t+1})}{F(\underline{a}_{t+1})} + U_{t+1}\right] \tag{2.6}$$

This equation indicates that the value of a match yields, for an employed worker, a current net return equal to the wage minus the disutility of supplying work, plus the continuation value due to a possible change in its labor market position. Finally, the present-discounted value of unemployment is :

$$U_t = b + E_t\beta_{t,t+1}\left[s_t(1-\psi_{t+1})\int_0^{\underline{a}_{t+1}} (W_{t+1}(a_{t+1}) - U_{t+1})\frac{dF(a_{t+1})}{F(\underline{a}_{t+1})} + U_{t+1}\right] \tag{2.7}$$

The unemployed worker enjoys the net return b from non-labor market activities (unemployment benefit, home production etc.) and expects to find and keep a job with probability

$s_t(1-\psi_{t+1})$. In the opposite case, the worker receives the future value of unemployment.

The matching framework ensures that a job generates some economic surplus. The instrument used to split the surplus is the wage. The last one is derived following the standard Nash bargaining solution which maximizes the weighted product of the workers and firms net value[4] :

$$w_t = \text{argmax}(W_t(a_t) - U_t)^\eta (J_t(a_t) - V_t)^{1-\eta} \tag{2.8}$$

with $0 < \eta < 1$ the relative bargaining power of the worker. It should be noted that U_t and V_t correspond to the labor market outside options of the worker and the firm, respectively. Furthermore, in equilibrium free entry must hold and the value of an open vacancy for the firm is zero. Thus, the individual wage satisfies the following optimality condition :

$$\eta J_t(a_t) = (1-\eta)(W_t(a_t) - U_t) \tag{2.9}$$

Therefore, using (2.4)-(2.7) and the free entry condition we obtain the wage $w_t(a_t)h_t$:

$$w_t(a_t)h_t = \eta\left(x_t z_t h_t + \frac{\kappa}{\lambda_t}\theta_t\right) + (1-\eta)\left(\frac{\kappa_h h_t^{1+\phi}}{(1+\phi)\lambda_t} + \frac{a_t}{\lambda_t} + b\right) \tag{2.10}$$

The negotiation is not just on wages but also on hours worked. The hours worked chosen by a pair satisfies :

$$x_t z_t = \frac{\kappa_h h_t^\phi}{\lambda_t} \tag{2.11}$$

In the event that a firm and a worker succeed in forming a matched pair and that the job is not separated, production begins and its output is given by the following production function : $f(h_t) = y_t = z_t h_t$. The productivity disturbance z_t follows the autoregressive process $\ln(z_t) = \rho_z \ln(z_{t-1}) + \varepsilon_t^z$.

Retailers and prices adjustment

There is a continuum of retailers indexed by j operating on a monopolistic competitive market. Retailer j produces $y_t(j)$ units of final goods by disaggregating intermediate goods according to the following CES technology :

$$y_t = \left(\int_0^1 y_t(j)^{\frac{\epsilon-1}{\epsilon}} dj\right)^{\frac{\epsilon}{\epsilon-1}} \tag{2.12}$$

4. With Nash bargaining solution, it is implicitly assumed that wages are renegotiated at each period. Furthermore, a consequence of the Nash bargaining scheme is that wages are closely related to the level of aggregate productivity.

where ϵ is the elasticity of demand for each intermediate good. Retailers sell their final goods directly to the household at the nominal prices $P_t(j)$. They are confronted to the following demand function :

$$y_t(j) = \left(\frac{p_t(j)}{p_t}\right)^{-\epsilon} y_t \tag{2.13}$$

with $p_t = \left(\int_0^1 p_t(j)^{1-\epsilon} dj\right)^{\frac{1}{1-\epsilon}}$ the aggregate price level. Prices stickiness occurs at this level. In particular, retail firms are not free to adjust their own prices but reset their prices following the scheme proposed by Calvo (1983). Each period only a proportion $1-\xi$ of retail firms is able to reset the prices. The other proportion ξ is stuck and charges the price prevailing in the previous period. Therefore, retailers choose their prices in order to maximize their expected profit by integrating that they may be stuck with a price during s periods

$$\max E_t \sum_{s=0}^{\infty} \xi^s \beta^s \frac{\lambda_{t+s}}{\lambda_t} \left(\frac{p_t(j)}{p_{t+s}} - x_{t+s}\right) \left(\frac{p_t(j)}{p_{t+s}}\right)^{-\epsilon} y_{t+s} \tag{2.14}$$

Finally, the evolution of the aggregate price is given by :

$$p_t = \left[(1-\xi)(p_t^o)^{1-\epsilon} + \xi p_{t-1}^{1-\epsilon}\right]^{\frac{1}{1-\epsilon}} \tag{2.15}$$

where p_t^o is the optimal price charged by retail firms which can reset the price.

Monetary authority and market clearing

The monetary authority controls the level of interest rate by following a standard Taylor rule. Consecutive to some deviations of output and inflation from their steady state level, the nominal interest rate is adjusted as follows :

$$\frac{r_t^n}{(r^n)^*} = \left(\frac{r_{t-1}^n}{(r^n)^*}\right)^{\rho_m} \left(\frac{\pi_t}{\pi^*}\right)^{\gamma_\pi(1-\rho_m)} \left(\frac{y_t}{y^*}\right)^{\gamma_y(1-\rho_m)} \nu_t \tag{2.16}$$

where π_t is the inflation rate, ρ_m the degree of interest rate smoothing, γ_y the reaction coefficient to output deviations and γ_π the one for inflation deviations [5]. In (2.16) ν_t corresponds to the i.i.d monetary shock, it follows an autoregressive process $\ln(\nu_t) = \rho_m \ln(\nu_{t-1}) + \varepsilon_t^m$.

Market clearing is achieved by imposing that all output is consumed and therefore $y_t = c_t$. Finally, output in the retail sector is given by : $y_t = n_t(1-\psi_t)h_t$. The dynamics of the model is then approximated by log-linearizing the equilibrium conditions around the deterministic steady state with no inflation.

5. The superscript * denotes steady state value.

2.2.2 Worker flows in the model

In the model, job creations are governed by the free entry condition. As long as the value of a vacancy is positive, firms open new vacancies. At equilibrium $V_t = 0$ and the vacancy posting condition can be written as :

$$\frac{\kappa}{\lambda_t q_t} = E_t \beta_{t,t+1}(1-\psi_{t+1})\left(x_{t+1}z_{t+1}h_{t+1} - w_{t+1}h_{t+1} + \frac{\kappa}{\lambda_{t+1}q_{t+1}}\right) \tag{2.17}$$

with $w_{t+1} = \int_0^{\underline{a}_{t+1}} w_{t+1}(a_{t+1})\frac{dF(a_{t+1})}{F(\underline{a}_{t+1})}$ the aggregate wage.

Endogenous separations take place when the realization of the preference shock implies a negative or a zero value for the joint surplus $S_t(a_t) = J_t(a_t) + W_t(a_t) - U_t$. Using the free entry condition and equation (2.9), the condition governing endogenous separations is :

$$x_t z_t h_t - \frac{\kappa_h h_t^{1+\phi}}{\lambda_t(1+\phi)} - \frac{\underline{a}_t}{\lambda_t} - b + \frac{1-\eta s_t}{1-\eta}\frac{\kappa}{\lambda_t q_t} = 0 \tag{2.18}$$

If we assume that λ_t is constant over time, the vacancy posting condition states that a fall in the sum of expected profits (the righ hand side of (2.17)) should be associated with a rise in q_t. In a model with endogenous separations, an increase in q_t can be the results of either an increase in unemployment or a fall in vacancies which in turn decreases the job finding probability. Concerning the threshold above which a job match is severed, equation (2.18) shows that any changes in the expected future joint payment from continuing the match (the last term of the left hand side) should be compensated by an opposite variation of the current payoff. Aggregate shocks will affect worker flows in the model by the combination of these two mechanisms.

A consequence of price stickiness is that an increase in the nominal interest rate induces a raise in the real interest rate. The latter increase changes household's behavior by lowering current and future demand for final goods. As the production sectors produce to meet demand, current and future expected profits of intermediate firms fall. In the vacancy posting condition, the fall in future profits requires an increase in q_t. It can be obtained by more unemployed and/or fewer vacancies. Furthermore, in the job destruction condition the decrease in current and expected profits requires a diminution of the threshold $\underline{a}_t$. The threshold being lower, job destruction unambiguously increases.

Concerning the technology shock, the disentangling of worker flows responses is less straightforward. Observe that the technology shock enters directly the two equations governing worker flows. All else being equal, an unexpected shock on z_t is likely to increase current and future expected profits obtained from a match pair. By contrast to a monetary shock, this implies a fall in q_t and an increase in the threshold at which a job is destroyed. However, it should be noted that the above mechanism do not take into account the demand channel. Indeed, as firms are not able to change their prices, the demand for final goods changes only slightly. Given the productivity increase, firms are able to produce the same amount of goods with less labor inputs. As a result, the job finding rate and the job separation rate are likely to move such that unemployment increases.

Conditional on the two aggregate shocks, the combination of worker flows responses and their respective strength generate unemployment in the model. Simulations of the latter will allow me to highlight which flow prevails in accounting for unemployment variations.

2.2.3 The benchmark French calibration

The model economy is calibrated in order to replicate the structural features of the French economy. Time length is quarterly. As commonly done in the DSGE literature, the quarterly discount factor rate β is set to 0.99. I follow Le Barbanchon et al. (2011) by assuming that the parameter governing the degree of habit persistence e is equal to 0.7. For the probability that firms cannot reset their prices, I select the value of 0.9. This value is slightly higher than the one proposed in Christoffel et al. (2009) or Trigari (2009) but it is in line with Le Barbanchon et al. (2011). Microeconomics and macroeconomics estimates do not converge and there is a debate on how to calibrate the inverse of the intertemporal elasticity of substitution of leisure. Consistently with Trigari (2009), I set ϕ equal to 10 which implies a low elasticity of intertemporal substitution. I choose the conventional value of 10% for the price markup implying an elasticity of demand $\epsilon = 11$.

Let me now turn to the calibration of labor market parameters and steady states. The steady state values of worker transition rates are based on the average empirical estimates of Hairault et al. (2015). Therefore, the quarterly job finding rate s^* is set to 0.226 and the quarterly job separation ψ^* rate to 0.036. These two values imply a steady state unemployment rate of 0.136 [6]. It is difficult to have solid empirical evidence about the proportion of endogenous separations. Following den Haan et al. (2000) and Zanetti (2011), I assume that one third of separations is endogenous [7]. The mean of the log-normal distribution of the idiosyncratic shock is normalized to 0. There is no empirical counterpart for the calibration of the standard deviation of the log-normal distribution of $\underline{a}_t$. To do so, this standard deviation is chosen such that the theoretical volatility of the overall job separation matches,

6. It should be noted that the measure of unemployment used in Hairault et al. (2015) is not based on the ILO's definitions. Instead, it is based on individual's own declarations. That is why, the average level of unemployment is higher than the one provided by official figures.

7. Subsection 2.2.4 shows that the share of endogenous separations has important implications for the properties of the model.

	Variable	Data	(I)	(II)	(III)	Benchmark
Standard deviations relative to output						
σ_z/σ_y	Productivity	0.69	1.01	0.94	0.81	1.03
σ_u/σ_y	Unemployment	5.83	0.55	2.67	8.96	5.49
σ_s/σ_y	JFR	4.07	0.83	3.99	4.33	5.11
σ_ψ/σ_y	JSR	5.86	1.19	2.93	18.79	7.28
σ_v/σ_y	Vacancies	5.81	1.65	7.84	15.40	9.20
Autocorrelations						
y_t	Real GDP	0.887	0.406	0.823	0.933	0.896
z_t	Productivity	0.827	0.397	0.868	0.823	0.852
u_t	Unemployment	0.915	0.618	0.914	0.916	0.912
s_t	JFR	0.533	0.614	0.611	0.740	0.561
ψ_t	JSR	0.574	0.379	0.602	0.705	0.546
v_t	Vacancies	0.803	0.563	0.508	0.864	0.413
Cross Correlations						
ρ_{y_t,u_t}	Real GDP,Unemployment	-0.847	-0.323	-0.533	-0.852	-0.466
ρ_{y_t,s_t}	Real GDP,JFR	0.661	0.110	0.293	-0.715	0.365
ρ_{y_t,ψ_t}	Real GDP,JSR	-0.381	-0.997	-0.762	-0.764	-0.491
ρ_{y_t,v_t}	Real GDP,Vacancies	0.8055	0.0152	0.150	0.943	0.172
ρ_{u_t,v_t}	Unemployment, Vacancies	-0.603	-0.193	-0.228	0.813	-0.133
	Separation	–	*Low*	*Low*	*High*	*High*
	Vacancy posting cost	–	*High*	*High*	*High*	*Low*
	Price stickiness	–	*No*	*Yes*	*Yes*	*Yes*

TAB. 2.1 – Second moment properties.

Sources : For transition rates and unemployment Hairault et al. (2015), for Real GDP and Vacancies French National Institute of Statistic and Economic Studies. Both simulated and observed time series are logged and HP filtered with a smoothing parameter equal to 1600. Simulated figures are computed from a sample of 2000 observations.

Notes : Model (I) corresponds to a model calibrated in the spirit of Shimer (2005). Model (II) add price stickiness and habit persistence to Model (I). Model (III) is Model (II) with a share of endogenous separation equal to 1/3. Column Benchmark displays the benchmark model with 1/3 of endogenous separations, low vacancy posting cost and nominal rigidities on prices.

JFR corresponds to Job Finding Rate, JSR corresponds to Job Separation Rate.

as close as possible, the empirical volatility of the job separation rate. As a consequence, in the benchmark it is set to 0.60 and it implies a threshold $\underline{a}$ of 3.88. Little evidence exist about the quarterly job filling rate on the French labor market. Here, I follow Christoffel et al. (2009) who calibrate this steady state for the Euro area by fixing q^* to 0.7. Burda and Wyplosz (1994) find that the elasticity of the matching function with respect to unemployment is equal to 0.7 in France. In their survey, Petrongolo and Pissarides (2001) conclude that a plausible value for this elasticity is between 0.5 and 0.7. I target α to 0.55 which is close to the lower bound suggested by the latter interval. The bargaining power is set to 0.5, a standard value in this literature. To choose a value for the parameter κ, I follow the same strategy as Blanchard and Galí (2010). More specifically, as there is a lack of direct evidence about the total cost spent for hiring, they indicate that a upper bound for the latter should represent 1% of total GDP. Thus, I choose κ in order to have a total vacancy posting cost which is less than 1% of model output [8].

Concerning the Taylor rule parameters, ρ_m the degree of interest rate smoothing is fixed at 0.85, γ_π the interest rate response to inflation is set to 1.5 while γ_y the interest rate response to output is set to 0.5.

Finally, I calibrate the two stochastic shocks of the model. The standard deviation of the productivity disturbance is set in order to reproduce the empirical volatility of French real GDP. After taking log and HP filtered the observed time series of output for the French economy, I fix σ_t^z the standard deviations of the productivity shock to 0.00964. The serial correlation of the productivity shock is also based on this approximation and it is set to 0.9. Concerning the monetary shock, evidence is less clear. For this reason, I follow a standard practice of the New-Keynesian literature by fixing the standard deviation of the monetary shock to 0.001 and its first order autocorrelation to 0.85.

2.2.4 Business cycle properties

Table 2.1 compares empirical moments of labor market variables with their counterfactual values obtained from different calibrations of the model [9]. In the data, unemployment volatility is roughly 5.5 times greater than the one of real GDP. Between the two transition rates the job separation is more volatile. Three parameters are keys in reproducing the unconditional observed moments : the share of endogenous separation in total separations, the total cost spent for vacancies governed by the scalar parameter κ and the incorporation of price

8. For the calibration of her model Trigari (2009) chooses a vacancy cost to output ratio equal to 5%. From my point of view this value is difficult to justify from an empirical point of view.

9. Both observed and simulated time series are logged and HP filtered with a standard smoothing parameter equal to 1600 before computations

rigidities. Column (I) reports business cycle statistics for a calibration of the model close to Shimer (2005), i.e. without habit persistence and price rigidities but with almost no endogenous job separation [10] and a high value of κ. Such a model yields unrealistic volatility of labor market variables and mirrors the "Shimer puzzle". Specifically, unemployment is 10 times less volatile than in the data. Adding price stickiness and habit persistence (column (II)) into the model improves its ability to match with empirical moments. However, this specification features no relevant variations of the job separation rate since it remains mainly exogenous. In this respect, in the last two columns of table 2.1 the endogenous share of separation is set to the standard value of one third. In those models, the calibration of vacancy posting cost is non-trivial. A model with the same amount of vacancy expenditures as in Shimer (2005) (4.5% of total output) implies unrealistic volatility of the job separation rate and vacancies. In particular, in this model the job separation is 18 times more volatile than output. It also gives rise to a strong positive correlation between unemployment and vacancies. This can be rationalized by the fact that, hiring being costly, the separation margin becomes the easiest way to adjust the employment level. Clearly, the benchmark model yields a better match between theoretical and empirical moments. As in the data, unemployment is 5.5 times more volatile than output. Such a good match of unemployment standard deviations implies slight more volatile transition rates. In the benchmark model, the job separation rate and unemployment are countercyclical while the job finding rate and vacancies are procyclical. The model features a negative Beveridge curve. Given the properties of other models, the benchmark model appears to be a good basis for studying labor market dynamics over the business cycles.

2.3 Empirical methology

This section presents the empirical framework of this paper. The data is first discussed and then the VAR econometric strategy.

2.3.1 Data

My benchmark specification contains five endogenous variables included in the vector $X_t = (\Delta z_t, \Delta\pi_t, r_t^n, \psi_t, s_t)'$, where Δ is the difference operator. All these variables are in logarithm. The labor productivity z_t is defined as output per employee. The inflation rate $\Delta\pi_t$ is calculated from the Consumer Price Index (CPI) provided by the Federal Reserve Bank of St. Louis. The interest rate is based on a 3-month interbank interest rate also available on

10. In table 2.1 models with low endogenous job separation include 95% of exogenous separations.

the FRED database[11]. The labor productivity and the interest rate are used to recover the two structural economic shocks that I aim to recover. I introduce the inflation rate in order to have a solid identification of the monetary shock because the interaction between them are well known in the literature.

The job separation rate ψ_t and the job finding rate s_t are taken from Hairault et al. (2015). These transition rates are calculated from the retrospective calendar of the French Labour Force Survey (FLFS). In this calendar, each individual interviewed for the first time recall his/her labor market status during the last twelve months. This measure of French labor market flows provides relatively long series since the retrospective calendar is available since 1990. However, due to the redesign of the FLFS in 2003 and to misclassification errors[12], the worker flows for the years 2003 and 2004 could not be calculated. For my purpose, this lack of observation is problematic because the VAR cannot be estimated with this kind of blank. To address this issue, I fill the gap by estimating automatically via the TRAMO procedure the ARIMA model relied on each time series[13]. The transition rates used in this analysis are corrected for temporal aggregation bias and for recall errors[14]. Notice that the transition rates are simply quarterly averages of monthly data. The VAR is estimated with quarterly series over the period 1990Q1-2010Q3 avoiding the problem of the zero lower bound of interest rate[15].

2.3.2 Bayesian VAR framework

Let $A(L)X_t = \nu_t$ be the VAR representation of the process[16]. Under the stability assumption, the Wold theorem implies that the VAR can be expressed as an infinite Vector Moving Average $VMA(\infty) : X_t = A(L)^{-1}\nu_t = C(L)\nu_t$, with $C(L)$ a matrix of polynomials in the lag operator L. In the literature, there is a consensus about the estimation of a VAR and Ordinary Least Squares are largely used. However, disagreements appear when structural shocks have to be recovered. Indeed, the residual terms ν_t of the reduced form has no reason to be uncorrelated implying that its variance-covariance matrix Σ has also no reason to be diagonal. The purpose is to find a mapping that allows retrieving structural (economic) shocks from the reduced form shocks. The reduced form disturbance ν_t and the structural disturbances ϑ_t are related by $\nu_t = D\vartheta_t$. Where the latter are mutually independent with a variance normalized

11. Both the index of CPI and the interest rate are freely available on the website of the Federal Reserve Bank of St. Louis.
12. Before 200,3, the survey was annual. Since 2003, the survey is quarterly.
13. The method used is based on the TRAMO (Time series Regression with ARIMA noise, Missing values, and Outliers). Appendix 2.A compares the initial data with the one obtained with TRAMO.
14. Hairault et al. (2015) use an original framework for the correction of recall errors.
15. The choice of the period is restricted by the availability of transition rate series
16. With L the lag operator, A the coefficient matrix and ν_t the $(n, 1)$ matrix of residuals.

	Variable	Range
e	Degree of habit persistence	[0.1 ; 0.9]
ϕ	Inverse of Frisch elasticity	[1 ; 10]
γ_π	Reaction of interest rate to inflation	[1.1 ; 2.5]
γ_π	Reaction of interest rate to output	[0 ; 1]
ξ	Probability of price stickiness	[0.6 ; 0.95]
α	Elasticity of matching function	[0.5 ; 0.7]
κ_h	Scalar of disutility	[0.1 ; 0.95]
η	Bargaining power of firms	[0.2 ; 0.9]
ρ_m	Persistence of monetary shock	[0.65 ; 0.9]
ρ_z	Persistence of technology shock	[0.6 ; 0.95]

Tab. 2.2 – Ranges of varying parameters.

to 1 and so $E(\vartheta_t\vartheta_t^{'}) = I$. In general, to achieve the identification of structural disturbances, the matrix D is computed, such that : $\Sigma = E(\nu_t\nu_t^{'}) = DE(\vartheta_t\vartheta_t^{'})D^{'} = DD^{'}$, where D is the Cholesky factor of Σ. Here, to find the matrix D, I follow Uhlig (2005) who observed that a candidate for the decomposition of Σ can also be $\Sigma = \tilde{D}\tilde{D}^{'}$, where $\tilde{D} = DQ^{'}$ and Q denotes some orthogonal matrix. Both D and $\tilde{D}$ provide a candidate for the decomposition of Σ $\left(\Sigma = \tilde{D}\tilde{D}^{'} = (DQ^{'})(QD^{'}) = DID^{'} = DD^{'}\right)$. Thus, I have to choose Q to retrieve the five meaningful shocks that I aim to estimate. Nonetheless, the matrix Q which allows to fully characterize the model is not unique and it is necessary to examine a large number of candidates.

In order to take into account the uncertainty about the multiplicity of Q and the VAR parameters, I proceed in a Bayesian framework. The general procedure is as follows :

1. I perform a Bayesian estimation of $A(L)$ and Σ by imposing a prior and a posterior to belong to the Normal-Wishart family
2. From the posterior distribution, I take n number of draws of $A(\hat{L})$ and $\hat{\Sigma}$. For each of these draws I evaluate m rotation matrix Q
3. For each joint draw, I construct the impulse responses functions and I check if the sign restrictions are satisfied. If all the imposed conditions are met I save the draw. However, if one or more of the sign restrictions are not satisfied I discard the pair and it receives zero prior weight.

The inference is based on the median response together with the 16th and 84th percentile confidence intervals. In the baseline model, I fix n and m to 5 000 and 25 millions of candidates are examined.

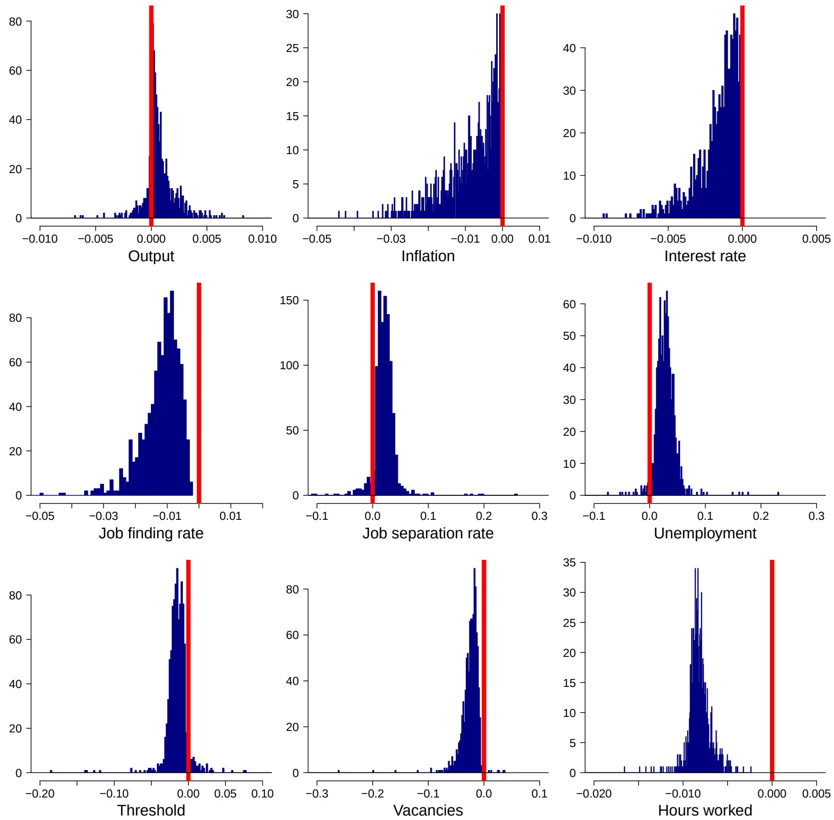

FIG. 2.1 – Distribution of theoretical impulse response to technology shocks.
Sources : Author's calculations.

2.3.3 Sign restriction justification

Comparatively to the traditional identification schemes which employ short-run or long-run neutrality restrictions, the sign restriction approach offers a more flexible framework. For instance, when shocks of different nature have to be identified, it is not easy to justify them jointly with the traditional approach. Furthermore, in many works the use of long run restrictions to deduce permanent effects of technology shocks from finite samples have been criticized [17]. Nonetheless, the sign restriction approach needs solid theoretical supports. In this respect, I base the isolation of structural shocks on the theoretical model developed in the previous section. More specifically, I depart from my benchmark calibration and I assume that some key parameters of the model are uniformly and independently distributed over a selected range. Table 2.2 gives the range chosen for varying parameters [18]. I then randomly draw 1000 sets of parameters. For each of them, I run the model and I compute the impact

17. When Faust and Leeper (1997) show that long run (and permanent) effects could not be precisely estimated in finite samples, Chari et al. (2008) demonstrate that researchers need extremely long time series to infer reliable long run effects of technology shocks. In practice, such long time series are not available.
18. The admissible range of each parameter is based on a survey of the theoretical and empirical literature.

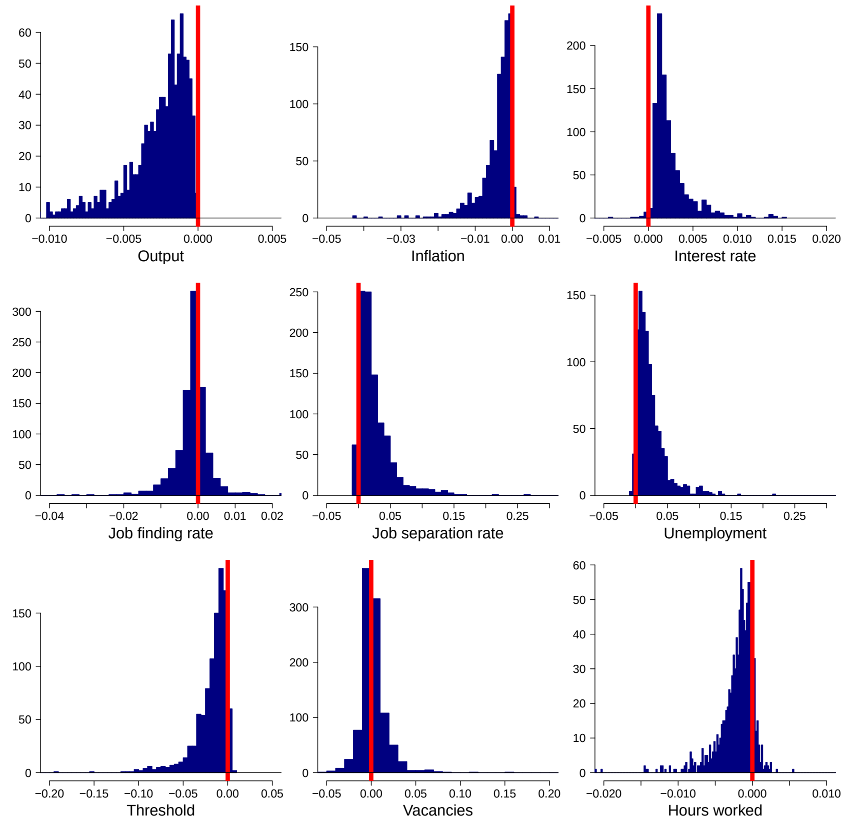

FIG. 2.2 – Distribution of theoretical impulse response to monetary shocks.
Sources : Author's calculations.

responses of the theoretical variables. The entire distributions of the impact responses of key variables are displayed. Their shapes serve as a guide for the identification [19]. This strategy has been already used by Peersman and Straub (2009), Pappa (2009) and Foroni et al. (2015) (among other).

Technology shock

Figure 2.1 displays the distributions of the impact responses obtained from 1000 simulations of the model. In a New-Keynesian economy, firms are not able to set their own prices at each period. They will take advantage of the technology improvement by reducing demand of labor. In the model, employment adjustment may occur at both margins. Thus, firms open fewer vacancies and the job finding rate decreases. Moreover, as hours, the real marginal cost and labor market tightness fall, the threshold at which a job match is severed diminishes. A direct consequence is the surge of the overall level of job separation. In the model

19. It should be noted that, in this subsection, I focus on the two shocks of interest. In appendix 2.B, I present the so-called "multiple shock" problem of the sign restriction framework and the identification of the other shocks of the VAR.

	Δy_t	$\Delta \pi_t$	r_t	λ_t^{EU}	λ_t^{UE}
Technology shock	+4	-1	-1	–	–
Monetary shock	–	-4	+1	–	–

TAB. 2.3 – Sign restrictions imposed to the impulse responses.
Notes : + for ≥ 0, - for ≤ 0, – for unrestricted, numbers next to the signs indicate the horizon of restrictions.

unemployment unambiguously increases. In a recent contribution, Thomas (2011) shows that the incorporation of labor market frictions in a New-Keynesian model is key to explain the negative and sluggish response of inflation empirically observed. As shown in the figure, the responses of interest rate and inflation are negative whatever the specification of parameters. Consequently, to isolate the technology improvement I choose a mix approach. I give up the long run sign restrictions on the labor productivity for a shorter restrictions. In particular, I restrict the response of labor productivity to be positive during 4 quarters. Otherwise, the responses of the inflation rate and interest rate are negatively restricted in the impact period. As mentioned previously, I keep free the responses of transition rates.

Monetary shock

Figure 2.2 presents the distributions of the impact responses after monetary shocks. Unsurprisingly, an increase in the interest rate acts as a negative demand shock. It decreases inflation and output. These results are insensitive to the parameter range. On the labor market, the distributions of the job finding rate and vacancies appear to be more sensitive to the set of parameters. However, as the threshold of endogenous separations is sharply negative, the unemployment response is positive. The reader should note that in my favorite calibration (subsection 2.2.3) both the job finding rate and vacancy posting decrease. This indicates that the fall in profits induces firms to post fewer vacancies leading to higher unemployment. In this context, the fall in expected profit also decreases the threshold of endogenous separations. To identify the negative monetary shock, I impose the interest rate to be positive one period after the shock and I force the response of inflation to be not positive during 4 quarters.

2.4 Results

This section lays out the main findings of the paper. The impulse responses of transition rates and unemployment are described. Then, unemployment variations are decomposed in terms of underlying worker flows. Finally, follows a battery of robustness check.

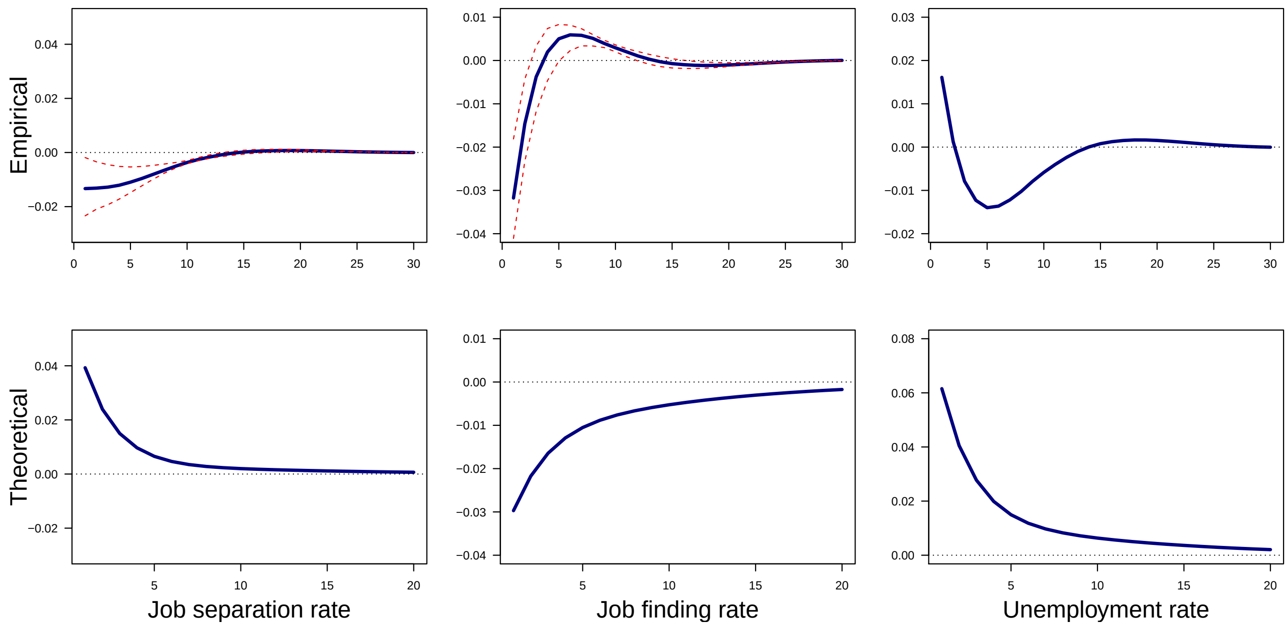

FIG. 2.3 – Impulse response functions to a positive technology shock.
Sources : Author's calculations.
Notes : Impulse responses to a one-standard deviation shock are reported. In the first row, solid blue lines represent the median impulses responses obtained with the VAR. Dashed lines correspond to the 64% of the posterior distribution. In the second row, blue lines correspond to the impulse responses obtained with the model.

2.4.1 Empirical impulse responses

Figures 2.3 and 2.4, respectively display the impulse response functions of labor market variables conditional on technology and monetary shocks. Each time the first row reports the responses obtained from the baseline VAR while the second row reports those obtained with the benchmark theoretical model.

Following an empirical technology shock, the labor market turnover, approximated by the sum of the two transition rates, is reduced. In particular, a positive technology shock implies an immediate fall in the job finding rate of about 3% relative to its steady-state equilibrium. This fall in the job finding takes between 4 or 5 quarters to regain its steady state level with a slight significant overshoot. As Balleer (2012), I find a negative comovement between the job finding rate and the labor productivity. The dynamic path followed by the job separation is quite surprising since it is weak and negative. In this respect, it is totally at odds with the U.S. evidence of Canova et al. (2013) who find that, in response to a neutral technology shock, job separation increases. As a consequence, the French evidence does not support the view

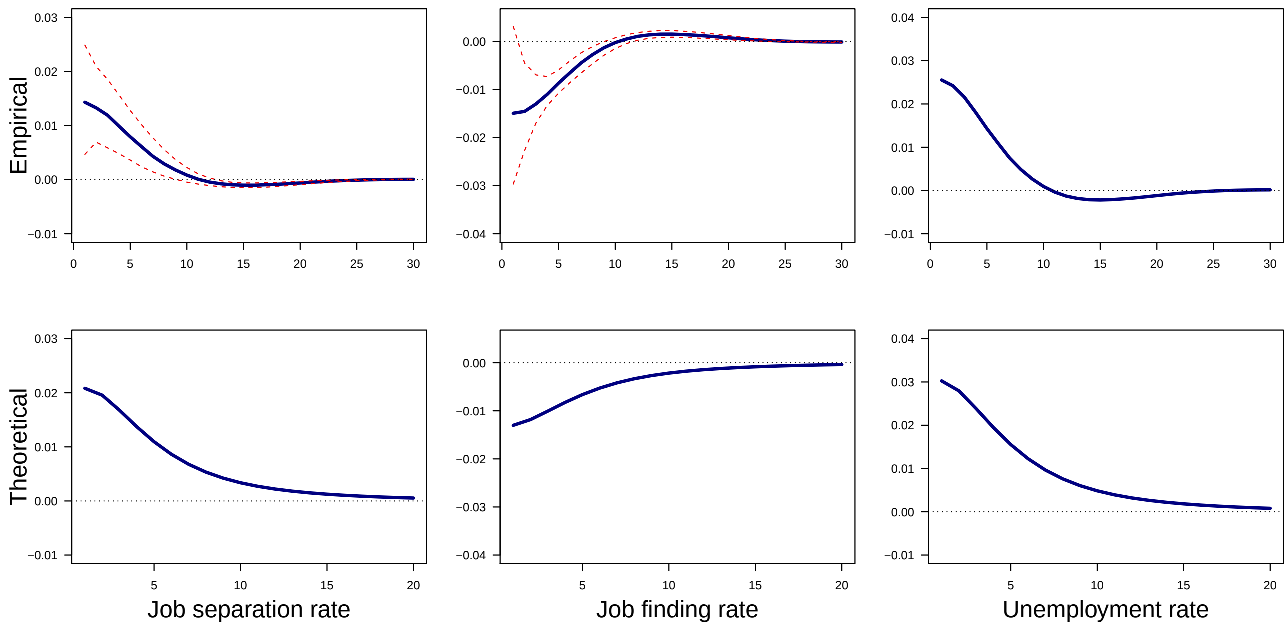

Fig. 2.4 – Impulse response functions to a negative monetary shock.
Sources : Author's calculations.
Notes : Impulse responses to a one-standard deviation shock are reported. In the first row, solid blue lines represent the median impulses responses obtained with the VAR. Dashed lines correspond to the 64% of the posterior distribution. In the second row, blue lines correspond to the impulse responses obtained with the model.

that a neutral technology shock has "Schumpetarian" features[20]. The concomitant decrease in the job finding rate and the job separation rate leads to a positive rise in unemployment in the first period after the impact. However, the response of unemployment is u-shaped and takes between 3 or 4 quarters to become negative before definitively reaching its steady state. On French data, the initial comovement between the labor productivity and unemployment is positive and a rise in productivity pushes the unemployment rate up. Concerning the model, it predicts the good response of the job finding at the impact. However, the job separation response is stronger and positive. As both margins move in opposite directions, unemployment unambiguously increases.

Following a monetary shock, the empirical responses displayed in figure 2.4 show that the job separation rate significantly increases. This rise in the separation rate is relatively persistent since it takes approximately 8 quarters to go back to its steady state value. At impact, the response of the job finding rate is very close to 0. However after 2 or 3 quarters, it becomes significantly negative but its magnitude is slightly lower compared to what it is

20. "Schumpetarian" features means that technology shocks yield more job separations and more return to jobs.

	Technology shock		Monetary shock	
	β^{ψ}	β^{s}	β^{ψ}	β^{s}
Empirical decomposition of $\ln u_t^*$	0.28	0.72	0.48	0.52
Theoretical decomposition of $\ln u_t^*$	0.58	0.42	0.62	0.38

TAB. 2.4 – Unemployment decomposition conditionally to a technology and monetary shocks.
Sources : Author's calculations.
Notes : "Betas" are defined as the contribution of changes in transition rates to the variance of steady state unemployment. ψ is the job separation rate, s the job finding rate.

for the job separation rate. As a consequence of these cyclical behaviors of worker flows, the tightening in monetary policy causes a significant and relatively persistent raise in unemployment with a peak at the impact. By contrast to the technology shock, the model provides a better match of the worker reallocation pattern. As in the data, the job separation increases, the job finding decreases leading to higher unemployment.

2.4.2 Decomposing unemployment fluctuations

To shed more light on the underlying mechanism driving unemployment, I decompose its fluctuations in contributions attributable to inflows and outflows. The starting point of the exercise is the conditional responses of transition rates. For each shock, from the impulse responses, I deduce two series of job separation rate and job finding rate. With these two hypothetical series in hand, I deduce the value of the steady state unemployment rate. Then, following Elsby et al. (2013) I decompose unemployment variations with a logarithm differentiation of u_t^* :

$$\Delta \ln u_t^* \approx ((1-u_t^*)(\Delta \ln(\psi_t) - \Delta \ln(s_t))$$

$$\Delta \ln u_t^* \approx \underbrace{(1-u_t^*)\Delta \ln(\psi_t)}_{C^*_{\psi_t}} - \underbrace{(1-u_t^*)\Delta \ln(s_t)}_{C^*_{s_t}} \tag{2.19}$$

As emphasized by Fujita and Ramey (2009), equation (2.19) can lead to an exact decomposition of variance of $\ln u_t^*$, and so I compute "beta values" as :

$$\beta^k = \frac{cov(\Delta \ln u_t^*, C^*_{k_t})}{var(\Delta \ln u_t^*)} \text{ with } k \in \{\psi, s\}$$

These "beta values" can be interpreted as the proportion of steady state unemployment u_t^* generated by the transition considered.

Table 2.4 reports the estimations for the relative contributions of the job separation and the job finding in generating conditional unemployment rate volatility. Two sources of difference stand out. The first one is related to the contribution of transition rates among shocks. The job finding is at the origin of 72% of cyclical changes in unemployment for the empirical technology shock against 52% for the empirical monetary shock. The second one is the divergent message delivered by the theoretical and the empirical models. Theoretically, following a technology shock, the job separation rate accounts for approximately 60% of unemployment rate variance. Empirically, its contribution is sharply lower since it amounts to 28%. The same finding operates for the monetary shock since in the model this margin explains 62% of unemployment variance against 48% empirically. Taken together, the unemployment decompositions suggest that the model is not able to reproduce the dominating role of the job finding rate after a shock. This is especially true for the technology shock.

2.4.3 Robustness analysis

Empirics

Identification scheme

An important robustness check is to establish whether the results are similar across different structural identification schemes. In this respect, I estimate successively two "more classical" SVAR models. The first one considers an identification of technology shocks based on long run restrictions *à la* Gali (1999). Specifically, I estimate a trivariate VAR including the log-difference of labor productivity and the two main transition rates in logarithm. Thus, it is assumed that the only shock affecting labor productivity in the long run is the technology shock. The second SVAR considers an identification of monetary shocks in line with Bernanke and Blinder (1992). Another trivariate VAR with the log of the two main transition rates and the interest rate is estimated. Monetary policy shocks are identified by applying a Cholesky decomposition of the covariance matrix. The interest rate being ordered last in the VAR, this implies that other variables of the system do not react contemporaneously to monetary shocks. The impulse responses obtained are reported in figure 2.5 and table 2.5 provides the relative contributions of inflows and outflows in generating unemployment.

After a technology shock the shapes of impulse responses are very close to those obtained with my sign restrictions. Both the job separation and the job finding decrease after the shock. In this framework, the response of the job separation rate is non-significant. The decline in both transition rates leads to higher unemployment. The unemployment decomposition of table 2.5 suggests that, following a technology shock, more than three quarter of unemployment fluctuations are generated by the job finding rate.

The second row of figure 2.5 displays the impulse responses to an unexpected increase in

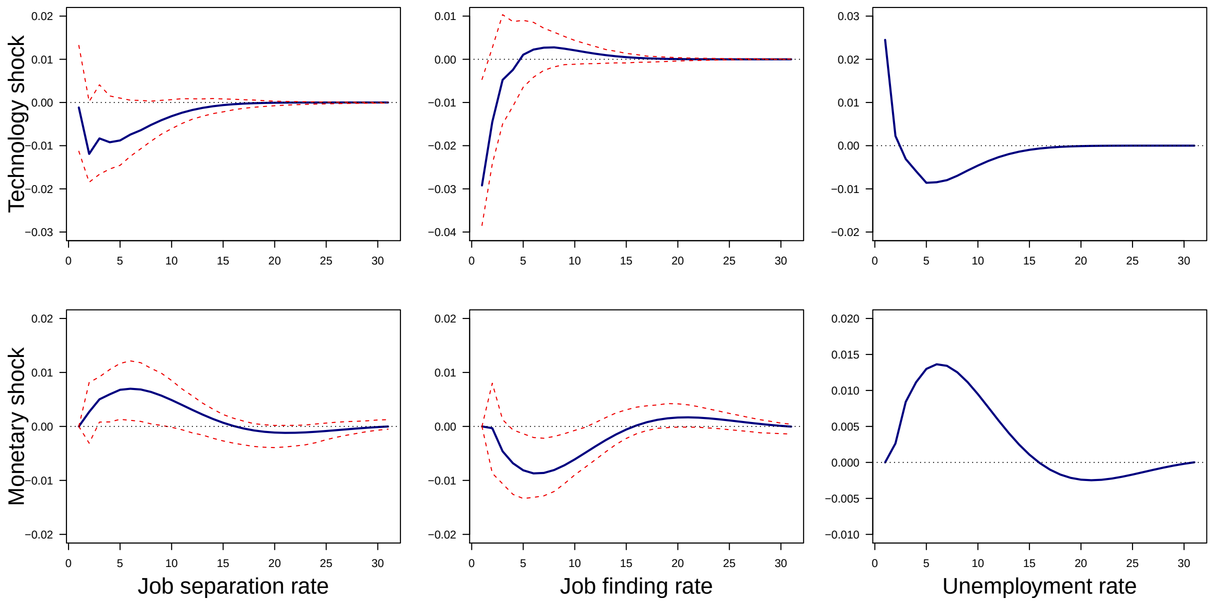

Fig. 2.5 – Impulse responses with "standard" identifying restrictions.
Sources : Author's calculations.
Notes : The first row corresponds to the impulse responses to technology shocks identified with long run restrictions in the spirit of Gali (1999). The second row corresponds to the impulse responses to monetary shocks identified with a Cholesky decomposition and the interest rate ordered last in the VAR as in Bernanke and Blinder (1992). Solid blue lines represent the median impulses responses. Dotted lines are 5th and 95th quantiles of the distribution of responses simulated by bootstrapping 1000 times the residuals of the VAR. Responses are expressed as log deviations from the steady-state levels.

monetary policy rate. A direct consequence of the identifying assumption is that the paths of impulse responses look different across the two applications. Indeed, as labor market transition rates are not able to respond immediately in this framework, the response of the job separation rate is positive and hump-shaped while the one for the job finding rate is negative and u-shaped. This difference should not disturb the reader, since I am more interested by the contribution of worker flows to unemployment variations. In this respect, table 2.5 indicates that conditional on a monetary shock, both transition rates contributed roughly equally to unemployment changes.

All in all, the robustness check confirms the empirical finding of the previous section. The job finding rate is largely dominant in characterizing unemployment variations consecutive to a technology shock, while both transition rates are equally important for a monetary shock.

Productivity per hour

In the baseline model, labor productivity is defined as output per employee. However, in the literature productivity is often defined as output per hour. To check the robustness of my results, I re-estimate the VAR model with the Eurostat measure of output per hour. As shown in table 2.5, the results are nearly the same.

Robustess to...	Shocks	β^{ψ}	β^{s}
... Identification scheme	Technology shocks *à la* Gali (1999)	0.21	0.79
	Monetary shocks *à la* Bernanke and Blinder (1992)	0.54	0.46
... Productivity variable	Technology	0.24	0.75
	Monetary	0.48	0.52
... lag length	Technology	0.46	0.55
	Monetary	0.31	0.69
... Restriction length	Technology	0.15	0.85
	Monetary	0.55	0.45

TAB. 2.5 – Robustness - Empirical unemployment decomposition under various perturbations.

Sources : Author's calculations.

Notes : "Betas" are defined as the contribution of changes in transition rates to the variance of steady state unemployment. ψ is the job separation rate, s the job finding rate.

Lag length

In the baseline model, number of lags included in the VAR follow the Hannan-Quinn criterion. As the Aikake criterion suggest the inclusion of more lags, I estimate the corresponding model. The relative contribution implied by this model is reported in the third row of table 2.5. The qualitative result is preserved. Conditional on a technology shock, the dominant influence of the job finding margin is weaker. By contrast, it explains a higher share of unemployment variations after a monetary shock.

Restriction length

To ensure that the results hold under perturbations to my medium-lived identification procedure, I reduce the maximum length of sign restrictions to 2 periods. Again, I find that results of the baseline model remain qualitatively unaffected. More specifically, the job finding margin is dominant conditional on technology shocks while the relative contributions are balanced conditional on monetary shocks.

Calibration of the theoretical model

In order to establish that the theoretical contributions of transition rates are insensitive to the calibration of parameters, I make several model simulations by changing each time one parameter and I compute the "beta"values . The results are displayed in table 2.6 [21].

On the overall, it appears that the job separation rate dominates in explaining unemployment variations conditional on both technology and monetary shocks. Thus, when prices are

21. To further check the robustness of the relative contributions, appendix 2.D depicts the distribution of "beta" value for the 1000 simulations of the model of subsection 2.3.3.

	Technology shock		Monetary shock	
	β^{ψ}	β^{s}	β^{ψ}	β^{s}
Benchmark (1)	0.58	0.42	0.62	0.38
Flexible prices (2)	0.72	0.27	–	–
(1) without habit	0.61	0.39	0.68	0.32
(2) without habit	0.92	0.07	–	–
(1) with $\eta = 0.9$	0.77	0.23	1.10	-0.10
(1) with $\phi = 5$	0.52	0.48	0.68	0.32
(1) with κ as in Trigari (2009)	0.65	0.34	0.98	-0.01

TAB. 2.6 – Robustness - Theoretical unemployment decomposition with parameter changes.
Sources : Author's calculations.
Notes : "Betas" are defined as the contribution of changes in transition rates to the variance of steady state unemployment.

flexible, the separation margin accounts for more than 70% of unemployment variations. This contribution is even higher when habit persistence is shut off. In all models incorporating sticky prices the contribution of outflows is always weaker than the contribution of inflows, ranging from 23% to 48%. Furthermore, notice that the relative contribution of the job separation margin is always higher for the monetary shock than the technology shock. Finally, it is noteworthy that the main finding is insensitive to changes in important parameters of the matching environment such that the vacancy posting cost κ and the bargaining power of firms η.

2.5 Interpreting the evidence

2.5.1 A French specificity : the job finding matters more

The exercises conducted in section 2.4 illustrate important stylized facts on French unemployment dynamics. Firstly, the origin of unemployment is varying with the type of the economic shock. This finding is at odds with Fujita (2011) who finds that U.S. labor market reallocation is the same whatever the nature of the aggregate shocks. The diversity in unemployment driving forces should be kept in mind for the design of economic policies. Secondly, it appears that the dominant role of the job finding is a striking feature of the French labor market. In this respect, my finding reinforces the result provided by previous French studies. Hairault et al. (2015) demonstrate that - during the 2004-2010 period - the job finding rate explained 60% of unemployment changes. Furthermore, Hairault and Zhutova (2014), with a conditional study, show that changes in unemployment are mainly dictated by the job fining margin. Both the unconditional analysis and the conditional analysis converge to the same result : none of the transition rates can be ignored, but the job finding remains, on the overall, more important. In this respect, French unemployment dynamics stands out from the U.S. labor market for which unconditional and conditional studies are at odds.

2.5.2 On the Shimer puzzle

The inability of the search and matching framework to replicate observed stylized facts is based on the comparison of unconditional standard deviations. Shimer (2005) also points out that labor market variables move almost one to one with productivity. Thus, after a technological improvement wages increase and absorb most of the productivity gain. By contrast to Shimer (2005), Balleer (2012) gauges the performance of the search and matching framework through the lens of standard deviations and correlations that are conditional on structural shocks. She finds that the Shimer critique does not hold when the analysis is conditional. However, the weakness of internal propagation is barely mitigated since the job finding moves in the same direction of labor productivity while her VAR shows the opposite. Surprisingly, although her empirical study integrates the job separation rate, her theoretical model considers that this margin is constant over time.

Here, the benchmark model with endogenous job separations provides a realistic picture of unconditional moments. However, it fares poorly in replicating the sources of unemployment variations in terms of transition rates. In particular, it is unable to attribute a prevailing influence to the job finding margin. This finding can be seen as a refinement of the "job finding puzzle" of Balleer (2012). A frictional labor market embedding into an otherwise New-Keynesian DSGE model is able to replicate the negative comovement between the job finding rate and labor productivity. However, the response of the job separation margin remains exaggerated in the model.

2.5.3 Should we model the job separation margin in a matching framework ?

Shimer (2012) computes the unconditional contributions of transition rates in explaining U.S. unemployment rate. He shows that the job separation margin has a minor contribution to unemployment changes [22]. Based on this kind of evidence, Shimer concludes that one does not need to model the separation margin for the analysis of the labor market. Several papers

22. For instance, the table 1 in Shimer (2012) indicates that, during the 1987-2010 period, 90% of U.S. unemployment variations are dictated by changes in the job finding rate.

have argued that such a conclusion was premature (Fujita and Ramey (2009), Elsby et al. (2009) among others). In a recent contribution, Canova et al. (2013) indicate that Shimer's conclusion does not hold when the respective contributions of the Ins and Outs are computed conditional on structural technology shocks. In particular, they show that the job separation is largely dominant in explaining unemployment volatility [23]. Although my conditional analysis indicates that in France the job finding rate matters more - as in Shimer (2012) - I do not share the idea that the abstraction of the separation margin is an acceptable approximation. At least two arguments support my view. First, as indicated in table 2.1 the introduction of an endogenous job separation, combined with a careful calibration of some parameters, allows to get rid of the Shimer critique. Second, the abstraction of the separation margin may be misleading because my empirical evidence suggests that unemployment driving forces vary with the sources of structural shocks. Therefore, a model with the two margins is desirable but it is necessary to reduce the relative role of the job separation in explaining unemployment variability.

To achieve this goal in the French context, the inclusion of particular labor market institutions seems promising. It is well known that the French labor market is characterized by a strong employment protection legislation materialized by important firing costs [24]. In the benchmark model, the hiring decisions of firms are costly while their separation decisions are left free. Consequently, the separation margin is the easiest way to adjust the employment level. This could be a possible explanation to justify its larger role for unemployment fluctuations. One can conjecture that the inclusion of firing costs could create some counterweight leading to a more balanced contribution of the two margins. However, doing so is beyond the scope of my analysis.

2.6 Conclusion

In this paper, I have studied the responses of French labor market transition rates consecutive to two aggregate economic shocks. I calibrate a New-Keynesian model incorporating labor market frictions and an endogenous job separation margin. I then estimate a VAR including the labor productivity, the inflation rate, the interest rate, the job separation rate and the job finding rate. To isolate structural meaningful economic shocks, I adopt the strategy of Uhlig (2005) by imposing sign restrictions directly on the impulse response functions.

The empirical technology shock induces a fall in both margins. The combined effects lead

23. At the impact effect of a neutral technology shock, Canova et al. (2013) find that 90% of unemployment variations are explained by the job separation rate.

24. The term firing cost should be understood as all administrative and procedural cost accompanying a separation.

to a positive raise in unemployment in the short run. The aggregate monetary shock appears to be recessionary for the labor market by increasing unemployment. Then, I assess the conditional contributions of the Ins and Outs of unemployment. Two insights appear. Firstly, depending on the origins of the shock, the unemployment driving forces are not the same. Both transition rates contribute equally to unemployment variations after a monetary shock, while the job finding rate is largely dominant after a technology shock. Secondly, the model and the data do not reveal the same underlying mechanism leading to unemployment variations for a technology shock. The model tends to attribute an exaggerated importance to the job separation margin.

The empirical evidence emerging from this paper sheds light on the plurality of mechanisms governing changes in the French unemployment rate. These patterns seem to be specific to the French economy, and are different to those highlighted with U.S. data. Furthermore, the theoretical application suggests that a simple benchmark is not sufficient to reproduce the underlying mechanism governing unemployment variations. This is especially true when the economy is hit by a technology shock. This indicates that other features, e.g. the institutions of the labor market as firing cost or unemployment benefits, may be possible candidates in explaining the determinant role of the job finding. This further theoretical investigations are left for future research.

Annexe 2.A Original transition rate series vs TRAMO series

Figure 2.6 compares the initial data and the series estimated by the TRAMO process. The estimated series track very well the initial data. Thus, I consider that data obtained for the years 2003 and 2004 with the estimated model are also close to the unknown initial data.

Annexe 2.B The other shocks of the VAR system

In his empirical framework, Uhlig (2005) imposes sign restrictions in order to isolate a unique monetary policy shock. However, the strategy consisting in the identification of a single shock in a sign restriction framework has been criticized in many works as in Fry and Pagan (2011). Consistently with the so-called multiple shock problem, I identify not only a single disturbance, but all disturbances of the system. More specifically, I identify the demand shock relative to the inflation rate and the two other shocks affecting transition rates.

2.B.1 The demand shock

In the NK literature, a demand shock is a perturbation on the utility of consumption and affects the household inter-temporal decisions. A positive demand shock induces an unexpected rise in consumption, which creates some positive pressure on inflation. This expansion of inflation coincides with an increase in output, and, contrary to the monetary shock, pushes up the interest rate. To recover a demand shock in my empirical model, I impose that the last one is required to increase the inflation rate for at least 4 quarters. Fujita (2011), Braun et al. (2007) and Peersman (2005) also use similar restrictions. Again, I do not restrict the responses of the job separation rate and the job finding rate and I let the data tell me how unemployment reacts consecutive to the shock.

2.B.2 Labor market shocks

In a NK economy characterized by nominal rigidities on prices, a shock on the job separation lowers the expected value of a job for firms, which react by opening fewer vacancies. This fall in the number of vacancies posted reduces the chances for a worker to find a job. Not surprisingly, these patterns of transition rates lead to higher unemployment. I translate these theoretical mechanisms by imposing the job separation to rise during 4 quarters and the job finding to decrease one quarter after the shock. Finally, I isolate a job search shock. A job search shock affects the efficiency of the matching process. It refers to all characteristics

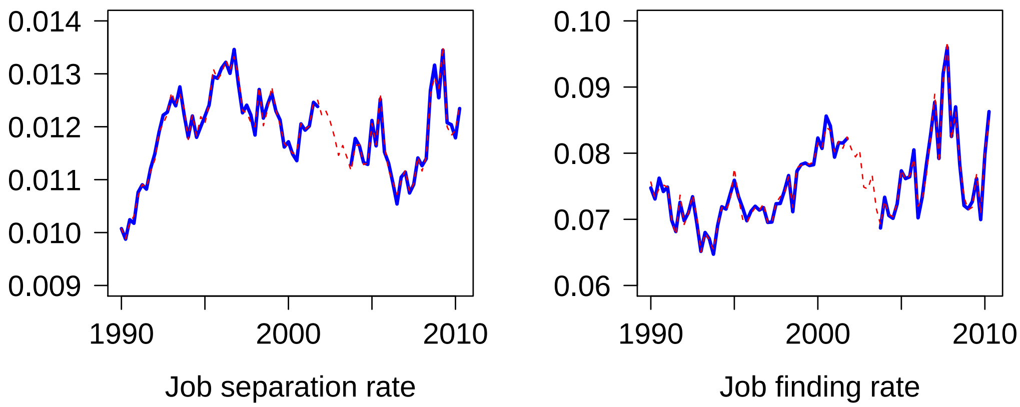

Fig. 2.6 – Comparison between the initial series of transition rates (solid blue lines) with the series obtained by TRAMO (dashed red lines).
Sources : Hairault et al. (2015), author's calculations.

facilitating the meeting between firms and workers. Theoretically, this perturbation increases the probability for a worker to find a job and pushes up the job separation rate. The channel is as follows : a matching efficiency shock increases the job finding rate but also the value of unemployment spells. Since the value of unemployment for a worker increases it becomes more costly for the workers to supply labor. All else equal the threshold at which endogenous job separation takes place diminishes, and the overall job separation rate increases. These movements of transition rates reduce unemployment because the first effect dominates the second. Empirically, I impose that following the search shock, the job finding increases during four quarters. The response of the job separation is required to be positive during the impact period. The fact that the two transition rates move in the same direction is essential for the identification of the job search shock. Other evidence justifying why the job search shock leads to positive comovements between the job separation rate and the job finding rate can be found in Hairault and Zhutova (2014).

Annexe 2.C Hypothetical impulse responses

To shed light on the relative contributions of labor market flows in shaping unemployment I conduct the same exercise as in Fujita (2011). The starting point of the analysis is the impulse responses. More specifically, I fix one of the responses of transition rates to its steady state level, and I trace the hypothetical behavior of the steady state unemployment. The results are displayed in figure 2.7. In each panel, the black solid line corresponds to the

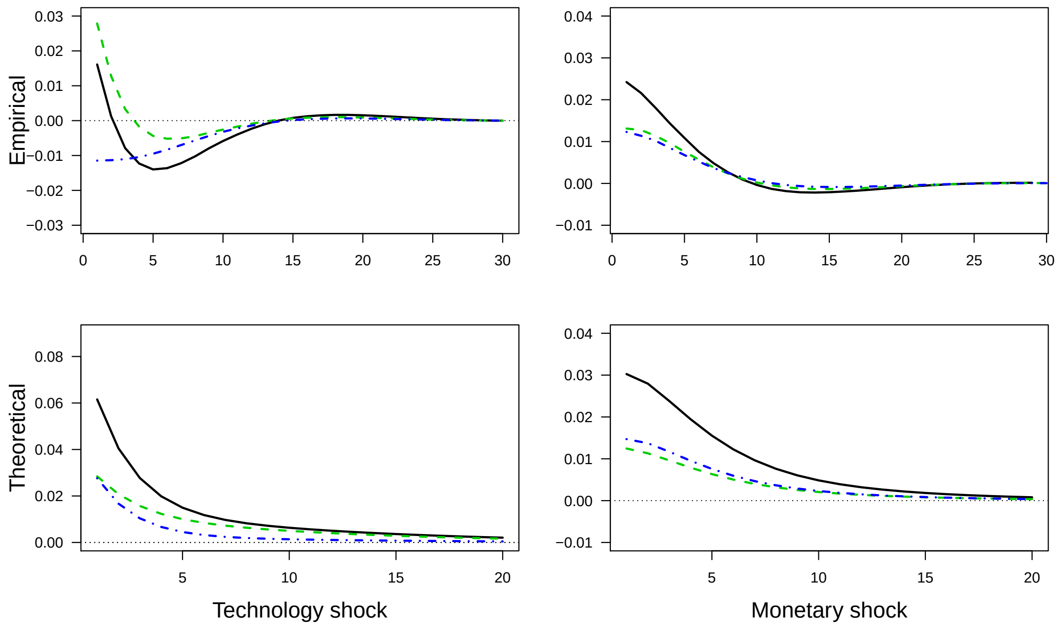

FIG. 2.7 – Contribution analysis from the impulse response functions.
Sources : Author's calculation.
Notes : The first row corresponds to the impulse responses of the empirical model, the second row to impulse responses of the theoretical model. Black solid lines are the median impulse responses of steady state unemployment when both transition rates fluctuate. The blue "dot-dashed" lines refer to the median response of steady state unemployment when the job finding rate is set to its steady state value. The green dashed lines refer to the median response of steady state unemployment when the job separation rate is set to its steady state value.

median response of steady state unemployment. The blue "dot-dashed" line refers to the path of unemployment if the job finding is voluntary fixed to its steady state value. This impulse response allows to shed light on how the job separation contributes to unemployment fluctuations. Finally, the green dashed line repeats the exercise by maintaining - this time - the job separation to its baseline steady state value.

The cyclical behavior of unemployment consecutive to a technology improvement is varying and depends on what transition rate is fixed. The dynamic response of unemployment is not retrieved when only the job separation fluctuates. However, when only the job finding rate varies the qualitative response of unemployment is entirely preserved. Note that the rise in unemployment is even greater than in the benchmark. This indicates that the job separation has a dampening role in the increase of unemployment. For a tightening in monetary policy, the message of the exercise looks different. The qualitative patterns of unemployment are the same in both cases and the two margins seem to contribute roughly equally to unemployment changes. The theoretical analysis is not in line with the empirical one since the qualitative paths followed by unemployment are not sensitive to which transition rate is fixed. Concerning the contribution of transition rates in generating unemployment, the mo-

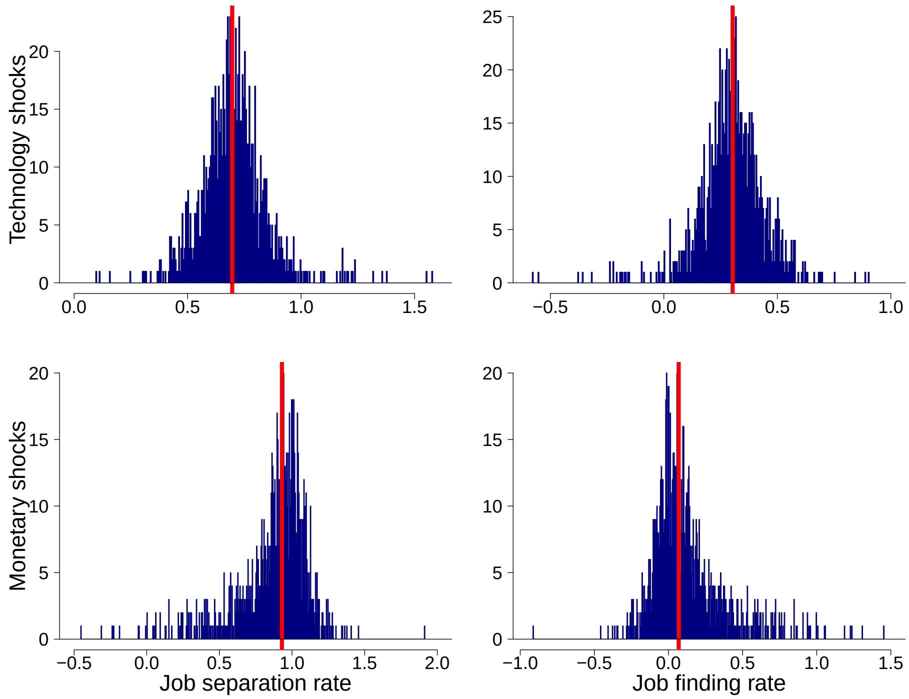

FIG. 2.8 – Distributions of “beta” values obtained after 1000 simulations of the model.
Sources : Author’s calculation.
Notes : Red vertical lines are the median of the distributions

del does not reproduce well the underlying mechanisms leading to unemployment consecutive to a technology shock. The contributions of the two margins appear to be balanced in the model, while the empirical model suggests that the contribution of the job finding is largely prevailing.

Annexe 2.D Relative contribution in the model

Figure 2.8 represents the distribution of “beta” values obtained for the 1000 simulations of the model of subsection 2.3.3. It clearly shows that in the model the job separation margin has a higher influence in generating unemployment variations. The median values for the contribution of the job separation are roughly equal to 0.70 conditional on technology shocks against 0.93 conditional on monetary shock. This finding indicates that my benchmark calibration does not exaggerate the main message of the paper.

Chapitre 3

Uncertainty and Labor Force Participation

3.1 Introduction

In comparison to other post WW-II recessions, the Great Recession of 2008 and the subsequent slow recovery were accompanied by an important increase in uncertainty [1]. Policy designers or economic press have often argued that uncertainty is a key factor explaining the sluggish rebounds of the years 2009-2010. This unusual macroeconomic behavior is at the origin of a burgeoning academic attention for uncertainty. The pioneer contribution of Bloom (2009), prolonged by those of Fernández-Villaverde et al. (2011), Bachmann et al. (2013) or Basu and Bundick (2014) among others, indicates that heightened uncertainty impedes economic activity. A strand of this growing body of literature puts attention to the aftermaths of higher uncertainty on the labor market. Empirically, the work of Caggiano et al. (2014) suggests that uncertainty shocks lead to a non-negligible increase in unemployment. Theoretically, the recent contribution of Leduc and Liu (2016) indicates that a surge in uncertainty pushes up the firm option value of "wait and see" for having more information about the future of the economy. As firms react by posting fewer vacancies unemployment unambiguously increases. However, to the best of my knowledge, all of these papers do not consider the participation margin. They are silent about a possible influence of uncertainty on the labor force participation (LFP, henceforth).

1. There is no "official" definition of uncertainty. In general, it should be understood as the unpredictability about the future state of the economy. This unpredictability may have several sources, such as, bad anticipations about the future level of macroeconomic variables (for instance, GDP, inflation or exchange rates), the indecision about economic policy (for instance, fiscal policy), concerns over the evolution of financial markets (for instance, European debt crisis, bankruptcy of Lehman Brothers) or major events (for instance, terrorist attacks or the *Brexit*).

Macroeconomists often abstract from the participation margin since it is recognized that it is mainly acyclical over the business cycle. However, this conventional wisdom is challenged by, at least, two recent facts. First, Elsby et al. (2015) demonstrate that entries and exits from non-participation account for one third of cyclical fluctuations in unemployment. Second, the downward trend followed by the U.S. LFP rate accelerated during the depth recession following the Great Recession, a period characterized by unusual level of uncertainty[2]. The purpose of this paper is to make the connection between these two concepts. In other words, what the data tell us about the response of LFP consecutive to an uncertainty shock ? To what extent uncertainty impacts the participation in the U.S. ? What is transmission channel of uncertainty shocks when a model economy explicitly includes a participation margin ?

To give answers to these questions, I investigate the empirical link between LFP and uncertainty. In particular, along the lines of Caggiano et al. (2014), Bachmann et al. (2013) and Leduc and Liu (2016), I estimate the joint dynamics of uncertainty, output and LFP within a structural Vector Autoregression (VAR, henceforth) framework. As a proxy for uncertainty I use the common macro uncertainty measure developed by Jurado et al. (2015). I follow the bulk of the literature by isolating an uncertainty shock with a Cholesky-type decomposition, the measure of uncertainty being ordered first in the VAR. The evidence is quite clear. An unexpected increase of uncertainty leads to a non-significant impact response of LFP. However, between 3 or 4 quarters after the shock, participation significantly decreases and follows an u-shaped path. This empirical evidence is robust to several alternative VAR estimations. Thus, changing the proxy for uncertainty, the participation variable and the Cholesky ordering do not alter the qualitative pattern followed by LFP in response to uncertainty surprise.

After the presentation of the empirical evidence, I adopt a theoretical point of view to rationalize the transmission channel of uncertainty. More specifically, I develop a New-Keynesian DSGE model, enriched with search and matching friction on the labor market and stochastic uncertainty volatility about the level of aggregate productivity. In contrast to previous works, the participation margin is explicitly modeled. Then, the DSGE model is simulated and the related impulse response functions are computed by employing a third-order perturbation method[3]. Based on this framework, I operate step by step. First, I eliminate price stickiness in the model to put in light to what extent the option value of waiting operates. Under this scenario, the macroeconomic effect of uncertainty is expansionary since output and participation increase. This finding suggests that the non-abstraction from the

2. BLS measures indicate that the participation rate has fallen about 2 percentage points during the first quarter of 2008 and the second quarter of 2011. Furthermore, Erceg and Levin (2014) find that the bulk of LFP variations during the Great Recession can be explained by cyclical factors.

3. As discussed below, a third-order perturbation of the model is required to evaluate the effects of volatility shocks.

participation margin induces a precautionary saving motive which undoes the "wait and see" channel. Hence, a model with flexible prices is unable to replicate the empirical comovements observed between uncertainty, output, and LFP. In contrast to Leduc and Liu (2016), I show that, when the participation margin is took into account, the introduction of a frictional labor market is not a sufficient condition to retrieve recessionary effects of uncertainty.

Second, I activate the demand channel by adding sticky prices to the model. This framework allows me to have theoretical comovements which are in line with those observed in the data. Along the lines of Basu and Bundick (2014), I find that the demand channel helps to greatly amplify the transmission of uncertainty shocks. Most prominently, heightened uncertainty prevents firms to reset prices and they must cut-off production to meet the depressed demand. Furthermore, driven by the "wait and see" behavior, firms become more cautious in their hiring decisions. Finally, observe that higher uncertainty leads to an increase in markups which is an additional channel for the propagation of the shock. These three mechanisms lead to a fall in future firm profits which react by opening fewer vacancies. As search activities have a lower probability to be successful, the value of participation of household decreases and the overall level of participation diminishes.

Finally, I test the sensitivity of the theoretical results to alternative parameterizations of the model. On the overall, the qualitative responses of the model economy are preserved, and a spike in uncertainty induces a fall in participation. I confirm the intuition of Cacciatore and Ravenna (2015). In addition to the demand channel, wage rigidities appear to be also an important factor for the magnification of uncertainty shocks. Furthermore, I also show that a specific monetary policy, which reacts to output gap and unemployment gap, may have an important stabilizing role.

This paper is not the first work that combines an empirical VAR analysis including an uncertainty proxy and a theoretical New Keynesian general setting with a frictional labor market. In this respect, an increasing number of papers, such as those by Bloom (2009), Baker et al. (2016), Caggiano et al. (2014) or Leduc and Liu (2016), uses VAR techniques to evaluate the macroeconomic effects of uncertainty shocks on the U.S. economy. All of them find that an unexpected increase in uncertainty affects U.S. real activity and especially the unemployment rate. By contrast to these papers, I use the macroeconomic uncertainty index of Jurado et al. (2015) and I focus my attention on a neglected labor market variable, the labor force participation rate. Furthermore, the reproduction and the understanding of the transmission channels of uncertainty volatility shocks in a general equilibrium setting are the subject of intensive research. In this respect, my finding reinforces the results of Basu and Bundick (2014) and Leduc and Liu (2016) indicating that nominal rigidities are keys in reproducing theoretical responses in line with the data. However, unlike all of the aforementioned paper, I explicitly include a participation margin into a New Keynesian model enriched with search and matching frictions. Hence, I show that, by altering the firm profits and the match value, uncertainty shocks decrease the expected return of search activities leading the representative household to allocate fewer members into participation.

The outline of the paper is structured as follows. Section 3.2 presents a brief survey of the literature. Section 3.3 investigates the empirical joint dynamics between uncertainty and participation. Section 3.4 describes the model economy. Section 3.5 presents simulations of the model and the main result. Finally, I conclude in section 3.6.

3.2 Related litterature

This paper combines two strands of literature. The first one aims at understanding LFP dynamics. The second one studies the macroeconomic impact of uncertainty.

3.2.1 Labor force participation

In contrast to the unemployment rate, the LFP rate is essentially acyclical. Based on this kind of evidence, the bulk of modern researches focuses on frameworks ignoring the participation margin. Nonetheless, current empirical evidence contradicts this view of labor market dynamics. In a recent article, Elsby et al. (2015) show that entries and exits from the labor force are at the origin of one third of unemployment variations. Furthermore, in recent years, the LFP rate displays an interesting feature. As indicated in figure 3.1, the LFP rate has begun to decline since the 2000's decade and this downward trend was not inverted. Is this fall in the LFP the consequence of demographic factors ? Some elements suggest a negative answer to this question. First, it is noteworthy that the fall trend decelerated between 2004 and 2007, before reinforced its decline with the Great Recession and the deep recession accompanying it. Second, several works, as those of Erceg and Levin (2014), Aaronson et al. (2012) or Fujita (2014) (among other), demonstrate that more than three-quarter of fluctuations in participation can be attributable to cyclical factors. As a consequence of the recent cyclical properties of LFP, it appears fundamental to investigate, both empirically and theoretically, the relationship between participation and the macroeconomic environment.

The introduction of a participation margin in an otherwise RBC-type model is not straightforward. Thus, the first papers dealing with this issue (see Ravn (2006), Tripier (2004) and Veracierto (2008)) faced difficulties to reproduce one key cyclical property of the labor market : the negative relation between unemployment and vacancies, i.e. the Beveridge curve. The drawback arises from the behavior of non-participation in response to aggregate shocks. For example, following a positive improvement in technology the representative household allocates more members into search activities. If the number of workers moving from non-participation to search unemployment is greater than those moving from search unemployment to employment, unemployment increases and exhibits a pro-cyclical behavior. The major problem is that these models do not match empirical moments of labor market participation. In the data, the participation is approximately 5 times less volatile than GDP, suggesting only a modest reaction of this margin to technology shocks.

Ebell (2011) is the first to formulate an answer to this puzzle, and she successfully replicates the low volatility of participation and the negative slope of the Beveridge curve. Her results rely on two choices in the calibration strategy. On the one hand, the elasticity of labor supply is chosen to match the low volatility of participation rather than GDP volatility. Thus, the value of this elasticity is relatively low and more in accordance with micro-econometric estimates. On the other hand, she adopts a calibration strategy close to the one proposed in Hagedorn and Manovskii (2008). In this respect, she introduces wage rigidity by imposing a low value of surplus share to the worker [4].

Arseneau and Chugh (2012) depart from the RBC structure of the model economy and develop a New-Keynesian equilibrium model with labor market frictions and a participation margin. In the spirit of Ebell (2011) they fix the elasticity of labor supply to a low value and they rely on an Hagedorn-Manovskii style calibration. In this framework, the volatility of labor force participation mimics the data fairly well. However differently from the RBC interpretation, though the level of participation decreases, unemployment increases after a productivity shock. In this setup, the demand channel acts, pushing up the unemployment.

Recently, Campolmi and Gnocchi (2016) introduce a participation margin in an otherwise New-Keynesian model embedding labor market frictions. Without an Hagedorn-Manoskii style calibration, they are able to reproduce key moments of aggregate labor market variables. For instance, the low volatility of participation is reproduced and the negative relationship between vacancies and unemployment. They also show that the abstraction of the labor force may lead to misleading results about the dynamics of the model economy. In particular, with the presence of participation the unemployment is four time more volatile than in a model without participation. Moreover, in a model with constant participation the volatility of unemployment to inflation stabilization is too large.

4. In is important to note that her fundamental results are not based on such extreme values of worker bargaining power and worker outside option as in Hagedorn and Manovskii (2008).

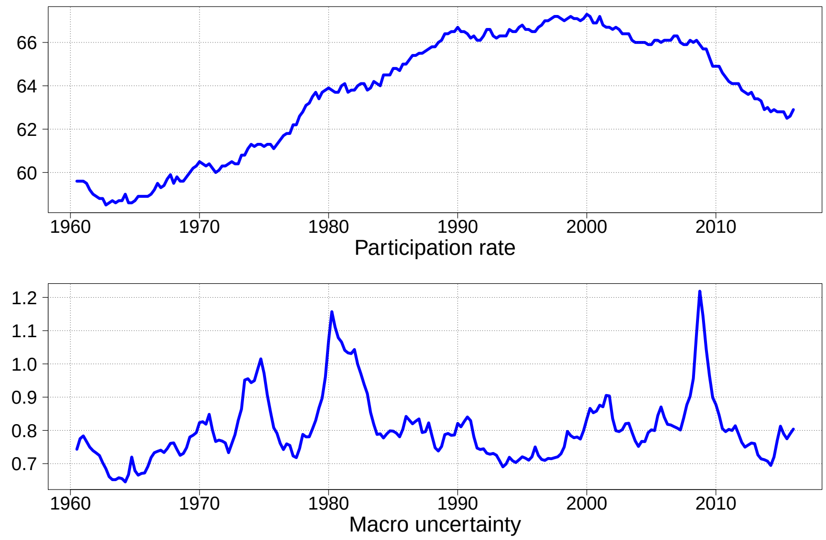

FIG. 3.1 – The participation rate and the macroeconomic uncertainty index of Jurado et al. (2015) over the period 1948-2015.
Sources : FRED database for the LFP, Jurado et al. (2015) for uncertainty.
Notes : The participation rate is expressed in percentage points.

3.2.2 Uncertainty and the macroeconomy

The macroeconomic effects of uncertainty attract a revived attention since the Great Recession and the subsequent low recovery. As indicated in the bottom panel of figure 3.1, the aggregate measure of macro uncertainty constructed by Jurado et al. (2015) increased sharply during the Great Recession. On the empirical side, the first purpose was to establish the sense of the effect and its importance in explaining macroeconomic fluctuations. Bachmann et al. (2013) analyze by means of structural vector autoregression (VAR, henceforth) the role of uncertainty in Germany and the U.S.. They find that heightened uncertainty induce, for both countries, a fall in manufacturing production, hours worker and employment. However, the negative effects of uncertainty are more persistent in the U.S. than in Germany. Also through the lens of VAR, the empirical findings of Basu and Bundick (2014), suggest that an uncertainty shock significantly pushes down output, consumption, investment and hours [5]. Finally, Alexopoulos and Cohen (2015) came to the conclusion that uncertainty explain an important share of variance of aggregate variables as output, production, consumption and investment [6].

5. Other researches document similar comovements between uncertainty and macroeconomic variables, for example Guglielminetti (2015), Leduc and Liu (2016), Charles et al. (2015).

6. The paper of Cesa-Bianchi et al. (2014) is in stark contrast with the results mentioned above. Starting from a Global VAR and assuming that uncertainty and business cycles are driven by common factors, they find that the former has no effect on the latter. Consequently, they favor the view that uncertainty should be seen as a symptom rather than the cause of economic fluctuations.

On the theoretical side of research, the interest for uncertainty is not new but it is renewed in recent times. In an "older" contribution, Bernanke (1983) argues that the presence of irreversible investments is key to understand uncertainty aftermaths. In such a framework, agents trade-off future returns of investments against the benefit of "wait and see" to have more information. Thus, in the event of a surge in uncertainty the option-value of waiting increases leading to a diminution in investment, and therefore in output. The paper of Bloom (2009) is at the origin of the renewed interest for uncertainty. In particular, he considers stochastic volatility uncertainty in a firm level model and he shows that the surprise shock diminishes output. The transmission channel is in line with Bernanke (1983). More specifically, Bloom (2009) shows that uncertainty expand an inner region, i.e. the degree of inaction of firms, by giving rise the real-option value of waiting. Thus, firms make a "pause" in their investment and hiring decisions because the value of waiting increases.

As for the participation margin, it is not straightforward to retrieve the comovements observed in the data with an equilibrium model. Basu and Bundick (2014) indicate that the introduction of price stickiness is a determinant factor in reproducing the effects of uncertainty. In a model with flexible prices and an elastic labor supply, a surge in uncertainty stimulates a precautionary motive leading the household to supply more labor. As flexible prices operate, markets clear and more inputs are used for production. Hence, heightened uncertainty implies a counter-intuitive result since it pushes down consumption but pushes up output. In contrast, when price adjustment is sluggish output is demand-determined. As firms are not freely able to adjust their own prices, they must reduce their production to meet demand. This mechanism induces a fall in consumption, investment, output and employment.

Finally, to my knowledge, three papers examine the impact of uncertainty in the context of DSGE model with frictional labor market. Leduc and Liu (2016) add a stochastic volatility uncertainty shock in a New-Keynesian model embedding a frictional labor market. They find that the presence of a non-Walrasian labor market is crucial for the transmission of uncertainty shocks. In this setup, an employment relationship can be assimilated to an irreversible investment as in Bernanke (1983). When uncertainty hits the economy the value of a job match decreases and firms are less likely to post vacancies leading ultimately to higher unemployment. Moreover, they also indicate that sticky prices amplify the negative effect of uncertainty on unemployment. In a more complex framework than Leduc and Liu (2016), Guglielminetti (2015) finds similar results. Finally, Cacciatore and Ravenna (2015) stress that wage rigidity deepen the negative effect of uncertainty on employment.

As in this paper, the aforementioned works add a frictional labor market in order to analyze the impact of uncertainty. However, they operate under the assumption that the participation margin is exogenous. I go one step further and I investigate to what extent uncertainty can affect the LFP dynamics.

3.3 The empirical evidence

This section presents the empirical evidence emerging from vector autoregression identified with a classical Cholesky decomposition. In a first part, the benchmark model is presented. In a second part, several sensitivity analyzes are conducted.

3.3.1 The baseline VAR

The baseline empirical model is a tri-variate VAR containing a measure of uncertainty, real GDP and a measure of participation. The uncertainty variable chosen is the common macro uncertainty measure of Jurado et al. (2015) [7]. This index of uncertainty is constructed from a data rich environment which provide direct empirical estimates of time-varying macroeconomic uncertainty [8]. As recalled by Jurado et al. (2015), no objective measure of uncertainty exists. The use of a stock market volatility, cross-sectional dispersion of firm profits, consumer perceived uncertainty or policy uncertainty based on newspaper coverage frequencies as a proxy of uncertainty can be problematic in several respects. On the one hand, such proxies of uncertainty capture, at best, one dimension of economic uncertainty. On the other hand, these variables are characterized by large variations non-related to genuine changes about uncertainty on economic fundamentals. In order to tackle this shortcomings, Jurado et al. (2015) exploit 132 measures of individual uncertainties [9] and aggregate them in one single index. Based on this index, uncertainty episodes are less recurrent, more persistent and more correlated with real activity than other popular uncertainty proxies. The sensitivity of my results to the choice of the uncertainty measure is evaluated in the next subsection. Output is measured by real GDP. The measure of participation is the civilian labor force participation rate [10]. The VAR is estimated on a quarterly basis and the sample

7. Strictly speaking, the authors constructed 3 measures of uncertainty for different forecast horizons. In this paper, I opt for the index related to a forecast uncertainty horizon of 3 months. My empirical results are insensitive to this choice (not shown in the paper, corresponding estimates are available upon request).

8. The updated data are freely available on the Ludvigson's website by following the link : https://www.sydneyludvigson.com/data-and-appendixes/.

9. These measures of individual uncertainties are themselves based on an econometric estimation. One of the contribution of Jurado et al. (2015) consists in removing the forecastable component of each time series. In this respect, uncertainty should be understood as the degree of unpredictability of the economy rather its degree of volatility. For more details, about the construction of this index the interested reader can referred to Jurado et al. (2015).

10. The series is freely available on the FRED website with the following ID : CIVPART.

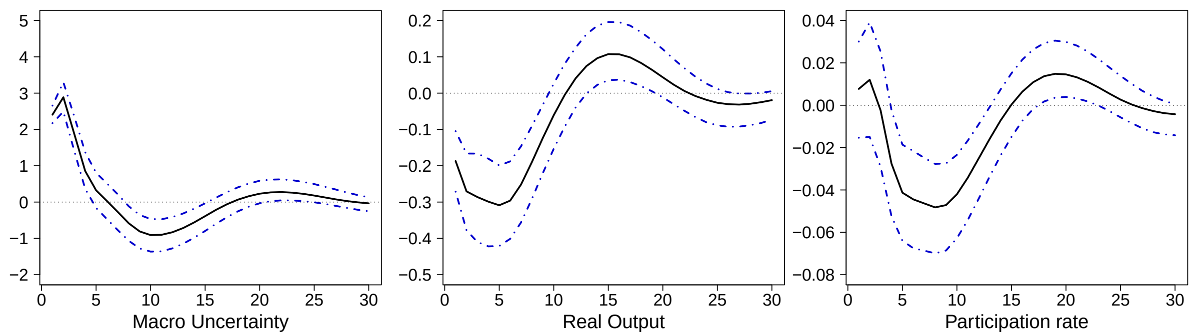

FIG. 3.2 – Impulse response functions to a one-standard deviation uncertainty shock.
Sources : Author's own calculations.
Notes : Black solid lines correspond to median responses, blue error bands represent the 5th and 95th of the distribution of responses simulated by bootstrapping 10000 times the residuals of the VAR.

covers the 1960Q2-2016Q1 period [11]. In order to interpret the effects of uncertainty shocks as short-term dynamics relative to the stationary steady state, and to avoid any problem of long term relationship between variables, the trend components of the series are removed with an HP-filter with a standard smoothing parameter (i.e. $\lambda = 1600$ for quarterly data) [12]. As suggested by the Akaike criterion, the VAR features 3 lags.

The isolation of a structural uncertainty shock is achieved by adopting the widely used Cholesky decomposition, and by ordering the measure of uncertainty first in the VAR. This identification scheme implies that the other shocks of the system have a contemporaneous zero effect on uncertainty. However, in subsequent periods, macroeconomic effects on uncertainty are allowed. Most importantly, another consequence of this strategy is that uncertainty shocks have an immediate impact on other variables of the system. Despite the fact that this identification assumption is very standard in the literature, it is possible to cast some doubt on the ordering of the variable. Once again, in a step of robustness check I re-estimate the VAR with an alternative ordering (see subsection 3.3.2) [13].

Figure 3.2 displays the estimated responses to a one-standard deviation uncertainty shock. In each panel, the black solid line represents the median response while the blue dashed lines report bands corresponding to 90th percent confidence interval. The one-standard uncertainty shock raises the level of macroeconomic uncertainty of about 3% relative to its steady state. It takes about 6 quarters to regain its steady state. Output falls immediately after the shock with a maximum impact 5 quarters after the shock. The negative comovement between output and uncertainty is a striking feature for the U.S. (see for example Basu and

11. Note that monthly variables are converted into quarterly by simple arithmetic average.
12. The KPSS test of stationarity indicates that all series are non-stationary because they are characterized by a trend. Once detrended all series are stationary and the VAR can be consistently estimated.
13. My paper is not the first to use a Cholesky-type identification to recover a structural uncertainty shock, Leduc and Liu (2016), Basu and Bundick (2014), Bachmann et al. (2013) (among other) use a similar strategy.

Bundick (2014), Leduc and Liu (2016) or Jurado et al. (2015)). Finally, a surprise increase in macroeconomic uncertainty leads to a non-significant response of particpation during the first 3 quarters following the shock. After this delay, the shock causes a significant decline in participation. On the overall, the dynamic response of participation is u-shaped. However and in contrast to output, its response is more persistent since it goes back to the pre-shock level after 3 years (against 2 years for output).

3.3.2 Robustness

The benchmark VAR presented in the last subsection suggests that an uncertainty shock diminishes the participation rate. In this subsection, I examine whether the main result is robust to several alternative choices.

Uncertainty indicator

By definition uncertainty is an unobservable concept with multidimensional origins such as financial markets, macroeconomics or economic policy. As a consequence of this inherent difficulty, it appears important to examine the sensitivity of the results to the choice of uncertainty proxy. In this subsection, I re-estimate the VAR by changing each time the measure of uncertainty. Specifically, I use three other proxies of uncertainty. The first one is the VIX index which measures the implied volatility of the S&P500 index options. The second one is the Composite Uncertainty Indicator (CUI, henceforth) constructed by Charles et al. (2015). In the spirit of the macroeconomic uncertainty index of Jurado et al. (2015), the CUI synthetizes distinct sources of uncertainty, namely macroeconomics, financial market and economic policy [14]. The third one is the News Based Economic Policy Uncertainty index of Bloom et al. (2012). It combines three components : newspaper survey, temporary federal tax code provisions and disagreement among economic forecasters. The left panel of figure 3.3 traces out the impulse response of participation to different type of uncertainty shocks. The qualitative responses of participation are similar whatever the measure of uncertainty, i.e. they follow an u-shaped pattern. However, the quantitative impacts are slightly different. For instance, the maximum decrease of participation is not reached in the same period, 9 quarters after the shock for the benchmark case against 7 quarters when the EPU index is used. When uncertainty is assessed by the VIX index the response of participation during the first three quarters is the highest, but remains indistinguishable from 0 (not shown in the figure). When the CUI index is used, the fall in participation appears to be of the

14. When the CUI is used as an uncertainty proxy the sample coverage is shorter. More specifically, the sample spans the 1985Q1-2011Q4 period which corresponds to the availability of the CUI data.

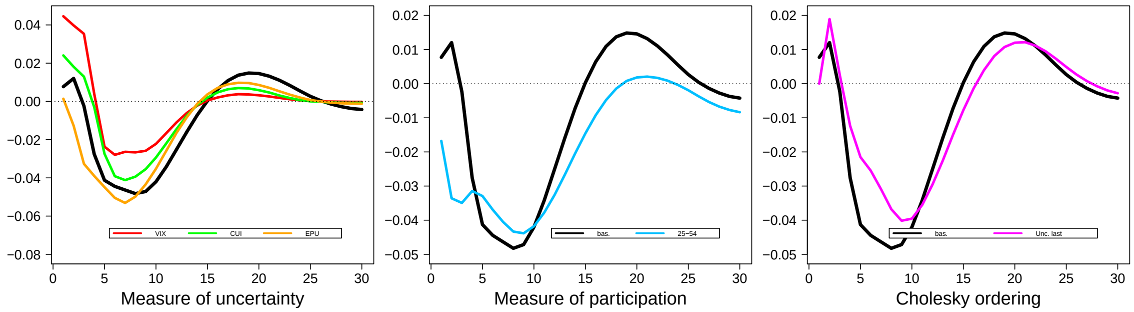

FIG. 3.3 – Robustness of VAR evidence.
Sources : Author's own calculations.
Notes : Black solid lines correspond each time to the benchmark case. The left panel presents impulse responses of participation to uncertainty shock obtained from separetely estimating tri-variate VAR. The red line corresponds to the case of the uncertainty proxy is the VIX index, the green line corresponds to the case of the uncertainty proxy is the CUI index from Charles et al. (2015), the orange line corresponds to the case of the uncertainty proxy is the Eonomic Policy Uncertainty index of Baker et al. (2016). The middle panel presents the impulse response consecutive to uncertainty shocks for different measures of participation. The red line refers to the case that the proxy of participation is the LFP rate of 25-54 years-old. The right panel presents impulse responses for different VAR ordering. The magenta line being the impulse response of LFP when uncertainty is ordered last.

same magnitude comparatively to the baseline. All in all, my favorite measure of uncertainty displays an impulse path for participation which closely tracks those obtained from other popular uncertainty proxies.

Measures of LFP

Demographic factors, as the retirement wave due to baby-boomers, have been often invoked to explain the downward trend followed by the LFP rate. To prevent demographic factors to play any role, in this subsection I focus on the core of the labor market. Specifically, I re-estimate the VAR of subsection 3.3.1 by replacing the participation variable by the LFP rate of 25-54 years old. The impulse response of participation in such a model is shown in the middle panel of figure 3.3. The dynamic response of participation is remarkably similar to the benchmark case and its u-shaped pattern is entirely preserved [15]. Since the recessionary evolution of participation is recovered when I focus on the 25-54 years old, demographic factors are not a noise for the main empirical results.

Cholesky ordering

Although the identification scheme chosen here is quite standard in the literature, the Cholesky ordering of the VAR is quite questionable. In order to check if this assumption may

15. Observe that the impulse response of the LFP rate of 25-54 years old is significant at the impact responses (not shown in the figure).

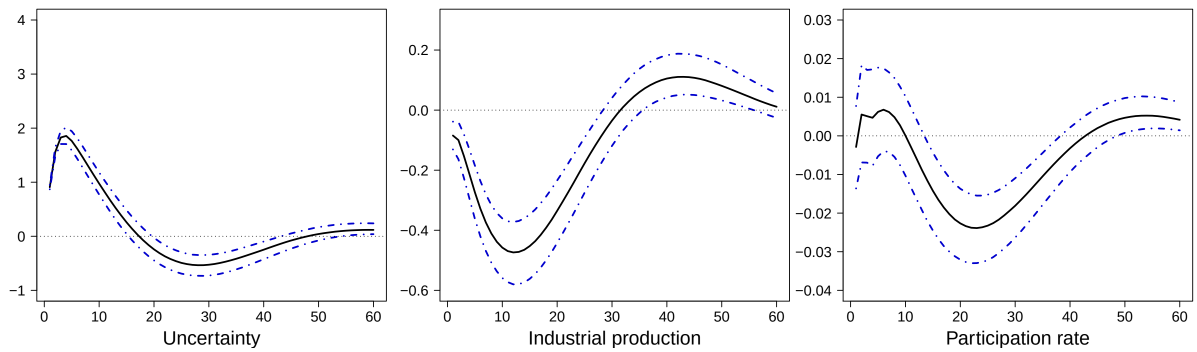

FIG. 3.4 – Impulse response functions to a one-standard deviation uncertainty shock - monthly data.
Sources : Author's own calculations.
Notes : Black solid lines correspond to median responses, blue error bands represent the 5th and 95th of the distribution of responses simulated by bootstrapping 10000 times the residuals of the VAR.

affect the results, the VAR is re-estimated with the measure of uncertainty ordered last. This novel ordering of the VAR implies that all shocks of the system may have a contemporaneous impact on uncertainty. Alternatively, in this context the unexpected uncertainty shock does not affect contemporaneously output and participation. The right panel of figure 3.3, which presents the result for the participation variable, indicates that the qualitative and the quantitative responses are nearly the same, whatever the Cholesky ordering of variables.

Monthly data

In order to examine whether the results are insensitive to the time length, I estimate a new VAR on monthly data. The structure of this empirical model is the same as in the baseline, except that real GDP is replaced by the industrial production index[16]. Figure 3.4 shows that the results hold. In particular, the response of LFP is u-shaped and non significant during the first year following the uncertainty shock. The finding is very similar to the one shown in figure 3.2.

More generous framework

As a final robustness check, and to ensure that comovements between uncertainty and participation are robust, I add two variables to the baseline VAR : the S&P500 index and the federal funds rate. Furthermore, I consider a novel ordering of the VAR[17]. To recover uncertainty shocks I apply a classical Cholesky decomposition and, except for the S&P500,

16. Real GDP is not available at monthly frequency.
17. The S&P500 is ordered first, then follow the macroeconomic uncertainty index, the federal funds rate, the LFP rate and real output. All variables, except the federal funds rate, are transformed in log and detrended with a HP filter before entering in the VAR.

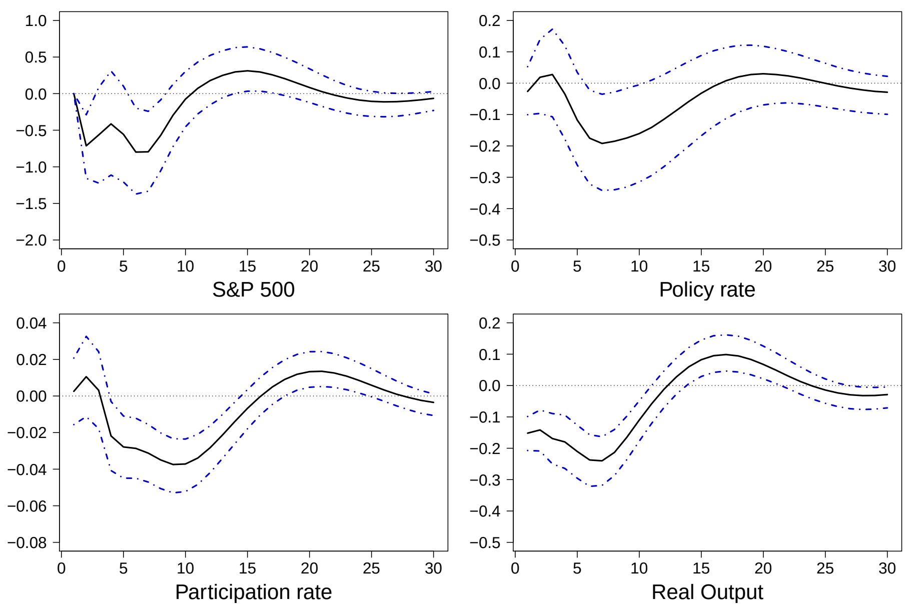

FIG. 3.5 – Impulse response functions to a one-standard deviation uncertainty shock - more generous framework.
Sources : Author's own calculations.
Notes : Black solid lines correspond to median responses, blue error bands represent the 5th and 95th of the distribution of responses simulated by bootstrapping 10000 times the residuals of the VAR.

macroeconomic uncertainty shocks may affect immediately U.S. real variables. Figure 3.5 plots the estimated responses to a one-standard deviation uncertainty shock. Unsurprisingly, an unexpected raise in uncertainty induces a decrease in stock market and policy rate. As previously, output and LFP level decline in an u-shaped manner. On the overall, my main results remain insensitive to the incorporation of other macro-variables in the system.

3.4 Model economy

All in all, the empirical exercise conducted in the last section demonstrates that there is a robust negative relationship between the unpredictability of the future state of the economy and the participation margin. This section takes another route and aims at reproducing this negative comovement within a theoretical model. In order to examine the effects of uncertainty about the future state of the aggregate economy on the labor market and especially the participation margin, I consider a DSGE model which departs from the standard New-Keynesian in the extent to which it incorporates : i) time-varying standard deviation of the technology shock ii) a frictional labor market in the spirit of Mortensen and Pissarides (1994), iii) and an endogenous participation margin. Furthermore, in its baseline development the model features external degree of habit persistence, risk adverse households maximizing their consumption levels, holding of bonds and labor supply. The production side is split in two sectors. In the first one, wholesale firms produce homogenous goods by using labor as their sole input. Wages are negotiated through the maximization of a Nash bargaining problem. The possibility of rigidities on wages is also studied. In the second one, retailers purchase intermediate goods and sell them directly to households on a monopolistic competitive market. Prices stickiness operates at this level by assuming that each period only an exogenous fraction of retailers can charge their own prices. The monetary policy authority is assumed to follow a Taylor rule. The New-Keynesian nature of the model is very useful since it easily allows for counterfactual analyses.

3.4.1 The household

The representative household can be seen as a large family composed by a continuum of measure one of individuals. Each family member can be classified either as a non-participant or as a participant to the labor market. In the former case, individuals enjoy leisure. In the latter case, individuals are engaged either in working activities either in searching for a job. As it is common in this literature, each family member has the same level of consumption, since each of them pools its income to insure each other against fluctuations in consumption due to instability position on the labor market. This assumption follows Merz (1995). The household discounted expected utility has the following form :

$$\mathrm{E}_t \sum_{t=0}^{\infty} \beta^t \left\{ \frac{(c_t - hc_{t-1})^{1-\sigma}}{1-\sigma} - \chi \frac{l_t^{1+\varphi}}{1+\varphi} \right\} \tag{3.1}$$

where β is the discount factor, c_t the level of consumption, l_t the size of the labor force, h the degree of habit persistence, σ the degree of risk aversion, φ the inverse of labor force participation elasticity with respect to wage and χ a scale parameter. The household is confronted to the following two constraints :

$$c_t + \frac{B_{t+1}}{p_t r_t^n} = w_t e_t + b(l_t - e_t) + \frac{B_t}{p_t} + \Theta_t - T_t, \forall t \tag{3.2}$$

$$e_t = (1-\rho)e_{t-1} + f_t(l_t - (1-\rho)e_{t-1}), \forall t \tag{3.3}$$

The household can spend its revenue by consuming or by purchasing bonds which pay a nominal interest rate r_t^n. The revenue of the household consists in wages of employed family members, unemployment benefits b of unemployed, bonds B_t, firm profits Θ_t minus taxes T_t paid to government. Furthermore, the constraint (3.3) corresponds to the household perceived law of motion of employment. It indicates that the level of employment in period t is equal to the sum of non-separated job in period $t-1$ (ρ being the exogenous job separation rate) plus the current job finding (f_t being the job finding rate). Observe that $l_t - (1-\rho)e_{t-1}$ is an alternative way to denote unemployment.

The household chooses c_t, B_{t+1}, e_t and l_t in order to maximize (3.1) subject to constraints (3.2) and (3.3). By denoting the Lagrangian of the household problem Λ_1, the first order conditions (FOCs, henceforth) are :

$$\frac{\partial \Lambda_1(.)}{\partial c_t} = 0 \Leftrightarrow \lambda_t = (c_t - hc_{t-1})^{-\sigma} - \beta h \mathrm{E}_t (c_{t+1} - hc_t)^{-\sigma} \tag{3.4}$$

$$\frac{\partial \Lambda_1(.)}{\partial B_{t+1}} = 0 \Leftrightarrow 1 = \beta \mathrm{E}_t \frac{r_t}{\pi_{t+1}} \frac{\lambda_{t+1}}{\lambda_t} \tag{3.5}$$

$$\frac{\partial \Lambda_1(.)}{\partial l_t} = 0 \Leftrightarrow \Gamma_t = \frac{\chi l_t^{\varphi} - \lambda_t b}{f_t} \tag{3.6}$$

$$\frac{\partial \Lambda_1(.)}{\partial e_t} = 0 \Leftrightarrow \Gamma_t = \lambda_t (w_t - b) + \mathrm{E}_t \beta \Gamma_{t+1} \left((1-\rho)(1-f_{t+1})\right) \tag{3.7}$$

where λ_t is the Lagrange multiplier associated to constraint (3.2), Γ_t the one associated to (3.3) and $\pi_{t+1} = \frac{p_{t+1}}{p_t}$ the price inflation. The FOC (3.4) represents the utility marginal of consumption when the model features habit persistence in consumption. The FOC (3.5) is the conventional Euler equation for bonds. Finally, merging equations (3.6) and (3.7) gives the following participation condition :

$$\chi l_t^{\varphi} \lambda_t^{-1} = b(1-f_t) + f_t \left(w_t + \mathrm{E}_t \beta (1-\rho) \frac{1-f_{t+1}}{f_{t+1}} \frac{\lambda_{t+1}}{\lambda_t} (\chi l_{t+1}^{\varphi} \lambda_{t+1}^{-1} - b) \right) \tag{3.8}$$

The LFP condition states that the marginal utility loss from allocating one additional family member into participation should equalize - at the optimum - the marginal expected return from having one additional member into the labor force. This expected payoff of participation is divided in two terms. On the one hand, if the job search fails at forming a match an unemployment benefit b is perceived. On the other hand, if the job search succeeds in forming a match, the payoff consists in a wage plus the continuation value. As indicated in Arseneau and Chugh (2012), the participation condition can be assimilated, from the household point of view, to a free-entry condition into search activities. Furthermore, it is noteworthy that in the event that matching frictions disappear, the above condition becomes identical to a standard labor/leisure condition [18]. In this model, instead, labor market frictions act and

18. Matching frictions are erased when the job finding rate is equal to 1. In this case the LFP condition is simply : $\chi l_t^{\varphi} \lambda_t^{-1} = w_t$.

participation is increasing with the job finding rate. All else being equal, when the job finding rate is high, returns of search activities are also high, and the value of participation increases. In this event, the household has an incentive to allocate more family members into search activities.

3.4.2 The labor market

The labor market is subject to search frictions *à la* Mortensen and Pissarides (1994). Specifically, it is assumed that to form a matched pair both firms and workers must engage in a costly and time-consuming search process. The existence of labor market frictions formalizes the idea that unemployment is an equilibrium outcome. Each period t, the aggregate flows of hires m_t are characterized by a Cobb-Douglas matching technology of the form :

$$m_t = \omega s_t^{\alpha} v_t^{1-\alpha} \tag{3.9}$$

where s_t denotes unemployed searchers and v_t aggregate vacancies. The parameter $\omega > 0$ reflects the matching efficiency and $0 < \alpha < 1$ corresponds to the elasticity of the matching technology with respect to search unemployment. As the matching function exhibits constant returns to scale, it is convenient to define the labor market tightness as $\theta_t = \frac{v_t}{s_t}$. During a period the job finding probability is $f_t = \frac{m_t}{s_t} = \omega\theta_t^{1-\alpha}$. Analogously, the probability that an open vacancy is filled is $q_t = \frac{m_t}{v_t}$.

When a firm and a worker succeed in forming a job match, it is assumed that the newly created job becomes immediately productive. The timing of events can be summarized as follows. At the begining of each period, a fraction ρ of existing jobs in the previous period is severed for some exogenous reasons. Then, the representative family makes its optimal decisions for LFP. The individuals allocated into job search plus those who were separated constitute the pool of job seekers s_t. A fraction f_t of these individuals find a job. As a consequence of this timing, a measure $e_t = (1-\rho)e_{t-1} + f_t s_t$ of individuals is productive in period t and a measure $u_t = 1 - e_t$ of individuals remain unemployed and receives an unemployment benefit.

3.4.3 Intermediate good producers

The intermediate sector is composed by a continuum of firms. They produce an homogeneous good and they sell it to retailers in a competitive market. Firms in the intermediate sector use labor (which they hire in the frictional labor market) as their sole input. The aggregate production function is given by :

$$y_t = z_t e_t \tag{3.10}$$

where z_t denotes the aggregate level of technology. It follows the following stationary stochastic process :

$$z_t = (1-\rho_z) + \rho_z z_{t-1} + \sigma_t^z \varepsilon_t^z \tag{3.11}$$

where, $-1 < \rho_z < 1$ represents the degree of persistence of the technology shock, ε_t^z the i.i.d. innovation of the technology process. The variable σ_t^z is not common in the DSGE literature. It is the time-varying standard deviation of the technology shock used as the model proxy for the uncertainty shock. Note that, in this framework an uncertainty shock is a second moment shock which follows the following autoregressive process :

$$\sigma_t^z = (1-\rho_\sigma)\sigma_z^* + \rho_\sigma \sigma_{t-1}^z + \sigma^\sigma \varepsilon_t^\sigma \tag{3.12}$$

In the latter equation, the parameter ρ_σ corresponds to the degree of persistence of the uncertainty shock, σ_z^* is the steady state standard deviation of the technology shock ε_t^z, ε_t^σ is an i.i.d. shock to the volatility of technology shocks and σ^σ its standard deviation. Similar modeling of uncertainty shocks can be found in Fernández-Villaverde et al. (2011), Basu and Bundick (2014) and Leduc and Liu (2016) (among other). In my baseline model, I focus mainly on the understanding of the effects of unexpected innovations in the volatility of the technology shock process, i.e. the response to ε_t^σ.

Intermediate good producers maximize their discounted profit by choosing the optimal level of employment e_t, the optimal number of vacancies v_t and by taking the wage as given

$$\mathrm{E}_t \sum_{t=0}^{\infty} \beta^t \frac{\lambda_t}{\lambda_0} \left(\frac{y_t}{\mu_t} - \kappa v_t - w_t e_t \right) \tag{3.13}$$

Subject to its perceived law of motion of employment

$$e_t = (1-\rho) e_{t-1} + q_t v_t \tag{3.14}$$

where in (3.13) $\mu_t = \frac{p_t}{p_t^x}$ define the price markup of retailers over intermediate good producers, κ denotes the vacancy posting cost and w_t the wage. The FOCs of this problem are (with Λ_2 the Lagrangian associated to the firm problem) :

$$\frac{\partial \Lambda_2}{\partial e_t} = 0 \Leftrightarrow J_t = \frac{z_t}{\mu_t} - w_t + \mathrm{E}_t \beta \frac{\lambda_{t+1}}{\lambda_t} (1-\rho) J_{t+1} \tag{3.15}$$

$$\frac{\partial \Lambda_2}{\partial e_t} = 0 \Leftrightarrow \frac{\kappa}{q_t} = J_t \tag{3.16}$$

Equation (3.15) represents the expected value of a job match for a firm. Merging the last two equations leads to the job creation condition :

$$\frac{\kappa}{q_t} = \frac{z_t}{\mu_t} - w_t + \mathrm{E}_t \beta \frac{\lambda_{t+1}}{\lambda_t}(1-\rho)\frac{\kappa}{q_{t+1}} \tag{3.17}$$

The job creation condition states that at the equilibrium the expected cost of posting a vacancy equalizes the expected benefit of creating a new match. This benefit is composed of the current net surplus (real revenues minus the wage) plus the continuation value [19].

3.4.4 Wage setting

In equilibrium, when a matched pair is created its total surplus should be higher than the sum of outside options. As it is standard in this literature, I assume that the wage, which shares this rent, is established through the solution of a Nash bargaining problem. Before describing the outcome of the Nash bargaining, the surpluses induced by the match have to be identified. The value of a job from the firm point of view is already known since it is given by equation (3.15). For workers, the marginal surplus from being employed corresponds to the derivative of the household problem with respect to employment e_t divided by the marginal utility of consumption λ_t. Thus, based on (3.7), it is possible to write the worker surplus $W_t - U_t$ as follows :

$$W_t - U_t = w_t - b + E_t \beta (1-\rho)(1-f_{t+1})(W_{t+1} - U_{t+1}) \tag{3.18}$$

The wage w_t chosen by the two partners satisfies the following optimal condition :

$$W_t - U_t = \frac{\eta}{1-\eta} J_t \tag{3.19}$$

with η the exogenous bargaining power of firms. After substitution of the expressions of the two surpluses into (3.19), the following expression for the Nash bargained wage w_t^N is obtained :

$$w_t^N = (1-\eta)b + \eta \left(\frac{z_t}{\mu_t} + E_t \beta (1-\rho) \frac{\lambda_{t+1}}{\lambda_t} f_{t+1} \frac{\kappa}{q_{t+1}} \right) \tag{3.20}$$

The Nash bargained wage split the rent generated by the job relationship according to the bargaining weight η. Hence, the first term of the right hand side states that workers are compensated for a fraction $1-\eta$ of the foregone unemployment benefit. The second term on

19. Implicitly, it is assumed that firms have a zero return when a job destruction takes place.

the right hand side indicates that workers are rewarded for a fraction η of firm revenues.

In a recent paper, Cacciatore and Ravenna (2015) study the importance of wage rigidity for the transmission of uncertainty shocks. They demonstrate that it greatly amplifies the response of the economy to surprise shocks. Inspired by this kind of evidence, I introduce wage rigidity in the model. Following, Leduc and Liu (2016) I assume that wage evolution is given by :

$$w_t = w_{t-1}^{\varsigma}(w_t^N)^{1-\varsigma} \tag{3.21}$$

where $0 < \varsigma < 1$ captures the degree of wage rigidity. In other words, the logarithm of aggregate wages is the weighted sum of the wage prevailing in the previous period plus the wage Nash bargained in current period. The weights being the share of matched pairs which are able to renegotiate and those which are not. This framework breaks down the conventional assumption saying that wages are implicitly renegotiated each period.

3.4.5 Retailers and price adjustments

There is a measure one of retailers indexed by j operating in a monopolistic competitive market. Retailers purchase aggregate intermediate goods, transform each unit of these goods into retail goods before resell them directly to households. Let $y_t(j)$ be the quantity of output sold by retailer j. In this context, final output is produced according to the following constant return to scale technology :

$$y_t = \left(\int_0^1 y_t(j)^{\frac{\epsilon-1}{\epsilon}} dj\right)^{\frac{\epsilon}{\epsilon-1}} \tag{3.22}$$

where ϵ is the elasticity of demand for each intermediate good. The demand curve faced by each retailer can be written as :

$$y_t(j) = \left(\frac{p_t(j)}{p_t}\right)^{-\epsilon} y_t \tag{3.23}$$

with $p_t(j)$ the nominal price set by retailer j, while, p_t is the aggregate price index $p_t = \left(\int_0^1 p_t(j)^{1-\epsilon} dj\right)^{\frac{1}{1-\epsilon}}$. Price stickiness takes place at this level. Following Calvo (1983) it is assumed that retail firms are not able to choose their own prices. More specifically, each period a fraction $1-\xi$ of retail firms can choose a new price, whereas, the other fraction ξ is stuck and constrained to keep the price prevailing in the previous period. The probability of a price change is constant overtime and independent of the time elapsed since the last adjustment. This assumption implies that a retail firm keeps the same price on average during $\frac{1}{1-\xi}$ periods. Retailers integrate that they may be stuck with a price during s periods and maximize the following discounted profits :

$$\max E_t \sum_{s=0}^{\infty} \xi^s \beta^s \frac{\lambda_{t+s}}{\lambda_t} \left(\frac{p_t(j)}{p_{t+s}} - x_{t+s} \right) \left(\frac{p_t(j)}{p_{t+s}} \right)^{-\epsilon} y_{t+s} \tag{3.24}$$

Finally, the prices evolution are given by

$$p_t = \left[(1-\xi)(p_t^*)^{1-\epsilon} + \xi p_{t-1}^{1-\epsilon} \right]^{\frac{1}{1-\epsilon}} \tag{3.25}$$

with p_t^* the optimal price.

3.4.6 Monetary authority and market clearing

The central bank controls the monetary policy by choosing the level of nominal interest rate according to a modified Taylor rule :

$$\left(\frac{r_t^n}{(r^n)^*} \right) = \left(\frac{\pi_t}{\pi^*} \right)^{\gamma_\pi} \left(\frac{y_t}{y^*} \right)^{\gamma_y} \tag{3.26}$$

with $(r^n)^*$, π^* and y^* the steady state values of the nominal interest rate, the inflation rate, and output respectively [20]. The coefficients γ_π and γ_y represent the degree of reaction of the central bank to deviation of inflation and unemployment rate from their steady states. As written in equation (3.26), the Taylor rule can be used to test different scenario of monetary policy [21]. Observe that this Taylor rule is identical to the one used by Leduc and Liu (2016).

Finally market clearing is achieved by imposing the following resource constraint :

$$y_t = c_t + \kappa v_t \tag{3.27}$$

The last equation states that output is either consumed or spent in vacancy posting.

3.4.7 Solution method

The purpose of the theoretical analysis is to assess the effects of a volatility increase (a positive shock to ε_t^σ) while keeping the level of productivity constant. To do so, I follow the bulk of the literature and I solve the model by perturbation methods to obtain an approximation of the policy functions. Since the work of Aruoba et al. (2006), it is recognized that perturbation methods are accurate and able to deliver a solution in a reasonable amount of

20. Henceforth, the superscript * denotes the steady state of variables.

21. In a robustness check, I assume that the monetary authority also responds to unemployment gap. In this case, the modified Taylor rule is $\left(\frac{r_t^n}{(r^n)^*}\right) = \left(\frac{\pi_t}{\pi^*}\right)^{\gamma_\pi} \left(\frac{y_t}{y^*}\right)^{\gamma_y} \left(\frac{u_t}{u^*}\right)^{\gamma_u}$, see also subsection 3.5.3.

Parameter	Signification	Value/Target
β	Discount factor	0.99
σ	Degree of risk aversion	1.5
φ	Inv. of Frisch elasticity	5
h	Habit persistence	0.2
ξ	Prob. of price stickiness	0.75
μ^*	Price markup	1.2
e^*	S.s employment rate	0.94
l^*	S.s participation rate	0.63
ρ	Job separation rate	0.07
q^*	Job filling rate	0.7
θ^*	Tightness	0.7
f^*	Job finding rate	0.49
κ	Vacancy posting cost	$\frac{\kappa v^*}{y^*} = 0.7\%$
b	Unemployment benefits	$\frac{b}{w^*} = 40\%$
η	Bargaining power	0.9

Tab. 3.1 – Baseline calibration.

time. As expressed in Fernández-Villaverde et al. (2011) traditional approximation methods, as log-linearization, do not work for the problem in hand. In particular, due to certainty equivalence a first-order approximation does not allow the examination of second moment shocks. In this case, the policy functions are varying only with level shocks and second moment shocks do not appear at all in the policy functions [22]. Moreover, a second-order approximation of the policy functions is also inconsistent because it captures the effects of second moment shocks indirectly. In particular, in the latter case the second moment shocks enter the policy functions with a non-zero coefficient in their interaction with their respective level shock. As a consequence, it is impossible to measure the effects of volatility shocks by maintaining constant the level shock associated. The innovations to second moment shocks enter separately in the policy functions, and independently of the level shocks, only in a third-order approximation [23].

A consequence of the use of a third-order approximation is that it moves the ergodic distributions of the endogenous variables away from their deterministic steady state values. This is potentially a problem for the computation of the impulse response functions. Thus, to limit this pitfall, I follow the same strategy than Basu and Bundick (2014). More specifically, starting from the steady state values, I simulate the model during 2000 periods by

22. As expressed in Fernández-Villaverde et al. (2011), the coefficients associated with these kind of variables are zero.
23. Since the version 4.0, the pruning algorithm of Andreasen et al. (2013) is implemented in Dynare.

shutting-off all the shocks of the system. This allows me to have that the literature calls the "stochastic steady state", i.e. the set of value reached wherein no shock perturbs the system. Then, I compute the impulse responses in percent deviation from the stochastic steady state of the model [24].

3.4.8 Calibration

The model is calibrated in order to reproduce key stylized facts of the U.S. economy. Period length is measured in quarter. The discount factor β is fixed to 0.99 implying an annual interest rate of 4%. The degree of risk aversion σ if set to 1.5. Along the lines of Campolmi and Gnocchi (2016), the parameter φ reflecting the inverse of the elasticity of participation to real wages variations is set to 5. This implies a low reaction of participation to changes in the macroeconomic environment. There is no large consensus about the value governing habit persistence. By choosing a value of h equal to 0.2, I follow Guglielminetti (2015) and the baseline model features moderate degree of habit persistence in consumption.

From the production sector of the model economy, I follow the literature by fixing μ^*, the steady state markup of retailers on intermediate firms, to 1.2. I set the probability that retailers cannot reset their prices to 0.75.

On the labor market, some steady state and parameters are based on their observed average values. Thus, the steady state value of the employment rate is set to 94% [25]. Similarly, the steady state participation rate is set to 63%. Concerning the exogenous job separation rate, estimates range from 0.07 to 0.15. Consistently with Merz (1995), I retain the lower bound. The scalar parameter of efficiency ω of the matching function is chosen in order to pin down a quarterly job filling rate of 0.7. This set of values implies a steady state labor market tightness and a steady state job finding rate equal to 0.7 and 0.49, respectively. The cost induced by a vacancy posting κ is set in order to pin down a total vacancy expenditure which represents less than 1% of total output. This strategy follows Abowd and Kramarz (2003), Chéron and Langot (2004) and Blanchard and Galí (2010). As in Campolmi and Gnocchi (2016), the value of unemployment benefit is fixed to target a steady state replacement ratio $\frac{b}{w^*}$ of 40%. The value of the firm bargaining power η is not imposed but deduced from the equilibrium condition. Thus, the implied firm bargaining power is equal to 0.9 [26].

24. It is also possible to compute an alternative generalized impulse response using simulation procedure around the ergodic mean of the endogenous variable in the spirit of Koop et al. (1996). However, as demonstrated by Basu and Bundick (2014) the two methods of impulse response computations provide nearly identical results.

25. More precisely, it corresponds to the employment rate within that active population.

26. The overall (quantitative and qualitative) results remain insensitive when η is set to 0.5, a more conventional value.

As regard to the monetary policy rule, I follow standard practices. Hence, γ_π the coefficient of reaction to inflation deviations is set to 1.5 and γ_y is set to 0.5. When the Taylor rule includes a reaction to unemployment gap, the γ_u is set to 0.125 as in Campolmi and Gnocchi (2016). Furthermore, a zero steady state inflation is targeted.

Finally, let me now turn to the calibration of the two shocks of the model. As standard, the steady state level of aggregate technology is required to be equal to 1. For the persistence of the technology shock, I retain a value of 0.90. Its standard deviation σ_z^* is set to 0.1. Consensus is not reached about how to calibrate the second moment shock of uncertainty. Along the lines of Basu and Bundick (2014), I retain a value of 0.8 for its persistence degree. Concerning the standard deviation of the uncertainty shock, I fix it to match the standard deviation of the empirical uncertainty shock.

3.5 Results

This section presents the theoretical impulse response functions. In order to give more intuition about the transmission channel of uncertainty shocks, the model is gradually modified. First, I consider the case of price flexibility. Second, price stickiness is introduced into the economy in order to activate the demand channel. Finally, under price stickiness, several alternative calibrations are considered. This last step allows me to check for the robustness of the overall results.

3.5.1 Model with price flexibility

As a starting point, I begin with the investigation of a model without prices stickiness. This framework is useful because it erases the demand channel. Two different mechanisms operate for the transmission of uncertainty shocks. First, higher uncertainty in the economy activates a precautionary saving motive leading the household to supply more labor in order to work more and insure it against risk. In the model developed here, the household will be more likely to allocate more individuals into search activities. As suggested by equation (3.8), the benefit of participation depends on current return (an unemployment benefit if the worker does not find a job or a wage if she finds a job) plus a discounted continuation value. All else being equal, higher uncertainty decreases the interest rate implying an elevation of the continuation value. Second, as the labor market is characterized by search frictions, an increase in uncertainty may induce firms to post fewer vacancies. As highlighted by Leduc and Liu (2016), a job match is similar to an (partially) irreversible investment. In this spirit, uncertainty pushes up the real option value of "wait and see" to have more information

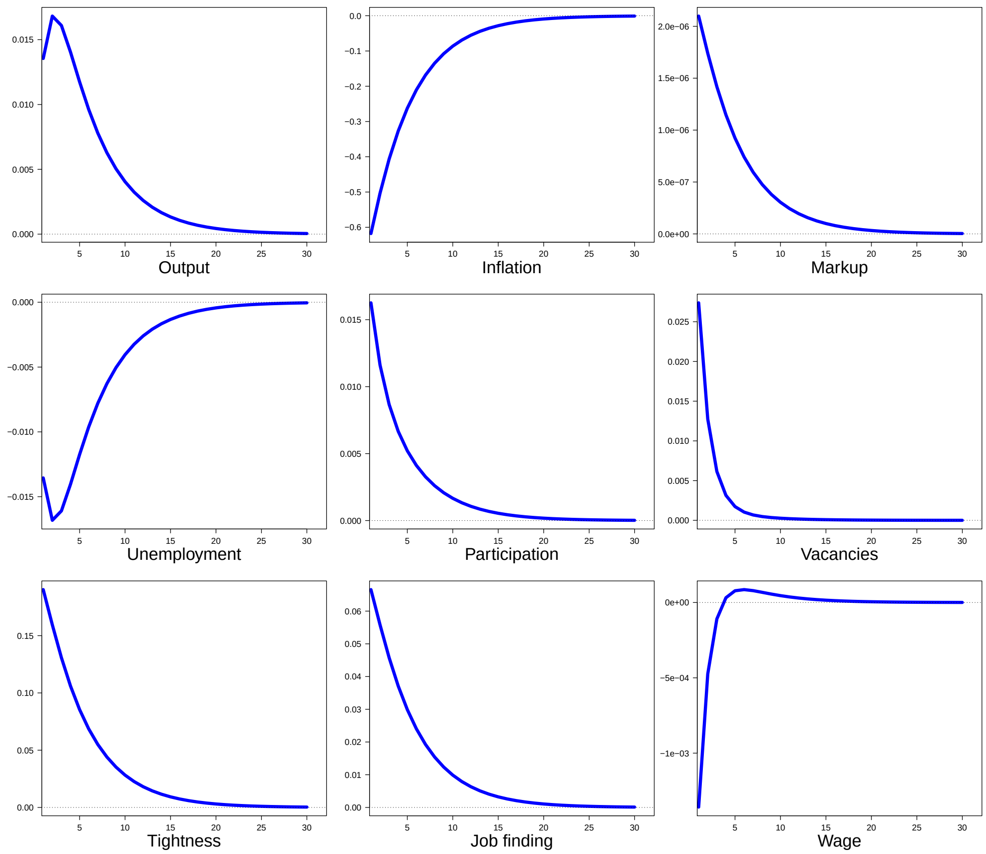

FIG. 3.6 – Impulse responses to an uncertainty shock under flexible prices.
Sources : Author's own calculations.
Notes : Percentage deviations from trend are plotted.

about the future and firms make a pause in their hiring investments. This channel may be important for LFP. A decrease in vacancy posting lowers the job finding probability leading ultimately to a fall in the gain of search activities. In reaction to this channel, the household will allocate fewer individuals into participation.

To put in evidence the dominant effect governing in such a model, figure 3.6 plots the impulse responses associated to this scenario. Unambiguously, the first effect prevails and uncertainty shocks give rise to a stronger precautionary saving motive. Thus, after the surprise the participation value increases and the number of participants increases. As more individuals search for a job, it becomes easier to fill a vacancy and firms are more likely to post new vacancies. The job finding rate increases leading to a fall in unemployment (the job separation margin being exogenous in the model). More inputs are used in production and retail firms will take advantage of this by lowering prices to meet demand. Ultimately, uncertainty is expansionary since output increases.

The dynamic behavior of the model economy contradicts my empirical evidence. It is also

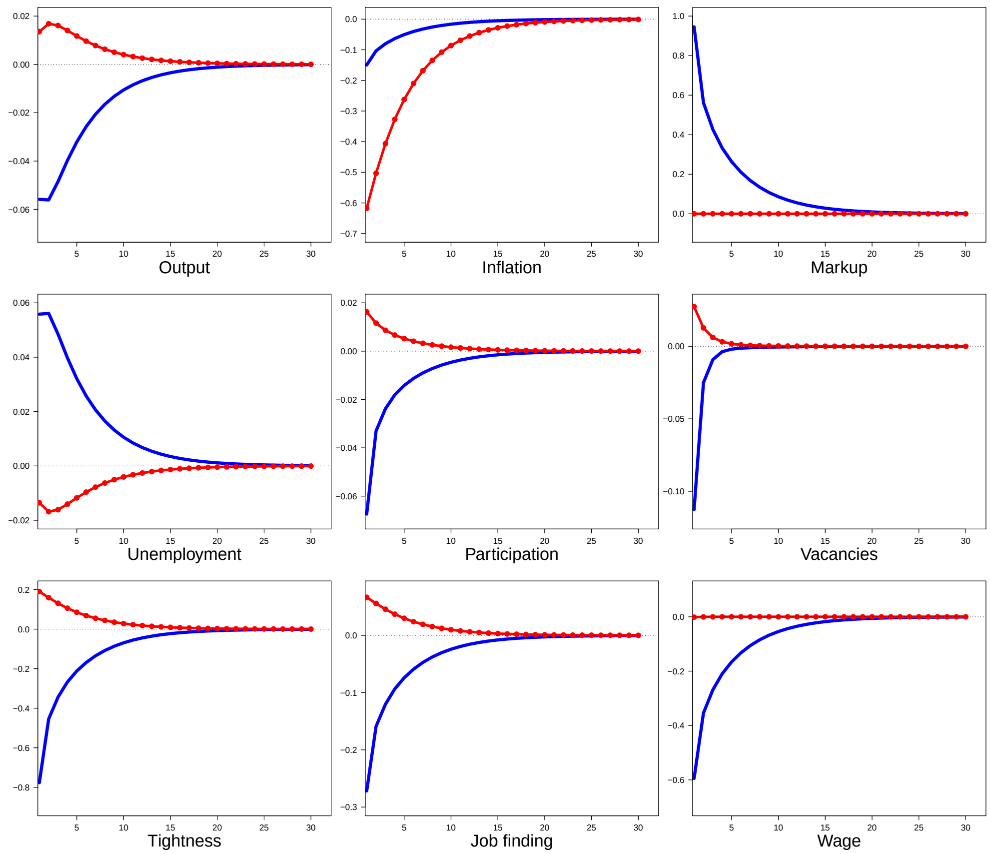

FIG. 3.7 – Impulse responses to an uncertainty shock under price stickiness.
Sources : Author's own calculations.
Notes : Percentage deviations from trend are plotted. Blue lines correspond to IRFs for a model with sticky prices. Red lines correspond to ird for a model with flexible prices.

at odds with theoretical illustrations of Leduc and Liu (2016) [27] and Guglielminetti (2015) [28]. In those models, close to the one developed here, but with an inelastic labor supply, they both find that uncertainty is recessionary since it declines output and increases unemployment. The surge in unemployment being explained by the raise in the value option of "wait and see". The non-abstraction of the participation margin explains these divergent results. As indicated previously, the participation condition is close to a traditional labor/leisure condition (the difference being frictions on the labor market) which induces a higher precautionary motive. In the context of the model developed here, this is translated to an important "flow" of non-participant members into the participation pool.

3.5.2 Introduction of price stickiness

In this subsection, I activate the demand channel by adding price stickiness to the model economy. Since the work of Basu and Bundick (2014), it is recognized that price rigidities greatly magnify the theoretical responses to an uncertainty surprise. Figure 3.7 depicts the dynamic responses of several key macroeconomic variables to a volatility uncertainty shock. First of all, in quantitative terms, the impulse responses confirm that price stickiness is an important channel for the transmission of uncertainty shocks. For instance, the peak response of output is multiplied by 3, while the peak response of participation is multiplied by a factor of around 7 (in absolute term for both). Second, the message delivered by the model economy is in stark contrast with findings of the previous subsection since now an uncertainty shock leads to a decline in output, labor market tightness, job finding rate and participation. Conversely, in this setup the price markup and the measure of unemployment both increase.

The general mechanism may be summarized as follow. When uncertainty shocks hit the economy, household behavior is driven again by a precautionary motive. Thus, all else being equal, the household chooses to consume less and to supply more labor. Under sticky prices, retailers cannot take full advantage of this increase of labor supply, which ultimately translates into higher markup. Furthermore, as price rigidities prevent firms to meet the new depressed demand, their profits fall. Finally, observe that the "wait and see" channel acts. Facing to higher uncertainty about the future level of productivity, firms prefer to postpone their hiring investments. These three mechanisms, when they are combined, unambiguously yield to a diminution in firm profits and in the value of a job match. As a consequence, fewer vacancies are opened and the job finding probability decreases implying higher unemployment. The decrease in the LFP results from this fall in job finding opportunities. As illustrated in equation (3.8), if the labor market is tightened from worker's point of view, the participation value decreases and the household optimally allocates fewer members into participation.

The analysis of this subsection confirms that the demand channel is crucial to reproduce comovements observed in the data. It completely reverses the expansionary effects of uncertainty observed under flexible prices. The introduction of price stickiness is also of first interest for the behavior of labor market variables. Hence, in this framework, the model is able to replicate the surge of the unemployment rate and the drop of participation observed empirically. From a theoretical point of view, it seems that the decrease in firm opportunities, which alter the efficiency of the match process, is key to understand the decrease in participation. The next subsection will test the sensitivity of these results to different model

27. For more details, see subsection IV.2.1 and figure 6 of their paper
28. For more details, see subsection 6.2 and figures 8 and 9 of her paper

specifications.

3.5.3 Sensitivity analysis

Figure 3.8 compares the response of the model economy under different parameterizations. All models presented in the figure feature price stickiness. Blue solid lines correspond to the specification including wage rigidity. Red lines refer to the model presented in the last subsection. Green and orange lines trace out the impulse responses for a model with an alternative formulation of the Taylor interest rule, and with high unemployment benefits respectively. Finally, the black-dashed lines correspond to a model with both wage rigidity and high level of habit persistence. In qualitative term, all impulse responses deliver the same message. Heightened uncertainty unambiguously increases unemployment, while, it has a negative effect on output, inflation, wage, labor market tightness and participation. Nonetheless, it should be noted that the purely quantitative effects are varying.

The introduction of wage rigidity is an additional transmission channel of uncertainty shocks. In this framework, an unexpected rise in uncertainty leads to the highest response of output, labor market tightness, unemployment and LFP. Unsurprisingly, the wage decrease is weak. Specifically, exposed to more uncertainty firms are not able to adjust wage downwards. This mechanism amplifies the decrease in the match value leading to a fall in labor market tightness and job finding (not shown on figure 3.8). From the household point of view, the value of allocating an additional member into participation decreases. At the optimum, fewer members move from non-participation to participation. The results presented here confirm the conclusion of Cacciatore and Ravenna (2015) about the important role of wage sluggishness.

When the replacement ratio is high (80% of real wage), the surge in unemployment is also important. Indeed, in this setup an unemployment spell has a higher value, leading workers to be more reluctant for accepting low wage.

As the model is demand driven, I investigate the effect of a change in the monetary policy conducted by the central bank. Thus, I run the model with an alternative Taylor rule. In particular, it is assumed that the monetary policy reacts to deviations of inflation, output gap and the unemployment gap. Under this scenario the response of the economy is significantly different. As shown in figure 3.8, the responses of output and inflation are sharply lower. For instance, the fall in output is 10 times less important with this specification. On the labor market, the new monetary policy has an important stabilizing role. As monetary policy reacts to unemployment gap, the fall in unemployment is the lowest. Furthermore, the labor market tightness is almost constant following the shock, leading ultimately to a moderate decline in participation.

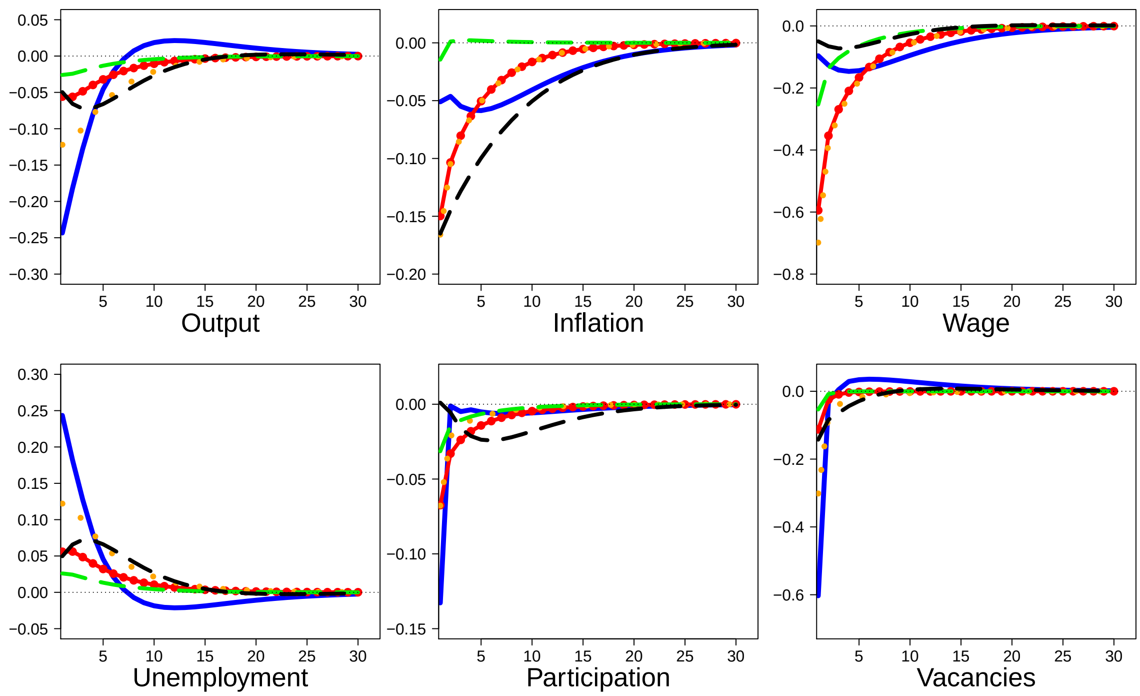

FIG. 3.8 – Impulse responses to uncertainty shocks - alternative calibrations.
Sources : Author's own calculations.
Notes : Percentage deviations from trend are plotted. Blue lines correspond to IRFs for a model with sticky prices and wage rigidity. Red lines correspond to IRFs for a model with sticky prices. Green lines correspond to IRFs for a model with sticky prices and an alternative formulation of the Taylor rule. Orange dotted lines correspond to IRFs for a model with sticky prices and high unemployment benefits (80% of real wages). Black dashed lines correspond to IRFs for a model with sticky prices wage rigidity and high level of habit persistence.

Finally, note that the empirical shapes of output and participation are retrieved when the model features a high degree of habit persistent and rigid wages. Thus, in this particular setup, the responses of output and participation are u-shaped. The peak response is reached approximately one year after the shock (the peak being achieved with a slight lag for participation). Furthermore, a hump-shaped pattern of unemployment, similar to the one found by Caggiano et al. (2014), is also reproduced.

3.6 Conclusion

This paper is the first to investigate the potential link between uncertainty and participation from empirical and theoretical points of view. Using a tri-variate structural Vector Autoregression, I show that an unexpected increase in uncertainty leads to an u-shaped dynamic response of participation. Although the impact response is not significant, it is statistically significant 2 quarters after the impact and relatively persistent thereafter. The negative comovement between uncertainty and LFP is robust to several VAR alternatives. Hence, when I change the measure of uncertainty, the qualitative response is entirely preserved and my favorite measure of uncertainty (the macro uncertainty index of Jurado et al. (2015)) appears to be a consistent estimate of the reaction of LFP to such a shock. Furthermore, the main result is insensitive to the choice of participation variable and to the Cholesky ordering.

I then incorporate search frictions, endogenous participation decisions and a time-varying uncertainty shock into an otherwise New Keynesian DSGE model. I show that the replication of empirical comovements is not straightforward. Thus, if the model features flexible prices, uncertainty is expansionary, increases output and participation but decreases unemployment. In this context, the precautionary saving motive dominates over the value option of "wait and see" of firms. Adding price stickiness greatly magnifies the response of the economy to uncertainty surprise. Furthermore, it is a key factor to reproduce observed comovements. In such a framework, firms cannot change their prices to meet the depressed demand. Hence, in addition to the "wait and see" channel, the demand channel pushes down future profits of firms. This mechanism totally undoes the precautionary behavior of household which responds to the fall in labor market tightness by moving fewer members from non-participation to participation. In addition, I also indicate that monetary policy can greatly stabilize the detrimental effect of uncertainty. Finally, along the lines of Cacciatore and Ravenna (2015), I demonstrate that, as sticky prices, wage rigidities is an important mechanism for the transmission of uncertainty shocks on participation. As firms cannot freely renegotiate future wages, future profits of firms further reduce, leading to an even more decrease in LFP.

The findings outlined in this paper are complementary to previous works. It emphasizes that the abstraction from the participation margin may be misleading, even if it seems to be acyclical in the data. It supports the view that rigidities on prices and wages are important keys for reproducing the negative relationship between uncertainty, output and participation. Furthermore, I think that the theoretical relationship between uncertainty and participation should be studied in more depth and in a more complex framework than the one proposed here. For instance, adding capital accumulation or specific labor market institutions in a theoretical model would be probably informative. In this sense, this paper should be seen as a starting point in the investigation of the relationship between the participation to the labor market and economic uncertainty.

Chapitre 4

The Causal Effect of Family Size on Mother's Labor Supply : Evidence from Reunion Island and Mainland France

4.1 Introduction

In Reunion Island [1], the participation rate to the labor market of women has experienced an important increase. In four decades, female participation increased by 30 percentage points, starting from 30% in 1974 to reach 60% in 2012. During the same period, the average number of children per women decreased dramatically from 6 children per women to 2.3. These two major trends about female participation and fertility behaviors are striking features also shared by French women since the post-World War II [2]. Nonetheless, a snapshot of women activity in 2012 shows that the labor supply of Reunionese women continues to be lower of approximately 10 percentage points comparatively to its French mainland level. Moreover, the fertility indicators still indicate that a Reunionese woman has more children than in France. The main objective of this paper is to study to what extent the gap in terms of women fertility can be an explanation of the different level of female activity between the specific region of Reunion and mainland France.

The identification of a causal relationship between motherhood and female participation

1. For simplicity, in the rest of the paper I use the short terms of Reunion to designate the Reunion Island. The term mainland France or France are used interchangeably to designate mainland France.

2. The decline in fertility is less pronounced in France since its level amounted to 2.5 children per women in 1970 and reached a value of 1.9 in 2012.

is of particular importance for both researchers and policy makers. It is crucial to understand the reason explaining the decrease in female participation with the number of children. For instance, if this decline is not related with female fertility but rather a consequence of other factors as the education level, policies aiming at reconciling professional and private life could not be efficient [3]. By contrast, if fertility has a negative causal impact on female activity, then such policies have higher chances to reach their targets and might be efficient. In the special case of Reunion, the interest could be even higher since it shares the same family policies than in France. In the case that family size has a more negative impact on female participation in Reunion than in France, policy makers should take into account this specificity by reinforcing policies that help mothers to reconciling family and work responsibilities.

The concrete measure of the relationship between family size and female labor supply is not straightforward. Although *prima facie* the correlation between them appears to be negative, it is quite hard to disentangle a causal relationship for at least three reasons. First, the two behaviors are influenced by common factors. Second, both fertility and participation decisions are jointly determined and it is difficult to determine whether the former is a cause or a consequence of the latter. Third, adverse selection driven by unobserved factors complicates the identification of a causal impact. It remains entirely possible that women with the biggest family size have a worse situation on the labor market regardless the presence of children. As a consequence of these three shortcomings, standard models as Ordinary Least Square (OLS, thereafter) suffer from endogeneity bias when simply using a fertility variable as an explanatory variable. In order to identify a causal effect of the number of children on mother's participation, an exogenous source of variation in family size is needed. In this respect, I follow Angrist and Evans (1998) by estimating instrumental variable (IV) models of labor supply. More specifically, the endogenous variable of fertility is instrumented either by an indicator of twin birth or by the sex mix of children ever born [4]. Using these instruments allows me to investigate the magnitude of the causal impact for different parities. In particular, I examine the negative causal impact for the presence of a second child (instrumented by twinning at first motherhood), a third child (instrumented by gender mix of the two eldest and/or twinning at second motherhood) and a fourth child (instrumented by gender mix of the three eldest and/or twinning at third motherhood).

Standard OLS regressions confirm a negative correlation between labor market outcome and motherhood. Interestingly, the correlation is nearly of the same magnitude for the two regions studied. However, the size of the impact changes when the presumed endogenous

3. Child care policy may be an example of such policies.

4. Similar strategies of instrumentation has been used in many works such as Cruces and Galiani (2007) for Argentina and Mexico, Frenette (2011) for Canada or Caceres-Delpiano (2012) for a sample of developing countries and Angrist et al. (2010) (among other).

fertility variable is instrumented. It also depends on the birth at which the increase in the number of children is studied. Thus, for mothers of at least one child, the presence of a second child reduces female participation of about 10 percentage points in Reunion against 9 points in France. The reduction of female participation is increasing in the number of children in the Reunionese sample whereas the opposite is true for the French one. For instance, for mothers of two children having at least one additional child yields a reduction in mother's labor supply probability of about 13 percentage points in Reunion. For French mothers, the causal impact of fertility on participation is sharply less important and contributes to lower the probability of female participation of only 8.2 points. My general result is robust to several alternative estimations and sample restrictions.

As additional contributions, I also examine particular features related to the causal link between fertility and labor supply. In this respect, I show that the magnitude of the effect depends on the time elapsed since the last childbirth. Thus, when I restrict my samples to mothers for whom the youngest child is under 4, I find that the negative impact is twice as large for a first birth. For a second birth, the causal impact is again stronger in France while my estimates for Reunion are indistinguishable from the baseline case. It also appears that the effect is heterogeneous across education levels. In particular, I show that "skilled" women are less likely to withdraw from the labor force than "low-skilled" when their family size increases. Such findings are broadly in line with the *ability* concept of Angrist and Evans (1998). Mothers with the highest *abilities* are those with the best career aspirations and are much more likely to remain active when they have children. Finally, as I show that there are important differences between France and Reunion, I investigate whether such disparities exist across mainland France regions. To provide first evidence about this particular questioning, I run the IV models at the regional level. Although there are not important differences of the negative impact between urban and rural areas, I show that at the regional level the magnitude of causal impact is quite varying.

This article makes several contributions to the literature. Firstly, it is the first to use the New Census of the French Population to estimate this causal relationship. This database is interesting in several respects. It contains a lot of variables, covers the entire French territory and it is the sole allowing me to retrieve a large sample in the case of Reunion. The latter element is non-trivial because other databases do not contain sufficient number of observations for Reunion. Furthermore, the size of the sample allows me to investigate various issues by restricting my samples according to the age of the youngest child, the education level and the region of residence. Secondly, this article updates French evidence since the previous paper dealing with this issue (Moschion, 2009) uses relatively old data spanning the 1990-2002 period. I also extent this work by providing more complete evidence. More specifically, Moschion (2009) examines only the effect of a third child on female participation while I also investigate the causal impact for other parities. Thirdly, this paper provides a first assessment of the causal impact of fertility on mother's labor supply for Reunion. To the best of my knowledge, little is known about this causal relationship for small island characterized by strong insularity. This is somewhat surprising since, as mentioned previously, the Reunionese labor market has known important structural changes for 40 years. By focusing my attention on this specific territory my paper fills an important void.

The rest of this paper is structured as follow. Section 4.2 provides a preliminary analysis and presents the Reunionese context. Section 4.3 describes the dataset and presents the econometric framework. In section 4.4 the main results of the paper are presented. Section 4.5 provides more specific analyses. Finally, section 4.6 concludes.

4.2 Preliminary

4.2.1 Causal impact of fertility and instrumental variable in the literature

Simple stylized facts still show that on average mothers experience worse labor market outcomes than childless women. Their chances to participate are lower [5] and once in employment their chances to take a part time job are higher and their earnings are lower (Korenman and Neumark (1992), Waldfogel (1998), Blundell et al. (2013)). These descriptive elements suggest that the correlation between women fertility and their labor supply is probably negative. Nonetheless, this correlation could be spurious. In the case of the impact of fertility on female participation three arguments complicate the interpretation of direct evidence. Firstly, the two phenomena may be explained by common factors. For instance, the education level of mothers may influence their career opportunities but also their childbearing behavior. Thus, it is necessary to add control variables in the model in order to mitigate this concern. Secondly, the fertility and the labor supply decisions are jointly determined and it is imperative to disentangle in what direction the causal effect operates. This is called the reverse causality problem. In particular, one can claims that depending on her career opportunities a woman may choose to diminish her desired number of children. Conversely, another one can argue that a woman with a large family may choose to reduce her activity or to withdraw from the labor force. Thus, it is quite difficult to say whether fertility is the cause or the consequence of the participation behavior. Thirdly, adverse selection driven by unobserved factors also impedes the identification of a causal effect. Adverse selection refers to the situation in which

5. See table 4.1 for an illustration.

women choosing to have a large family have weaker labor force attachment than women choosing to remain childless. This is potentially problematic because it implies a bias in the correlation : women with children have a worse situation on the labor market whatever the presence of children. As a result the assessment of a causal impact is complicated by the presumed endogeneity of fertility in the estimation of the labor supply equation.

To retrieve a causal effect, empirical studies propose estimating the equation of interest by the instrumental variable method. The purpose is to find variables highly correlated with the endogenous fertility variable but not directly related to the labor market outcome. The instruments should create an "exogenous" fertility shock, randomly assigned in the sample such that the affectation is similar to a natural experiment. Different sources of exogenous variations of fertility were used in the literature, the first being the incidence of multiple births (Rosenzweig and Wolpin, 1980). The twin birth (at first, second, third or fourth motherhood) is probably a good instrument in the extent to which it cannot be anticipated, it is almost not related to maternal characteristics [6] and it provokes an exogenous shift in fertility of the desired number of children. Caceres-Delpiano (2012), with a sample of mothers from developing countries, shows that women with twins at first birth are in a worse labor market situation that women with singletons, the probability of employment being 3 points lower. More recently, Li et al. (2015) find that fertility induced by multiple births does not affect significantly female participation to the labor market in rural China. Since the pioneer contribution of Angrist and Evans (1998), another trend of the literature consists in the exploitation of parental preferences for a mixed sibling sex composition as a natural experiment [7]. Since parents with two eldest of same gender have a higher probability of having a third additional child, and assuming that sex composition is randomly assigned, a variable indicating the sex composition of the first two children is probably a good instrument for fertility. This identification strategy has been followed by several authors and for quite different countries [8]. On the overall, it appears that an exogenous shock of fertility induced by the event of non-mix gender deteriorates female labor market outcomes. However, the magnitude of the causal effect varies : from approximately less than -10 points in the U.S., Canada or Argentina to -20 points in France. Furthermore, the causal impact is not

6. This statement must be mitigated by at least two stylized facts. Firstly, it is known that older women are more likely to have twins. Secondly, multiple births are more frequent for women who undergo fertility treatment.

7. Recently, other instruments have been proposed in the literature. Agüero and Marks (2008) use infertility shock whereas Lundborg et al. (2014) propose the use of in-vitro fertilization success as natural experiments. These two identification strategies provide consistent estimates of the impact of fertility on female labor supply. However, to be replicated these identification strategies need specific database which contain private and sensitive information.

8. Examples include Cruces and Galiani (2007) for Argentina and Mexico, Frenette (2011) for Canada, Hirvonen (2010) for Sweden, Moschion (2009) for France.

significant in Sweden, Great Britain and Chile.

4.2.2 The reunionese context

Reunion was a former French colony. After World War II, the island obtained the status of French department and became a French oversea region in 1982. In the middle of the sixties Reunion began its economic take off. During 25 years, between 1974 and 1999, the economic growth amounted to an average of 5% per year. This strong economic growth was accompanied by an increase in the Human Development Index (HDI) which is approximately equal to 0.87 in 2004 (Goujon, 2008). However, from an economist and a politician point of view the most striking feature characterizing Reunion is not its relatively high level of economic growth but rather its specific labor market with a high level of unemployment. Between 1995 and 2012, the unemployment rate (according to the ILO's standards) has never decreased below 24% [9]. Although this specific feature should attract great attention, it should not hide other important changes of the Reunionese labor market. For instance, the economic and development expansions have changed female behavior in several aspects. The female participation rate doubled in 40 years indicating that Reunionese women are much more likely to supply their labor. Furthermore, women fertility declined dramatically. Despite these concomitant structural changes, the participation rate of women is lower in Reunion and the average number of children higher than in France. Furthermore, Reunion shares nearly the same institutions than in France and family policies are very close across the two regions. In this particular context, the identification of a causal relationship between fertility and female activity could reveal differences between these two regions suggesting that policies should be adapted to take into account the specificity of this overseas region.

4.3 Empirical methodology

4.3.1 Data and descriptive statistics

The information about female labor supply and their fertility are extracted from the New Census of the French Population [10] (NCFP, thereafter). Since 2004, the French Census is a survey and a global representativeness of the French population is achieved by stacking five consecutive annual surveys. For this research, I work with each wave of annual census between 2004 and 2012 [11]. The use of this dataset is crucial because it is the sole allowing a

9. It peaked to 33% in 2003 and amounted to 28% in 2012.
10. In French : *"Le Recensement Rénové de la Population"*.
11. Because of the large number of observations, Census data are preferred to the French and Reunionese Labour Force Survey.

$x+$	Sample A 1+		Sample B 2+		Sample C 3+	
	Fr	**Run**	**Fr**	**Run**	**Fr**	**Run**
Age	34.2	33.4	35.3	34.6	36.1	35.5
Age at 1st birth	25.9	23.3	25.0	22.3	23.4	20.9
No degree	0.152	0.377	0.175	0.443	0.269	0.576
Below high school	0.283	0.273	0.298	0.271	0.323	0.242
High school	0.206	0.178	0.193	0.145	0.157	0.096
High school + 2	0.191	0.092	0.179	0.075	0.129	0.041
> High school +2	0.168	0.080	0.155	0.066	0.122	0.045
Participation	0.828	0.721	0.785	0.678	0.658	0.581
Nb. of children	1.90	2.08	2.44	2.63	3.34	3.57
More than x children	0.624	0.666	0.333	0.402	0.243	0.346
x boys first	–	–	0.261	0.261	0.143	0.145
x girls first	–	–	0.236	0.234	0.121	0.127
Same sex	–	–	0.497	0.495	0.264	0.272
Twins at x birth	0.019	0.014	0.016	0.014	0.016	0.014
Couple	0.838	0.712	0.871	0.744	0.872	0.720

TAB. 4.1 – Summary statistics of mothers of at least 1, 2 or 3 in mainland France and Reunion.

Source : NCFP, author's own calculations.

Notes : High school refers to the French equivalent for the A level, i.e. the "baccalauréat".

very large sample for Reunion, a necessary condition to have robust estimations. The NCFP contains a lot of socio-demographic variables such as the age, the education and the labor market state [12]. Most prominently, it gives a set of information about the family structure (sex of children, date of birth etc.) which is of first interest for the topic of this article. Three separate samples for each region are constructed for the empirical analysis. One consists of mothers with at least one child (sample A). The second sample includes mothers with two or more children (sample B) while the third sample contains mothers with three or more children (sample C). As the NCFP includes information only for children living in the household, I restrict my samples to relatively young mothers aged between 20 to 41 [13]. By doing so, the study focuses on women the most affected by the choice between activity and motherhood

12. Here, it is important to note that the definitions of labor market states (employment, unemployment and not in the labor force) are different from the ILO's standards. Most prominently, each individual reports "spontaneously" his labor position.

13. Angrist and Evans (1998) restrict their sample to mothers aged between 21 and 35. Appendix 4.B report estimates with this sample choice. On the overall, the main results of this paper remain insensitive to this sample restriction.

decisions. After these restrictions, the French samples contain 2570062, 1603249, and 533187 while the Reunionese samples contain 55498, 36958, and 14862 (for samples A, B and C respectively). In order to identify the labor market attachment, the outcome of interest is the participation to the labor market. Thus, the purpose is to examine the impact of family size on the decision to be active, i.e. searching for or occupying a job.

Table 4.1 documents a summary of descriptive statistics about samples of mothers living in France or Reunion. In the restricted samples, French women are older than their Reunionese counterparts. Unsurprisingly, Reunionese mothers have their first child earlier and there is a difference of approximately 3 years in average age at first birth between Reunionese and French mothers. Moreover, the average age at first birth decreases with the total number of children, reflecting that mothers who expect the biggest family size begin their motherhood earlier. The levels of female qualifications are very different across the two regions. In Reunion, women are more often unskilled and less often skilled than in France. In terms of labor supply, the labor market participation rate is around 83% in France for mothers with one child or more. The female participation is sharply lower in Reunion and it is approximately equal to 70% [14]. As expected, the female participation rate is decreasing in the number of children. In France, the participation rate of mothers amounts to 78.5% and 65.8% for mothers of (at least) 2 and 3 children respectively. A very similar picture emerges for Reunion. Thus, the difference in terms of participation, between those who have (at least) 2 and those who have (at least) 3 children, is approximately of 10 percentage points [15].

The last sixth rows of table 4.1, provide a set of descriptive statistics about fertility, sibling sex composition and household composition. The dummy variables indicating if the mothers have one more child are of primary interest for the labor supply equation since they correspond to the presumed endogenous variables. Thus, around 40% of Reunionese mothers with two children have at least one additional child. The corresponding figure for French mothers is 33.3%. Furthermore, 35% of women with 3 children have at least one more child in Reunion against 24% in France. Consistently, the average number of children per mother is always lower in France. Concerning the instruments (twin births, first two children of same sex and its alternatives), the figures of the table do not reveal huge differences between France and Reunion : around 1.5% of births correspond to twins and around 50% of the first two children have the same sex. Unsurprisingly, having two eldest daughters is less frequent that

14. It should be noted that disparities in terms of participation are sharply lower when controlling for the education level. For instance, 86% of mothers with a high school degree are active in France against 81% in Reunion. For a degree superior to the "high school +2" approximately 92% of women participate to the labor market for both France and Reunion.

15. The participation rate of mothers with 4 children equals to 50,6% in France and 48%. Therefore, comparatively to mothers of 3 children, the difference in participation rate amounts to 15 points in France against 10 points in Reunion.

having two sons. Finally, observe that Reunionese mothers live less frequently with a partner than in France. This suggests that controlling for this aspect in the participation equation is important.

4.3.2 Econometrics

The model of interest aims at estimating the causal effect of having one more child on female's labor force participation. The labor supply equation is :

$$y_i = \alpha^{'} w_i + \beta c_i + \varepsilon_i \tag{4.1}$$

where y_i is the labor participation variable equal to 1 if the woman supplies her labor and 0 if she is out of the labor force, w_i contains a set of socio-demographic variables, such as, the age of the mother, the age at the first birth, the gap between the last two motherhood, the education level (in 5 levels), annual fixed effects, a dummy indicating the sex of the first child, a dummy indicating if the mother lives with a partner and a dummy indicating if the mother was born abroad, $\alpha^{'}$ is the vector of coefficients for control variables, ε_i the error terms. The variable c_i is the presumed endogenous variable indicating if the mother has one more child (at least) and β is the coefficient of main interest. When it is causal, it indicates to what extent mother's labor supply responds to an increase of the number of children.

OLS estimates of β could be biased by adverse selection driven by unobserved variables implicitly included in ε_i. A legitimate questioning is about the direction of the bias implied by OLS models. Two elements are at its origin : i) the relationship between the presumed endogenous variable (c_i) and the unobserved variable and ii) the relationship between the latter and the participation variable (y_i). As an example, let me consider the case where the unobserved factor is *ability*. It captures the idea that some women are more "ambitious" and have better career aspirations. In the event that *ability* is positively correlated with participation and negatively correlated with fertility, excluding this variable from equation 4.1 would lead to an upward bias (in absolute values) in OLS estimates. For instance, when women *abilities* are low, their likelihood to have more children is higher while their likelihood to be active is lower. Thus, β overestimates the true impact of c_i since it confuses two negative effects : the one due to motherhood and the one due to low *ability*. Observe that the *ability* concept can also be rationalized by putting emphasis on the opportunity cost of home production. Women with the best (unobserved) career expectations could have a higher opportunity cost of withdrawing from the labor force leading them to have fewer children. By contrast, women with the lowest opportunity cost have fewer chances to have a good career and could devote more time to parental education.

	$P(c_i = 1/z_i = 1)$	$P(c_i = 0/z_i = 1)$
$P(c_i = 1/z_i = 0)$	Always takers	Defiers
$P(c_i = 0/z_i = 0)$	Compliers	Never takers

Tab. 4.2 – Subpopulations depending on the instrument.
Notes : In the table $P(\cdot)$ is a conditional probability.

To circumvent the potential pitfall of endogeneity in the estimation of the participation equation, instrumental variables (IV) are used to estimate (4.1). More specifically, along the lines of Angrist and Evans (1998), Agüero and Marks (2008) or Caceres-Delpiano (2012) (among other), I estimate a Two-Stage Least Squares (2SLS) linear probability model. Two general assumptions are required for the validity of the IV framework. First, the instruments should have a significant predictive power on the endogenous variables. Second, they should not be correlated with the error terms of the regression. Put differently, instruments must be themselves exogenous.

A practical advantage of the 2SLS is that the first stage can be easily estimated. In the context of this paper, it consists in estimating the fertility equation linking the variable "having one additional child" c_i, to the instruments z_i and other socio-demographic covariates w_i :

$$c_i = \pi_0^{'} w_i + \gamma z_i + \eta_i \tag{4.2}$$

with η_i the residuals of the first stage estimation. Since I will estimate several models, the fertility variable indicating the presence of additional children will be instrumented, either by a dummy indicating if the mothers have had multiple births, or, for samples of mothers of at least 2 and 3 children, by a dummy equal to 1 if the eldest are of same gender (0 otherwise). Note that the "same-sex" instrument can be divided into two others variables : eldest-boys and eldest-girls. The first stage serves as a test for the validity of the first assumption.

It is noteworthy that β of the IV model has a special causal interpretation. It tells us to what extent the probability of participation varies with family size only for mothers affected by the instruments. As argued by Angrist and Imbens (1995), β should be interpreted only as a local average treatment effects (LATE).

4.3.3 What is the effect of treatment measured by the IV model ?

To have a better understanding of the LATE, it is useful to make the analogy with randomized trials and to split the overall sample into instrument-dependent subpopulations. Table 4.2 reports the different subpopulations depending on i) their situations relative to the treatment c_i (having one additional child in the context of this paper), and ii) any IV z_i (twin births or sibling sex composition). In this context, the subpopulation of *compliers* consists of mothers who have one additional child because of the instrument. For these mothers, the value assigned to the treatment is equal to 1 because they "respond" to the instrument. Thus, when the same-sex dummy is used as an instrument, *compliers* are mothers with one more child (at least) because they have an incentive to have a bigger family size due to sibling sex composition. Subpopulations of *never-takers* and *always-takers* do not exhibit any reactions to the instrument. The *never-takers* are indifferent to the instrument and whatever its assignment they never have one additional child, while, the *always-takers* are also indifferent to the instrument but whatever its assignment they always have one more child [16].

As indicated by Angrist and Pischke (2009), the LATE is based on four assumptions. First, the instrument must be randomly assigned and independent of the vector of potential outcome and treatment. This assumption is similar to the exogeneity hypothesis mandatory for the appropriateness of the IV framework. If the same-sex instrument is not related to any maternal's characteristics and any labor market outcomes, the twin instrument could violate this assumption. In particular, it is known that multiple births have a higher incidence for older women and among women who undergo fertility treatment to have a pregnancy. To mitigate this concern, the empirical model includes age variables as covariates. Second, the effect of the instrument on the outcome studied is only indirect and operates through its (direct) effect on the treatment (exclusion restriction). As for the independence assumption, there is no direct evidence of a potential effect of sibling sex on mother's labor supply. However, Rosenzweig and Zhang (2009) emphasize a possible violation of the exclusion restriction with the twin instrument. In particular, as twins have, on average, a lower birth weight and a higher infant mortality than singletons, parents might have the incentive of either allocating more resources to their twin children by withdrawing from the labor market, or increasing their hours worked to obtain higher resources for medical expenditures. Such behaviors undo the exclusion restriction and indicate a (possible) direct impact of twin births on female participation beyond its indirect impact as an exogenous fertility shock. To address this problem, Rosenzweig and Zhang (2009) add, in their empirical model, a variable informative about children birth weight. Unfortunately, such a variable is not available in NCFP preventing any attempt for controlling this shortcoming [17]. The third assumption states that the causal effect of the instrument on the treatment is not zero in average. This hypothesis can be tested by the first stage estimation. As indicated in subsection 4.4.1, all instruments used have a significant

16. Strictly speaking there is a fourth subgroup which reacts in the opposite direction relative to the instruments : the *defiers*. However, the assumption of monotonicity, mandatory for the validity of the LATE, excludes this possibility.

17. Subsection 4.4.4 discusses the validity of the twin instrument with more depth.

causal impact on the fertility variable. Finally, even if it remains possible that the instrument has no effect on some people, the instrument acts in the same way for all people affected with the instrument switch on. This last assumption is called the monotonicity assumption, and, with a formal point of view it implies that $P(c_i = 1/z_i = 1) \geq P(c_i = 1/z_i = 0)$. Under the last fourth assumptions, β of IV model is the effect of treatment on the population of *compliers*, namely those who have one more child because they are effectively affected by the instrument. It is noticeable that, as the instrument is randomly assigned, the LATE is representative of all *compliers* and not only those for which the instrument is switched on.

Without further information, the estimated LATE differs from the average treatment effect on the treated. The latter can be expressed as a weighted average of effects on *compliers* with instrument assignment equal to 1 and *always takers*. In general, it also differs from the average treatment effect on the non-treated which is a weighted average of effects on the *never-takers* plus *compliers* with instrument assignment equal to 0 (Angrist and Pischke, 2009). The last statement is generally true except when the instrument implies a perfect compliance. This is the case when the twin variable serves as instrument. In particular, a distinctive feature of the twin instrument is that it excludes the possibility of *never-takers* since $P(c_i = 0/z_i = 1) = 0$. All mothers having twins for a certain pregnancy are automatically treated and become *compliers*. Consequently, the non-treated subpopulation perfectly overlaps the *complier* population. As the LATE estimates the effect of treatment on the *compliers* and assuming that twinning is randomly distributed, the twin instrument measures the average treatment effect on non-treated. Therefore, the multiple birth instruments identify an increase in the expected number of children for mothers who wanted one more child but were pushed to a bigger family size due to twinning.

Given the fact that different instruments measure different LATE, it will not be surprising to find different causal effects between the twin and the same-sex instruments. In this respect, Angrist et al. (2010) underline that the *complier* population associated to sibling sex composition is less complete than the one implied by the twin instrument insofar a proportion of the non-treated are *never-takers* for the former. Furthermore, they also show that the same-sex instrument leads to less precise estimates. In order to tackle this shortcoming, they estimate IV models combining the twin and the same-sex instruments. Such a strategy has the advantage of increasing the populations of *compliers* and leads to estimates closer to the average treatment effect.

4.4 Results

In this section, the main results of the paper are presented. In a first step, the first stage estimations are detailed and the strength of the IV are discussed. Then, the second stage estimations are reported. The last two subsections discuss the results and their validity.

	(1)		(2)		(3)		(4)		(5)		(6)	
	Fr	**Run**	**Fr**	**Run**	**Fr**	**Run**	**Fr**	**Run**	**Fr**	**Run**	**Fr**	**Run**
Covariates	**No**						**Yes**					
Sample A : Mothers of at least one child												
					0.383	0.339					0.411	0.397
Twins-1	–	–	–	–	(0.002)	(0.017)	–	–	–	–	(0.002)	(0.014)
F-stat	–	–	–	–	29695	412	–	–	–	–	57532	13721
Sample B : Mothers of at least two children												
	0.020	0.039					0.018	0.036				
Same-sex	(0.000)	(0.005)	–	–	–	–	(0.000)	(0.004)	–	–	–	–
			0.019	0.039					0.017	0.036		
2-boys	–	–	(0.000)	(0.006)	–	–	–	–	(0.001)	(0.006)	–	–
			0.021	0.038					0.019	0.037		
2-girls	–	–	(0.000)	(0.006)	–	–	–	–	(0.001)	(0.006)	–	–
					0.678	0.606					0.685	0.610
Twins-2	–	–	–	–	(0.002)	(0.021)	–	–	–	–	(0.002)	(0.018)
F-stat	730	58	360	29	55460	804	26157	842	24849	800	31260	925
Sample C : Mothers of at least three children												
	0.003	0.026					0.005	0.019				
Same-sex	(0.001)	(0.004)	–	–	–	–	(0.001)	(0.007)	–	–	–	–
			-0.007	0.039					0.001	0.029		
3-boys	–	–	(0.002)	(0.011)	–	–	–	–	(0.002)	(0.010)	–	–
			0.015	0.024					0.013	0.021		
3-girls	–	–	(0.002)	(0.012)	–	–	–	–	(0.002)	(0.011)	–	–
					0.769	0.663					0.756	0.680
Twins-3	–	–	–	–	(0.005)	(0.033)	–	–	–	–	(0.004)	(0.027)
F-stat	6	9	51	7	29424	401	7170	346	6830	330	9483	391

TAB. 4.3 – The impact of the instruments on the fertility variable : first stage estimation.

Source : NCFP, author's own calculations.

Notes : Fr refers to France while Run refers to Reunion Island. Standard errors are reported in parenthesis. All coefficients reported are statistically significant at the 1% level. Sample size : for France 1+ 2570062, 2+ 1603249, 3+ 533187 ; for Reunion 1+ 55498, 2+ 36958, 3+ 14862. The estimations are based on a sample of mothers aged between 21 and 40 years old.

4.4.1 First stage results

Estimations of the first stage fertility equation which have the fertility dummy "having one more child" as dependent variable are presented in table 4.3. First stage coefficients should be attentively analyzed since they provide some insight about the appropriateness of the instruments. Without exception, all estimated coefficients reported in the table are statistically significant at 1% level [18]. This indicates a non-negligible correlation between IV and the endogenous fertility variable. To gauge the statistical power of the instruments, Stock and Yogo (2005) propose several criteria for selecting minimum threshold for the F statistic of first stage equations. Concretely, an F statistic above 10 suggests a non-weak instrument. Here, nearly all F statistics are largely above 10, especially for samples of mothers with at least 1 and 2 children. However, for the sample of mothers with at least 3 children, F statistics are below 10 when the first stage incorporates any covariates. This may suggest that the same-sex instrument, when applied to the first three eldest, provides a weaker incentive to expand the family size. On the overall, the correlation between the instruments and the endogenous variables, combined with the above criteria, suggest that the second stage estimations would not be affected by the concern of weak instrument. Another important result of the first stage is that the estimated coefficients are modified only slightly when covariates are included in the model. As a result, there is no strong correlation between the instruments and covariates and the influence of the former on the fertility variables cannot be attributed to any noise implying these observed variables.

Now, let me turn to a detailed analysis of the first stage estimation. Unsurprisingly, the Reunionese twin first stage coefficients are smaller than the French ones. This suggests that a Reunionese mother typically has a larger family size than a French mother. For instance, the twin first stage coefficients in the sample of mothers with at least two children are equal to 0.685 in France and 0.610 in Reunion. Thus, 31.5% percent of French mothers with at least two children would have a third child whatever the twin instrument assignment. In the Reunionese sample the corresponding figure amounts to 39%. Concerning the same-sex instrument, the regressions confirm the idea that mothers prefer to have children with different gender for the sample B. In a model without any covariates, the probability of having a third child when the first two eldest are of same sex is higher of 3.9 percentage points in Reunion against 2.0 points in France. When the same-sex variable is split into two separate variables (two-boys and two-girls) the finding is similar and no sex preference is noticeable. In columns (4) and (5) covariates w_i are added to the regressions and allow me to have more precise estimates of the effect of gender sibling sex on further childbearing. As a result, the estimation suggests that in Reunion mothers who have had two eldest of same sex are 3.6

18. That is why, table 4.1 does not report star to save some space.

points more likely to have a third motherhood than mothers with two eldest of different sex. The corresponding figure amounts to 1.8 points in France.

The general picture is less clear for the sample of mothers with three children at least (sample C in table 4.3). As shown in columns (1) and (4), although statistically significant, the estimated coefficient is almost 0 in France. In Reunion, the estimated coefficient suggests that having three eldest of same-sex increases the likelihood of having an additional child-bearing by approximately 2 percentage points (see column 4 of table 4.3). A joint use of the instruments three-boys and three-girls provides another finding. For French mothers, having three daughters increases the probability of a fourth motherhood of about 1.3 percentage points while having three sons has almost no effect. For Reunionese women having either three eldest girls or three eldest boys raise the probability of having (at least) a fourth child.

	OLS(1)	2SLS(2)	2SLS(3)	2SLS(4)	2SLS(5)
Instrument(s)	–	*Same-sex*	*Same-sex divided*	*Twins*	*Same-sex & Twins*
Sample A : Mothers of at least one child					
France	-0.132 *** (0.000)			-0.093 *** (0.004)	
Réunion	-0.124 *** (0.004)			-0.099 *** (0.039)	
Sample B : Mothers of at least two children					
France	-0.199 *** (0.000)	-0.269 *** (0.033)	-0.266 *** (0.033)	-0.076 *** (0.004)	-0.082 *** (0.003)
Réunion	-0.183 *** (0.006)	-0.297 ** (0.128)	-0.301 ** (0.128)	-0.117 *** (0.034)	-0.132 *** (0.031)
Sample C : Mothers of at least three children					
France	-0.232 *** (0.001)	0.245 (0.284)	0.353 (0.183)	-0.064 *** (0.007)	-0.063 *** (0.003)
Réunion	-0.198 *** (0.009)	0.291 (0.500)	0.412 (0.379)	-0.139 *** (0.051)	-0.131 *** (0.050)

TAB. 4.4 – The impact of fertility on labor market participation of mothers : second stage estimation.

Source : NCFP, author's own calculations.

Notes : Standard errors robust to heteroskedasticity are reported in parenthesis. Significant levels : * 10% ; ** 5% ; *** 1%. Sample size : for France 1+ 2570062, 2+ 1603249, 3+ 533187 ; for Reunion 1+ 55498, 2+ 36958, 3+ 14862. The estimations are based on a sample of mothers aged between 21 and 40 years old. In each regression only the coefficient estimated of the variable "having one more child" is documented. All model reported include covariates.

4.4.2 Second stage results

The second stage estimation linking female participation with fertility and control variables are displayed in table 4.4. Due to space limitations, only the coefficients of the presumed endogenous variable "having at least one more child" are reported for separate regressions in which the instruments used are varying [19]. In addition, since the results are insensitive to the inclusion of control variables, I report only the estimates including controls [20]. As shown in column OLS(1) of table 4.4 the OLS estimates consistently show a negative association between having an additional child and female labor supply in all samples. Surprisingly, the magnitude of the negative correlation is of same size for both France and Reunion.

The last four columns of table 4.4 provide IV estimates. For the sample of mothers of at least one child the only available instrument is twinning. Thus, the presence of a second child, generated by a non-singleton birth, has a negative impact on mother's labor supply by reducing it of about 9 percentage points. Again, the two estimated coefficients are very close for France and Reunion suggesting that for lowest parities the negative impact of family size are nearly identical.

For samples B and C, in addition to the twin variable, the gender composition of the eldest can be used as an exogenous fertility shock. Let me first focus my attention on the results associated to mothers of at least two children. The negative impact of having at least three children appears to be relatively high when the same-sex instrument is the engine of the causal inference. Specifically, the estimated coefficients amount to -0.27 and -0.30 for France and Reunion, respectively. However, it should be noted that they are fairly imprecise with a standard error of 3 and 12.8 percentage points respectively. The general picture is very similar when the gender mix is split into two variables according to gender (see column 2SLS(3)). In column 2SLS(4), the fertility variable is instrumented by the twin birth variable. Unsurprisingly, this changes the magnitude of the effect and when multiple births serve as an exogenous fertility shock the causal effect is lower. I also estimate models that combine the two sets of available instruments. From a technical point of view, when the two instruments are used together the coefficient associated to the endogenous variable corresponds to a weighted average of the instrument first stage effects. As indicated by Angrist et al. (2010), this strategy increases precision and provides estimates closer to the average treatment effect. According to these estimates, a Reunionese mother is much more likely to remain inactive when she has at least 3 children than a French mother. Most prominently, having more than two children decreases the probability of participating by 13 percentage points for Reunionese mothers. In France, the same negative impact of fertility on female labor supply is halved

19. Additional results concerning other variables of the model can be found in appendix 4.A.
20. Corresponding results are available upon request.

and amounts to 8.2 points.

The bottom part of table 4.4 provides additional results and focuses on the impact of a fourth birth on female's labor supply. First, observe that the estimated effects are not statistically significant when the sibling sex composition variables are used as instruments. Furthermore, such models do not provide the good sign of the treatment effect which is curiously positive for the two regions. This counter-intuitive finding is probably a consequence of the possible instrument weakness, as indicated in the last subsection. However, for this sample the variable indicating a twin birth at the third motherhood remains a valuable instrument. In particular, when using multiple births as a source of variation of family size, I find that having more than three children has a more negative impact for Reunionese mothers than for French mothers. In particular, the likelihood of labor force participation is reduced by 13.1 percentage points for mothers living in Reunion against 6.3 percentage points for mothers living in France (see column 2SLS(5)).

Taken together, my results suggest that having an additional childbearing induces a higher reduction in female participation for Reunionese mothers than for their French counterparts, especially after the second birth. Furthermore, the effect of fertility on female labor supply is decreasing in the number of children in France (when twins is an instrument for motherhood). In Reunion, this relationship is also valid but in the opposite sense.

4.4.3 Discussion

The two instruments used in the IV model generate their own local effect (LATE), the gender mix instruments leading to higher and less precise estimates of the causal impact. As mentioned by Angrist et al. (2010), the *compliers* populations associated with each of these instruments are different and the one for same-sex is less complete since it excludes the *never-takers*. Furthermore, the essence of these two variables is different since they identify very different situations in terms of expected family size. An additional birth, when driven by the sibling composition of ever-born children, corresponds to a real desire of increasing the family size of one. By contrast, the twin instrument shifts the family size beyond the expected number of children since the mother receives one (in case of twins) or more (in case of triplets or quadruplets) additional children. Some economic arguments have been invoked to rationalize the reason explaining the difference between the two identified causal impacts. As an example, let me consider the case of a third birth. Mechanically, when the second motherhood gives rise to twins, the youngest child is necessarily older than a third child born after three singleton births. Assuming that a younger child needs more parental attention

Sample	**1+**		**2+**		**3+**	
Region	**Fr**	**Run**	**Fr**	**Run**	**Fr**	**Run**
Instrument(s)	*Twins-1*		*Same-sex & Twins-2*		*Twins-3*	
Participation	-0.204 *** (0.007)	-0.225 *** (0.065)	-0.132 *** (0.007)	-0.135 *** (0.06)	-0.064 *** (0.011)	-0.015 (0.077)

Tab. 4.5 – IV estimated coefficients when the youngest child is under 4 years old (strictly).
Sources : NCFP, author's own calculations.
Notes : Fr refers to France while Run refers to Reunion Island. Standard errors robust to heteroskedasticity are reported in parenthesis. Significant levels : * 10% ; ** 5% ; *** 1%. Sample size : for France 1+ 1127763, 2+ 645578, 3+ 232981 ; for Reunion 1+ 22012, 2+ 14557, 3+ 6810.

and that having two children of the same age may yield some positive returns to scale [21], then the causal impact measured by same-sex as a driver of family size would be higher.

As mentioned in subsection 4.3.2, adverse selection might imply an upward bias in OLS estimates. Due to high *abilities* and opportunity cost of home production, some women are much more likely to supply their labor and reduce their desired number of children. By contrast, those with low *abilities* and opportunity cost of home production are much more likely to withdraw from the labor force to devote more time to parental education. For the Reunionese samples, estimated parameters associated to the endogenous variable "having one more child" are not statistically different to OLS estimates with gender mix as IV, while for the French ones they are significantly higher. However, whatever the sample, IV model using twins as exogenous fertility shock leads to a lower causal impact than OLS estimates. My results about the magnitude of the causal impact are in line with the international literature. Lopez de Lerida (2005) (for Chile), Hirvonen (2010) (for Sweden) find that IV estimates generated by same-sex as exogenous fertility shock lead to a causal impact higher than the ones suggested by OLS, whereas, Frenette (2011) (for Canada) and Caceres-Delpiano (2012) (for developing countries) find that IV estimates generated by multiple births imply the opposite. Thus, the hypothesis of Angrist and Evans (1998) and Agüero and Marks (2008) about the direction of the bias, are confirmed only when twinning is the instrument.

4.4.4 The Rosenzweig and Zhang's concern

As mentioned previously, Rosenzweig and Zhang (2009) indicate that the twin variable could violate the exclusion restriction. In particular, they argue that parents could adapt their labor supply in order to respond to a negative prenatal endowment shock due to twinning.

21. As suggested by Frenette (2011), it is possible that multiple births requires less parental inputs per child.

Such behaviors, by underlying a particular effect of multiple births, raise concerns about the external validity of the twin instrument. In the ideal case, controlling for this effect requires the use of a variable indicating the prenatal endowment (child birth weight, for example) of children. However, such information is not available in the NCFP. Rather, to further investigate this issue, I run auxiliary regressions in which the endogenous fertility variable is split into two dummies : having one more child without twinning and having twins [22]. The estimated models are identical to those used in table 4.4, and the fertility variable is instrumented by sibling sex composition [23]. The argument of Rosenzweig and Zhang (2009) would be a concern if the estimated coefficients associated to fertility were significantly different from the one associated to twinning [24]. For the Reunionese samples (B and C), regressions show any significant difference between the two coefficients [25]. However, for the French sample of mothers of at least two children, the model suggests that the coefficients are not equal. Surprisingly, the opposite case appears for the sample of mothers with three children or more. From my point of view, it is quite difficult to justify that i) by contrast to Reunionese, French mothers (of two children or more) exhibit a particular reaction to twin births violating the exclusion restriction, and ii) the exclusion restriction is violated for a second twin birth but not for a third twin birth. To explain this curious finding, it should be noted that sample sizes are very different between France and Reunion (more than 1.6 million against 40 thousand, respectively) but also between French samples of mothers of at least two and three children (the latter contains 530 thousand individual observations). As a consequence, the estimated variance of parameters for the French sample B are mechanically lower leading ultimately to a rejection of the null hypothesis of coefficient equality [26]. To examine the sample size effect, I select by random sampling 399 samples of the same size as in the Reunionese case. For each of them, I run the IV models and I check whether the coefficients associated to child and twins are different. For more than 85% of models the equality test does not reject the null hypothesis of coefficient equality [27]. Without further evidence, the twin instrument remains valid and the criticism of Rosenzweig and Zhang (2009) is not a subject of concern.

22. This step of robustness check follows Angrist et al. (2010).
23. As any other instrument is available for a first childbirth, this test can be applied only for a second and a third birth.
24. In this case, twin births impact labor supply behavior differently of an additional singleton birth.
25. To save space, corresponding tables are not reported. They remain available upon request.
26. Technically, the null hypothesis of the test is $H_0 : \beta_{child} = \beta_{twins}$ and the alternative hypothesis is $H_1 : \beta_{child} \neq \beta_{twins}$. The *t statistic* for this test is given by : $\hat{t}_{\hat{\beta}_{child}-\hat{\beta}_{twins}} = \frac{\hat{\beta}_{child}-\hat{\beta}_{twins}-0}{\sqrt{\hat{V}(\hat{\beta}_{child})-\hat{V}(\hat{\beta}_{twins})-2cov(\hat{\beta}_{child},\hat{\beta}_{twins})}}$. As the variances appear in the denominator, the *t statistic* increases when the variances decrease.
27. Detailed results are available upon request.

Sample	**1+**		**2+**		**3+**	
Region	**Fr**	**Run**	**Fr**	**Run**	**Fr**	**Run**
Instrument(s)	*Twins-1*		*Same-sex & Twins-2*		*Twins-3*	
Low-skilled	-0.116 *** (0.009)	-0.125 *** (0.064)	-0.094 *** (0.006)	-0.152 *** (0.040)	-0.082 *** (0.009)	-0.125 ** (0.057)
Skilled	-0.079 *** (0.005)	-0.075 *** (0.043)	-0.071 *** (0.004)	-0.092 *** (0.046)	-0.040 *** (0.009)	-0.194 ** (0.096)

TAB. 4.6 – IV estimated coefficients when samples are divided according to the education level

Sources : NCFP, author's own calculations.

Notes : Fr refers to France while Run refers to Reunion Island. Standard errors robust to heteroskedasticity are reported in parenthesis. Significant levels : * 10% ; ** 5% ; *** 1%. Sample size : for France-Low-skilled 1+ 1119485, 2+ 758398, 3+ 315517 ; France-Skilled 1+ 1451127, 2+ 844851, 3+ 217670 ; for Reunion-Low-skilled 1+ 36101, 2+ 26371, 3+ 12211 ; for Reunion-Skilled 1+ 19397, 2+ 10587, 3+ 2651.

4.5 Other estimates

This section investigates other issues related to the strength of the negative causal impact of interest. First, I investigate whether the magnitude of the causal impact is the same with the age of the youngest child. Second, I study to what extent the negative effect depends on mother's education level. This allow me to have further insight on the *ability* concepts. Third, I examine the heterogeneous effects of fertility on female participation across area status and mainland France regions.

4.5.1 Controlling for the last birth

When studying the causal impact of having one more child on mother's labor supply, non-linearities about the time elapsed since the last childbirth could be a source of bias. In particular, as young children certainly require more parental attention than older children, the longer the time elapsed since the last childbirth is, the easier the return to labor market activities should be. This kind of non-linearity could induce an underestimation of the causal effect since mothers of young children could have a higher incentive to withdraw from the labor force. To address this issue, I re-estimate IV models by restricting my samples to mothers having a youngest child aged under 4 years old (strictly) [28]. Table 4.5 presents the corresponding results. On the overall, the emerging picture is in line with the assumption that the causal impact is sharply higher for mothers with young children. Thus, for mothers of at

28. This age restriction is chosen such that Reunionese samples provides significant results

Sample	**1+**	**2+**	**3+**
Instrument(s)	*Twins-1*	*Same-sex &* *Twins-2*	*Twins-3*
Urban areas	-0.093 *** (0.004)	-0.082 *** (0.004)	-0.061 *** (0.007)
Rural areas	-0.089 *** (0.010)	-0.070 *** (0.007)	-0.072 *** (0.013)

TAB. 4.7 – IV estimated coefficients for French urban and rural areas
Sources : NCFP, author's own calculations.
Notes : Standard errors robust to heteroskedasticity are reported in parenthesis. Significant levels : * 10% ; ** 5% ; *** 1%. Sample size : for France urban : 1+ 2035052, 2+ 1241996, 3+ 423675 ; for France rural : 1+ 535570, 2+ 361253, 3+ 109512.

least one child, when the youngest child is under 4, having at least two children rather than just one reduces the labor force participation by around 20 percentage points in France and 22 percentage points in Reunion. In comparison to results of table 4.4 the negative impact is doubled. Concerning the presence of a third child (sample 2+ in table 4.5) [29], I find that the causal impact is again statistically higher for French mothers with the restricted sample, while for Reunionese mothers confidence intervals associated to the estimated coefficient do not allow drawing any conclusions. Likewise, for mothers of at least three children, the restricted samples do not provide sufficient statistical power to conclude about a higher negative effect of family size when the youngest child is under 4. Summing up, this investigation allows me to show that the time elapsed since the last childbirth might lead to an underestimation of the causal effect, especially after the birth of a second and a third child.

4.5.2 Heterogenity across education levels

To further investigate the link between the *ability* concept, the opportunity cost of staying at home and the causal impact of family size on female labor supply, I run regressions by splitting the samples according to the education level. Indeed, theoretical models often predict that women with the highest education levels face a higher opportunity cost of home production. Thus, I identify two levels of education in my samples : i) the "low-skilled" which correspond to mothers without any degree or those with a degree inferior to the high school, and ii) the "skilled" which correspond to mothers with at least a high school degree [30]. Table

29. Quantitative results are the same if the fertility variable is instrumented by twin births only.
30. This sample restriction is guided by the fact that more than 60% of Reunionese mothers are "low-skilled". As a consequence, the inclusion of mothers with a high school degree to the skilled allows me to have sufficient number of observations in this category. Results with other restriction for the French samples

4.6 shows the results. The likelihood that a woman is currently non-active on the labor market, when having children, is higher when she is "low-skilled". Except in one case [31], this is true for all childbirth and for the two regions. For instance, a third additional child reduces labor supply of "low-skilled" mothers of about 15 percentage points in Reunion while the same effect amounts to 9 percentage points for "skilled" mothers. A very similar message emerges for French mothers. Clearly, my results suggest that skilled mothers, probably those with the highest opportunity cost of home production, are less likely to withdraw from the labor force when their family size increases. This is consistent with the *ability* concept proposed by Angrist and Evans (1998).

4.5.3 Is the causal effect homogeneous in France ?

With the IV models of table 4.4, I point out that the negative impact of interest is quite heterogeneous between mainland France and Reunion, one of its overseas regions. In this subsection, I wonder if the French estimates are themselves homogeneous. For example, one could argue that the negative impact of fertility on female participation depends on i) the childcare development in a specific area [32] or ii) the regional economic situation (high or low unemployment rate, available jobs at the regional level etc.). To have a first idea about this potential issue, I re-estimate the models by splitting the French samples according to the area status (urban vs. rural) [33] and according to the 13 new regions of mainland France [34]. Table 4.7 compares the results of the IV models between urban and rural areas [35], and figure 4.1 displays the regional distribution of the estimated coefficients associated to the endogenous fertility variable. It is worth noting that there are not huge and statistically significant differences of the IV estimates between urban and rural areas. However, as shown in figure 4.1, the effects of additional births on female participation are very heterogeneous across mainland France regions. For instance, the causal effects of having a second child

are available upon request.

31. The curious exception is about the case of a fourth birth in the Reunionese sample. However, it should be noted that this sample contains only 2651 mothers and that the estimated coefficient is fairly imprecise.

32. Statistics of the French National Institute of Statistics and Economic Studies indicate that in some rural areas there are more than 50 children per childcare place. By contrast, in some urban areas as those of Ile-de-France or Provence-Alpes-Côte-d'Azur regions this statistic falls to 4 children per childcare place (see also : http://www.lemonde.fr/les-decodeurs/article/2015/05/27/creches-les-bien-et-les-mal-lotis_4641241_4355770.html).

33. In the NCFP, above 10000 an area is urban whereas below 10000 an area is rural.

34. Since 2013, French mainland region were aggregated into 13 bigger regions. The 13 regions (in French) are : Occitanie, Nouvelle-Aquitaine, Normandie, Hauts-de-France, Grand-Est, Auvergne-Rhône-Alpes, Bourgogne-Franche-Comté, Centre, Pays-de-la-Loire, Ile-de-France, Bretagne, Corse and Provence-Alpes-Cotes-d'Azur.

35. Such a classification has no sense in the case of Reunion since nearly all (98%) geographical areas are considered as urban.

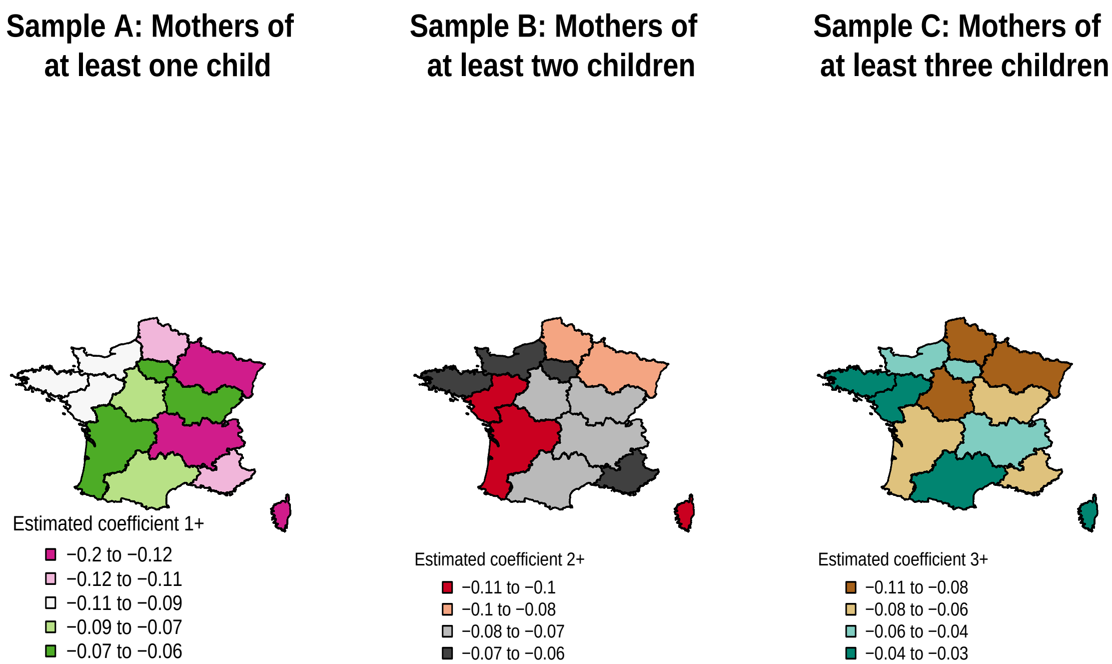

FIG. 4.1 – Regional dispersion of the causal impact of family size on female participation in mainland France.
Sources : Author's own calculations.

range from -6 percentage points (Nouvelle-Aquitaine) to -19.6 percentage points (Corse). The dispersion of the causal effect for the third and fourth birth is tinier ranging respectively from -5.8 (Normandie) to -11.3 (Corse) and from -3.3 (Occitanie) to -11 (Grand-Est) [36]. All in all, my regional estimations provide a negative answer to the question asked by the title of this subsection. Although estimations are not very different according to the area status, regional models show a very different picture with huge differences across mainland France regions.

36. For the first and the second birth all estimated coefficients are statistically significant at the 1% level. However, estimated coefficients for samples of mothers of at least 3 children are not significant for Occitanie, Bretagne, Corse and Pays-de-la-Loire. For the remaining regions coefficients reported are significant at 5% level.

4.6 Concluding remarks

Starting from the New Census of the French Population (NCFP) microdata, I investigate the impact of motherhood on female participation to the labor market. Although the French case is also considered, this study puts a particular attention to one of its overseas region : Reunion Island. Indeed, since the seventies the Reunionese labor market has known important structural changes with an important increase in female activity combined with an equally significant decrease in fertility rate. However, disentangling a causal relationship of childbearing on female labor market outcomes is complicated by the endogeneity phenomenon. As standard OLS models could be biased, I use twin birth and sibling sex mix as an exogenous variation in family size. My estimates reveal that the number of children has a more negative impact on female labor supply in Reunion than in France. Furthermore, the size of the negative impact (in absolute value) is increasing with the number of children in Reunion whereas it is decreasing in mainland France. Furthermore, I also consider three types of heterogeneity. First, I show that the magnitude of the causal impact is sharply higher when the youngest child is under 4. With such restricted samples, I show that having two children rather than one reduces the probability of female participation of about 20 percentage points against 9 percentage points when the sample is left unrestricted. Second, "low-skilled" women appear to be more likely to withdraw from the labor force in order to devote more time to children education. This result is consistent with the *ability* concept indicating that mothers with the best career opportunity have the highest opportunity cost of being inactive. Finally, a regional analysis reveals that the causal impact of fertility on mother's participation are very heterogeneous in mainland France suggesting that local characteristics could influence the size of the negative causal effect.

All in all, my study should be seen as a first step in understanding the link between fertility and female activity in Reunion. It shows that even if family policies are nearly identical across two regions, some others (observed and unobserved) characteristics could influence the size of the effect. As a consequence, policy makers should design policies that improve the reconciling between private and professional life. Such questioning about what kind of policies should be used to improve female participation in Reunion is left for further researches.

Annexe 4.A Effects of control variables on female participation

Table 4.8 displays estimated coefficients for covariates. Although significant, the effect of mother's age and age at first birth on participation is weak. Unsurprisingly, having a high level of education increases the probability of participation. In comparison to mothers with a high school degree mothers without any degree have 20 percentage points less chance to be active on the labor market. Furthermore, in Reunion mothers with a master ($>$ HS +2) degree are 10 percentage point more likely to participate than a mothers with high school degree. Surprisingly, living with a partner (a man or a woman) reduces the probability of participation of about 5 percentage points in both mainland France and Reunion.

Sample	**1+**		**2+**		**3+**	
Region	**Fr**	**Run**	**Fr**	**Run**	**Fr**	**Run**
Instrument(s)	*Twins-1*		*Same-sex & Twins-2*		*Twins-3*	
Age	0.010 ***	0.009 ***	0.025 ***	0.015 ***	0.027 ***	-0.019 ***
	(0.000)	(0.002)	(0.001)	(0.001)	(0.007)	(0.002)
Age at 1st birth	0.000 ***	-0.003 ***	-0.015 ***	-0.011 ***	-0.013 ***	-0.018 ***
	(0.000)	(0.002)	(0.002)	(0.002)	(0.000)	(0.003)
No degree	-0.191 ***	-0.205 ***	-0.177 ***	-0.202 ***	-0.201 ***	-0.212 ***
	(0.001)	(0.006)	(0.003)	(0.007)	(0.002)	(0.014)
Below HS	-0.049 ***	-0.082 ***	-0.050 ***	-0.087 ***	-0.056 ***	-0.099 ***
	(0.001)	(0.005)	(0.001)	(0.007)	(0.002)	(0.014)
HS +2	0.047 ***	0.070 ***	0.062 ***	0.081 ***	0.082 ***	0.078 ***
	(0.001)	(0.006)	(0.001)	(0.008)	(0.007)	(0.002)
$>$ **HS +2**	0.043 ***	0.104 ***	0.066 ***	0.136 ***	0.110 ***	0.166 ***
	(0.001)	(0.006)	(0.001)	(0.008)	(0.002)	(0.019)
Couple	-0.044 ***	-0.051 ***	-0.033 ***	-0.055 ***	-0.071 ***	-0.054 ***
	(0.001)	(0.006)	(0.003)	(0.005)	(0.002)	(0.014)
Born abroad	-0.124 ***	-0.089 ***	-0.083 ***	-0.063 ***	-0.056 ***	-0.004
	(0.001)	(0.005)	(0.001)	(0.013)	(0.002)	(0.014)

TAB. 4.8 – Estimated coefficients for covariates

Sources : NCFP, author's own calculations.

Notes : Fr refers to France while Run refers to Reunion Island. HS is High School. Standard errors are reported in parenthesis. Significant levels : * 10% ; ** 5% ; *** 1%. Sample size : for France 1+ 2570062, 2+ 1603249, 3+ 533187 ; for Reunion 1+ 55498, 2+ 36958, 3+ 14862. The estimations are based on a sample of mothers aged between 21 and 40 years old. Standard errors reported are robust to heteroskedasticity.

Sample	**1+**		**2+**		**3+**	
Region	**Fr**	**Run**	**Fr**	**Run**	**Fr**	**Run**
Instrument(s)	*Twins-1*		*Same-sex & Twins-2*		*Twins-3*	
Participation	-0.119 *** (0.005)	-0.112 *** (0.046)	-0.094 *** (0.006)	-0.154 *** (0.042)	-0.074 *** (0.011)	-0.106 (0.070)

TAB. 4.9 – Results with samples of mothers aged between 21 and 35 years old.

Sources : NCFP, author's own calculations.

Notes : Fr refers to France while Run refers to Reunion Island. Standard errors robust to heteroskedasticity are reported in parenthesis. Significant levels : * 10% ; ** 5% ; *** 1%. Sample size : for France 1+ 1139254, 2+ 726169, 3+ 205720 ; for Reunion 1+ 31868, 2+ 18594, 3+ 6410.

Annexe 4.B Robustness to sample age

As indicated in the main text, samples are restricted to mothers aged between 20 and 41. This choice has been guided by the will of having sufficient robust estimation for Reunionese samples. Naturally, the sensitivity of the overall results to this important sample restriction should be tested. Table 4.9 shows the results when the samples are restricted, as in Angrist and Evans (1998), to women aged between 21 and 35. With this restricted sample the causal effect appears to be higher in nearly all samples. For example, the decrease in participation is higher of around 2-3 percentage point for a second birth. On the overall, the age restriction has no incidence on the main message on the paper.

Conclusion générale

Cette thèse avait pour objectif l'amélioration de la connaissance sur les dynamiques du marché du travail en prenant en compte, autant que possible, les entrées/sorties de la population active. Pour ce faire, les quatre essais qui la composent ont adopté des voies de recherche différentes mais, en somme, assez complémentaires. La démarche globale suivie peut être résumée comme suit : lorsque cela est nécessaire partir des microdonnées, construire un ensemble de faits stylisés à partir des outils économétriques et les confronter aux mécanismes économiques en action au sein des modèles théoriques. Dans ce qui suit, un rappel des principaux résultats de cette thèse est proposé. S'en suit alors une présentation des limites et des perspectives futures de recherche offertes par les articles de cette thèse.

Le premier chapitre avait pour but la construction de séries temporelles sur les flux de travailleurs en France, la présentation d'un ensemble de faits stylisés relatif à ces derniers et la mise en lumière des origines des variations du taux de chômage en termes de flux. En effet, le chômage étant la résultante d'un mouvement perpétuel de mouvements entre les différents états du marché du travail, il est utile de savoir si ce dernier augmente en raison d'une faible probabilité de retour à l'emploi, d'une augmentation du taux auquel les individus quittent l'inactivité pour le chômage ou encore d'un taux de séparation depuis l'emploi élevé. Pour mener à bien cette étude, l'exploitation de l'Enquête Emploi en Continu et la repondération de ses échantillons longitudinaux étaient nécessaires. Le chapitre a permis de mettre en évidence l'influence non-négligeable des mouvements depuis et vers l'inactivité dans le façonnement des variations du taux de chômage. En effet, à eux seuls, ces derniers expliquent environ le tiers des variations du chômage en France sur la période 2003-2012. Par ailleurs, le chapitre confirme le résultat selon lequel la hausse du chômage qui a suivi le Grande Récession de 2008 était principalement due à une diminution importante du taux de retour à l'emploi. Enfin, les analyses sur des segments plus fins de la population montrent que les expériences en matière de transition sont très variables (forte mobilité des jeunes, rôle important de l'inactivité pour les seniors, difficultés multiples pour les moins qualifiés).

Toujours dans cette optique, le chapitre 2 a étudié les processus de réallocation de main d'œuvre conditionnellement à des chocs agrégés affectant l'économie. En effet, il n'est pas évident que les flux de travailleurs répondent de manière identique selon que l'économie soit frappée par des chocs d'offre ou des chocs de demande. Pour mettre la lumière sur cette problématique, le chapitre combine aussi bien une approche théorique qu'empirique. La première est nécessaire puisqu'elle permet l'apport de bases solides à l'analyse empirique. Elle a également du sens car, depuis les travaux de Shimer (2005), il est établi que le modèle d'appariement ne permet pas nécessairement de reproduire la volatilité des agrégats du marché du travail ainsi que les corrélations observées. Qui plus est, la littérature n'a étudié que de manière parcellaire l'aptitude du modèle à générer des réponses des flux en accord avec les observations empiriques. L'approche empirique, quant à elle, retient une modélisation jointe des fluctuations de la productivité, du taux d'intérêt et des taux de transition par le bais d'un modèle VAR structurel. Les chocs structurels sont identifiés à l'aide des restrictions de signe qui permettent la coexistence, dans un même cadre, de chocs de nature différente. Les fonctions de réponse impulsionnelle montrent que les processus de réallocation de la main d'œuvre diffèrent selon le choc. En effet, après le choc d'offre, les variations du chômage résultent principalement de la réponse du taux d'accès à l'emploi, tandis que, les deux taux de transition contribuent de manière équilibrée après le choc de demande monétaire. Ce résultat empirique n'est pas retrouvé dans le modèle théorique, et ce, malgré une calibration attentive des paramètres du modèle. Ainsi, peu importe la nature du choc, dans le modèle les hausses du chômage s'expliquent principalement par une augmentation du taux de séparation.

Si en raison d'un manque de données, le chapitre 2 ne pouvait pas prendre en compte les aspects "participation" au marché du travail, le chapitre 3 s'est consacré à cette dimension. L'un des faits marquants de la dernière récession est l'augmentation importante du niveau d'incertitude dans l'économie. Cette dernière est parfois jugée comme responsable de la lente reprise économique qui suivi la Grande Récession de 2008. Face à ce phénomène macroéconomique plutôt inhabituel, la littérature a cherché à mettre en évidence les canaux de transmission de l'incertitude au sein de l'économie. Il est notamment montré qu'un choc d'incertitude est en mesure d'exercer une pression à la hausse sur le taux de chômage. A ma connaissance, les effets éventuels de l'incertitude sur la participation au marché du travail n'ont pas été étudiés. Ce chapitre contribue à la littérature en mettant en connexion ces deux concepts. Là aussi, l'analyse est à la fois empirique et théorique. La partie empirique du papier consiste à mettre en évidence des faits stylisés nouveaux. En effet, par le biais d'une modélisation VAR, dans laquelle le choc d'incertitude est identifié par le biais de contraintes de court terme, je montre que le taux de participation diminue en réponse à une augmentation non-anticipée de l'incertitude. Ce résultat est robuste à de nombreuses alternatives. Une fois le fait stylisé présenté, le chapitre cherche à reproduire ce type de co-mouvements à partir d'un modèle DSGE Néo-Keynésien. Les simulations du modèle mettent en avant que la reproduction des effets négatifs du choc d'incertitude sur la participation n'est pas directe. En effet, lorsque l'économie n'est pas soumise à des rigidités nominales, l'incertitude augmente le taux de participation. Dans un tel cadre, le motif de précaution induit le ménage représentatif à allouer plus de membres de l'inactivité vers la population active. En revanche, l'introduction des rigidités nominales renverse totalement les effets positifs du choc d'incertitude. Ainsi, les firmes, ne pouvant ajuster leurs prix pour faire face à la demande comprimée des ménages, voient leurs profits diminuer. Ces dernières réagissent en ouvrant moins de postes, ce qui diminue la probabilité de retour à l'emploi des chômeurs. Les opportunités sur le marché du travail étant moins bonnes, le ménage représentatif transfère une proportion moins importante de ses membres vers la participation.

Le quatrième chapitre de cette thèse se focalisait toujours sur les aspects "participation" au marché du travail, mais cette fois-ci, avec une vision plus microéconomique. Il a étudié l'un des freins potentiels à la reprise d'une activité féminine à La Réunion et en France métropolitaine, à savoir, le nombre d'enfants. En effet, les statistiques descriptives montrent qu'il existe toujours une corrélation négative entre le nombre d'enfants et l'activité féminine. Toutefois, si la corrélation parait forte, cette dernière pourrait s'avérer fallacieuse car les deux comportements s'influencent mutuellement. De plus, les coefficients estimés à partir d'une régression standard risquent d'être biaisées en raison d'un problème d'anti-sélection. Pour éviter ces écueils, le chapitre propose une estimation de l'effet causal du nombre d'enfants sur l'activité féminine par la méthode des variables instrumentales. Ainsi, dans l'équation de participation, la variable présumée endogène captant la fertilité sera instrumentée par des indicatrices de naissances gémellaires et de présence d'ainés de même sexe. Les résultats empiriques suggèrent que la probabilité d'activité féminine en présence d'enfants est plus faible à La Réunion. Par exemple, pour les mères de 2 enfants au moins, avoir un troisième enfant réduit leur probabilité d'activité de 13 points à La Réunion contre 8 points en France métropolitaine. Les estimations empiriques montrent également que l'ampleur de l'effet causal est croissante à La Réunion alors qu'elle est décroissante en France métropolitaine. La richesse de la base de données a permis également d'affiner l'analyse. En particulier, le papier montre que l'effet causal est i) bien plus élevé lorsque les enfants sont jeunes, ii) plus fort pour les mères peu diplômées et iii) différent selon les régions de France métropolitaine.

Cette thèse a cherché à contribuer à la littérature en plusieurs aspects : construction de nouvelles séries temporelles de flux, prise en compte de l'inactivité, mise en évidence de résultats empiriques et théoriques nouveaux. Toutefois, les perspectives de recherche suggérées par les travaux de cette thèse restent nombreuses. Tout d'abord, il est utile de remarquer que la longueur des séries construites dans le premier chapitre reste courte. En effet, l'étude couvre une période particulière (2003-2012) marquée par un fort ralentissement économique. Dans les années à venir, il pourrait être utile de calculer les flux sur une période plus étendue. Cela permettrait de mettre en évidence si les mécanismes à l'origine des variations du chômage (rôle de la probabilité d'accès à l'emploi, influence de la non-participation) sont les mêmes sur longue période. Qui plus est, avoir des séries plus longues sur les transitions depuis et vers l'inactivité permettrait d'étendre le spectre des analyses envisageables. Ensuite, les études du chapitre 1 et 2 partagent un point commun dans la mesure où l'emploi est considéré comme un ensemble homogène. Or, dans le cas français, il existe des disparités profondes au sein même de l'emploi. D'un côté, les dualités en matière de contrat de travail (contrat à durée indéterminée vs. contrat à durée déterminée) et de durée du temps de travail (emploi à temps complet vs. emploi à temps partiel) sont fortes. De l'autre, l'emploi public, qui représente une proportion conséquente des emplois en France (environ 21% de l'emploi total), pourrait avoir un rôle non-négligeable dans la dynamique globale du marché du travail. Ces spécificités méritent d'être étudiées plus en profondeur. Puis, remarquons qu'à des fins de simplification de l'analyse, des hypothèses parfois fortes ont été posées. Par exemple, l'accumulation du capital n'est pas prise en compte dans le modèle du troisième chapitre. Les aspects "demande" de travail ne sont pas considérés dans le quatrième chapitre. Enfin, comme évoqué dans le chapitre introductif, cette thèse adopte une vision positive. Les aspects normatifs, bien qu'évoqués, ne constituent pas le centre de la démarche. Sans aucun doute, cela ouvre la voie à d'autres recherches. Par exemple, les institutions (protection de l'emploi, salaire minimum, allocations chômage, etc.) qui régissent le marché du travail français jouent un rôle prépondérant dans son fonctionnement. On pourrait supposer que leur prise en compte, par exemple dans le chapitre 2, modifie la dynamique d'ensemble du modèle et améliore ses capacités prédictives. De même, la question des politiques à mettre en place pour diminuer le taux de chômage et "stimuler" les bons flux pourrait être envisagée à travers des modélisations théoriques mais aussi des évaluations d'impact.

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