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"Macroeconomic Imbalances, Crises and Management of crises in Euro area countries."

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Abstract

This dissertation consists of three essays on how macro-financial imbalances precede crises to what extent their consideration can help better management of crises in the Eurozone countries. It aims to show the importance of market confidence in the analysis of the link between imbalances and crises. Furthermore, it suggests to account for the effects of market confidence on improvement of long run growth.

The first chapter tries to identify the macro-financial imbalances that exposed the euro area countries to fiscal stress before the outbreak of the European debt crises. Contrary to conventional wisdom that interprets fiscal stress in terms of fiscal sustainability, we focus on short-term fiscal vulnerability as reflected by the conditions of debt refinancing in the sovereign bond markets. We find that market-based indicators capturing risk perceptions of sovereign debts have been influenced by the indicators defined in the European Macroeconomic Imbalance Procedure (MIP) and by variables of financial vulnerability. When pricing the risk of sovereign bonds, the holders of government debts take into account, not only the macroeconomic imbalances, but also factors such as banking distress, corporate bond risk, liquidity risks in the interbank market or the volatility of stock prices.

The second chapter investigates how risk premium affects depositors' behavior and economy through a simulated two-countries DSGE model. In this framework, we assume that the risk premium depends positively on deposit guarantee and negatively on probability of sovereign default. Our findings are twofold. Firstly, our results confirm the stabilizing role of deposit guarantee in banking sector by reducing deposit withdrawals after a positive shock to sovereign default probability. Secondly, by accounting for the role of regulatory-driven and market-driven

capital requirements in banking sector, our findings suggest that, more capital constraint could reassure depositors by helping to reduce deposit withdrawals and enhance production. However, higher deposit guarantee and capital constraint could also have negative effect on banking and/or production sectors due to depositors' reallocation of resources.

The chapter three is interested in how debt constraint in the international capital markets can affect capital flows and long run growth. We extend and simulate the [1]' overlapping generation model of a constrained economy. We assume that debt constraint increases with the quality of institutions/governance and the ability to collect tax revenue. Mainly, our results confirm the Balassa-Samuelson effect only when the economy is unconstrained. Indeed, when the country is constrained, higher tradable sector productivity, better ability to collect taxes and quality of institutions/governance appreciate the real exchange rate and enhance capital inflows; but without long run growth improvment. In an unconstrained economy, a positive shock to tradable sector productivity and higher tradable sector tax rate increases investment abroad, appreciates the real exchange rate and promotes long run growth.

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Introduction

L'objet de cette thèse est d'étudier les liens qui existent entre les déséquilibres macroéconomiques et les crises, et de voir dans quelles mesures leur prise en compte peut aider une meilleure gestion des crises dans les pays de la zone euro.

Bien que les déséquilibres macroéconomiques, tels que les déficits des balances courantes et budgétaire, la dette publique, etc... aient été abondamment étudiés dans la littérature économique, les crises récentes ont remis leur analyse au centre des débats. En effet, les économistes s'accordent sur les nombreux risques associés à l'accumulation des déséquilibres globaux.

Dans la zone euro, les crises récentes de dettes publiques ont mis en évidence et accentué l'hétérogénéité des situations/réalités macroéconomiques des pays membres, une hétérogénéité qui existait déjà avant l'adoption de la monnaie unique. Dès 1995, on observait une divergence des comptes courants due au déséquilibre qui s'est progressivement développé entre les pays qui accumulaient des excédents importants et ceux qui creusaient leurs déficits.

De même, entre 1999 et la crise financière mondiale, des écarts de compétitivité-prix croissants ont été observés entre les pays membres. Les pays excédentaires tels que les Pays-Bas, l'Allemagne, la Finlande et l'Autriche ont une forte compétitivité contrairement aux pays déficitaires tels que la Grèce, l'Irlande, le Portugal et l'Espagne, qui ont subi la plus grande détérioration de leurs finances publiques du fait de la crise de la dette.

Dès lors, compte tenu de l'interdépendance économique entre les Etats membres de la zone euro, les déséquilibres d'un Etat peuvent avoir de graves réper-

cussions sur les autres Etats et par conséquent sur la stabilité de l'économie européenne dans son ensemble. A titre d'exemple, avec la crise de la dette, les pays faisant preuve d'une plus grande rigueur budgétaire, ont dû porter le fardeau du sauvetage financier des pays plus laxistes ; le risque de contagion à travers les marchés financiers et le secteur bancaire étant important.

Une augmentation des divergences macro-économiques a donc pour risque de rendre le taux directeur unique fixé par la BCE, inadapté aux réalités économiques des Etats membres. Par ailleurs, l'existence de ces déséquilibres entraîne des ajustements douloureux (mesures d'austérité, réformes structurelles, baisse des salaires) à court, moyen ou long terme dans les pays déficitaires ; ce qui a des répercussions sur les autres pays de l'union (affaiblissement de la demande, contraction du commerce). Enfin, la confiance des marchés en la monnaie unique et en la capacité des états à faire face aux crises successives, se trouve également ébranlée.

Les différents chapitres de cette thèse tentent d'apporter des réponses à trois questions importantes :

- Quels sont les indicateurs macro-financiers qui pourraient aider à mieux anticiper les épisodes de stress budgétaire dans les pays de la zone euro ?
- Quelles seraient les conséquences de la mise en place d'un système de garantie des dépôts bancaires sur les variables macroéconomiques et sur le comportement des investisseurs, investisseurs qui tiendraient compte du risque de défaut souverain?
- Dans quelle mesure une meilleure qualité des institutions de la gouvernance pourrait-elle aider à améliorer la croissance de long terme d'une économie contrainte sur le marché international des capitaux?

En retenant une approche de court terme, les deux premiers chapitres montrent l'importance de la confiance des marchés dans l'analyse du lien entre déséquilibres macroéconomiques et crises. Dans le troisième chapitre, nous adoptons une perspective de plus long terme pour analyser les effets de cette confiance des marchés sur la dynamique de la croissance. Notre approche est à la fois théorique et empirique. L'approche théorique se base sur les modèles DSGE (modèles d'équilibre

général stochastiques dynamiques et la modélisation d'une crise dans une petite économie ouverte. L'approche empirique se focalise sur les modèles Probit/Logit sur données de panel et sur un modèle d'alerte fondé sur des signaux avancés (early warning indicators).

Les crises qu'ont connues les pays de la zone euro ont pour origine des déséquilibres macro-financiers globaux. Les nouveaux dispositifs mis en place par la Commission Européenne visent à les identifier et à prévenir leur occurrence en amont de la surveillance multilatérale. Mais encore faut-il que les Etats s'entendent sur les déséquilibres à considérer comme prioritaires pour la cohésion de la zone. Nous présentons brièvement ceux étudiés dans nos travaux, puis nous exposons le contexte de crise dans lequel nous nous intéressons à leurs effets.

0.1 Déséquilibres macroéconomiques

Malgré les différents travaux de recherche en la matière, les déséquilibres restent une problématique importante et mettent en évidence la nécessité d'une action politique résolue, globale et coordonnée des Etats.

0.1.1 Qu'est-ce qu'un déséquilibre?

Selon le règlement (UE) numéro 1176/2011 sur la prévention et la correction des déséquilibres macroéconomiques, un déséquilibre macroéconomique peut être défini comme étant "toute tendance donnant essor à des développements macroéconomiques ayant un effet préjudiciable ou susceptibles d'avoir un effet préjudiciable sur le bon fonctionnement de l'économie d'un État membre, de l'Union économique et monétaire ou de l'Union dans son ensemble" et les déséquilibres excessifs comme "des déséquilibres graves, notamment des déséquilibres compromettant, ou susceptibles de compromettre, le bon fonctionnement de l'Union économique et monétaire".

En d'autres termes, on peut considérer un déséquilibre comme étant tout écart par rapport à un niveau souhaitable. Cependant, certains " déséquilibres "

peuvent ne pas s'avérer préjudiciables car s'inscrivant uniquement dans une dynamique d'ajustement économique. Les déséquilibres qui nécessitent une surveillance étroite et une correction sont ceux qui entravent significativement le bon fonctionnement d'une économie. En effet, ces déséquilibres préjudiciables sont sujets à une dynamique non viable ou se situent au-delà d'un seuil critique qui nécessiteraient un ajustement brutal et important et, par conséquent, dommageable.

0.1.2 Types de déséquilibres

Déséquilibres définis par la Procédure de Déséquilibres Macroéconomiques (PDM)

Avant la crise, les déséquilibres globaux dans la littérature économique étaient principalement associés au déficit/excédent de la balance courante, au déficit budgétaire, à la dette publique, à la dette étrangère, à l' épargne/investissement, aux taux élevés d'accumulation des réserves étrangères.

Dans la zone euro, la Commission Européenne avait mis en place à partir de 1997, une procédure de contrôle de la situation budgétaire basée sur le Pacte de Stabilité et de Croissance. Les principaux critères retenus lors de la signature de ce pacte étaient le maintien du niveau de déficit public et d'endettement public en-dessous respectivement de 3% et 60% du PIB. Toutefois, les crises récentes ont montré les insuffisances de cette procédure.

Dès lors, une nouvelle procédure a été introduite en 2011 par la Commission Européenne pour détecter à un stade bien plus précoce les déséquilibres macroéconomiques dans les États membres et pour les corriger. Cette procédure de surveillance et de contrôle, appelée procédure sur les déséquilibres macroéconomiques (PDM) repose sur la surveillance de onze indicateurs répartis en deux sous-groupes:

- Déséquilibres externes et compétitivité:
  - Le solde du compte courant, est l'une des variables identifiée par de nombreux travaux comme à l'origine des crises (voir [2]). Un déficit du

compte courant indique généralement que l'économie emprunte plus qu'elle ne prête et/ou qu'elle exporte plus qu'elle n'importe.

- La position extérieure nette globale (PEGN) enregistre la position financière nette (passifs moins actifs) d'un pays par rapport au reste du monde. Cet indicateur fournit une vision globale de la position extérieure nette d'un pays et met en évidence la vulnérabilité extérieure des pays et le risque de crises (voir [2] ou [3] et [4]).
- les parts de marché à l'exportation permettent de capter les pertes structurelles en termes de compétitivité. Cet indicateur mesure la part des exportations de biens et de services d'un pays par rapport au total des exportations mondiales.
- Le coût salarial unitaire (CSU) nominal permet de comparer la hausse des coûts de la main-d'œuvre et celle de la productivité du travail. Une augmentation du CSU peut être une menace pour la compétitivité-coût d'une économie, si d'autres coûts (par exemple coût du capital) ne sont pas ajustés pour la compenser.
- Les taux de change effectifs réels (TCER) visent à évaluer la compétitivité-prix par rapport aux principaux partenaires commerciaux. La littérature économique a souvent montré que le TCER faisait partie des indicateurs pertinents d'alerte précoce des crises économiques (voir [5], [2]).

• Les déséquilibres internes:

- La dette du secteur privé (consolidée) permet de mettre en lumière les risques liés à la stabilité financière et à la vulnérabilité du pays aux chocs économiques. Berkmen et al. (2009) montrent que les pays ayant un niveau de dette privée élevé ont le plus souffert pendant la crise.
- Les flux de crédit du secteur privé est un indicateur de vulnérabilité du système bancaire (voir [2] ; [6]). [7] et [8] montrent un impact significatif d'une hausse du crédit sur la probabilité des crises bancaires, des crises monétaires et des défauts souverains.
- L'évolution des prix de l'immobilier mesure l'évolution des prix du marché de l'immobilier par rapport à l'évolution des prix à la consommation. Comme le soulignent un certain nombre d'analyses (voir [9]), une baisse

significative de la valeur réelle des prix immobiliers peut être source de crises économiques.

- La dette du secteur public est un indicateur dont la hausse est synonyme d'une plus grande vulnérabilité à faire face aux crises. Il est associé à l'indicateur de dette du secteur privé et fournit une vision globale du niveau d'endettement d'un Etat.
- Le taux de chômage est un indicateur permettant de surveiller les taux élevés et persistants du chômage. Il met en évidence une mauvaise répartition potentielle des ressources et le manque général de capacité d'ajustement d'une économie.
- Les passifs du secteur financier rendent compte de l'évolution des dettes de l'ensemble du secteur des sociétés financières.

Tableau : Description des indicateurs de la procédure de déséquilibres macroéconomiques (PDM)

Indicateurs	Descriptif	Seuils
Balance des transactions courantes	en % du PIB, moyenne mobile 3 ans	de -4% à +6%
Position extérieure nette*	en % du PIB	-35%
Taux de change effectif réel	taux de croissance sur 3 ans	de +/- 5% (zone euro)
Parts de marché à l'exportation	taux de croissance sur 5 ans	- 6%
Coû t salarial unitaire (CSU) nominal	taux de croissance sur 3 ans	9% (zone euro)
Prix de l'immobilier	taux de croissance annuel	6%
Flux de crédits au secteur privé**	en % du PIB	15%
Dette privée**	en % du PIB	160%
Dette publique	en % du PIB	60%
Taux de chômage	moyenne mobile sur 3 ans	10%
Passifs du secteur financier	croissance annuelle	16.50%

* : patrimoine/endettement net vis-à-vis de l'extérieur. ** : sociétés non financières et ménages. Source: Commission européenne.

Déséquilibres financiers

Durant les dernières décennies, la littérature financière et économique (voir [10]; [11]; [12]; [13]) a porté un grand intérêt à l'instabilité financière comme l'un des premiers symptômes du désordre du système financier. Les crises récentes,

ont remis en évidence les effets dévastateurs qui peuvent être associés à la négligence des déséquilibres financiers. Il s'avère donc nécessaire de considérer les indicateurs de stress financier comme des indicateurs d'alerte pertinents pour une analyse des récentes crises successives.

A l'instar de nombreuses études empiriques, nous nous intéresserons particulièrement à l'indice de stress financier (ISF), utilisé comme indicateur d'instabilité financière. Cet indicateur permet de mesurer l'influence des facteurs macroéconomiques, externes, financiers et institutionnels sur l'instabilité financière. D'après [14], un épisode de stress financier peut être défini comme une période où le système financier est sous pression de sorte que sa fonction d'intermédiation s'en trouve altérée. Il peut également faire référence à une interruption du fonctionnement " normal " des marchés financiers ([15]). Les caractéristiques principales du stress peuvent être entre autres une augmentation de l'incertitude sur le comportement des investisseurs et sur la valeur fondamentale des actifs (voir [15], [16], [17]). Sachant que l'ISF est un indice global (agrégé), ses quatre composantes sont :

- Le "bêta du secteur bancaire" mesure la corrélation de la rentabilité d'un actif à celle du marché. Elle permet de mesurer l'ampleur des risques systématiques non diversifiables d'un actif.
- Les rendements des marchés boursiers permettent de mettre en évidence une fuite vers la liquidité et vers la qualité. En effet, une diminution de ces rendements peut décourager les investisseurs ayant une faible aversion au risque ; ce qui peut être vu comme une augmentation du stress financier.
- La volatilité des rendements du marché boursier rend compte de l'asymétrie de l'information, de la fuite vers la liquidité des investisseurs et de l'incertitude sur les valeurs fondamentales.
- Un index de pression du marché de change (EMPI) aide à mesurer la pression spéculative sur le marché de change.

La prise en compte de ces indicateurs permet d'apprécier la solidité du système financier, afin de mieux appréhender les risques d'instabilité qui y sont associés.

Déséquilibres liés à la mauvaise qualité des institutions

La littérature économique s'est beaucoup intéressée à la qualité des institutions comme variable explicative des différentiels de croissance entre pays, du commerce international (voir [18]; [19]; [20]; [21]) ou des investissements directs étrangers (voir par exemple [22]). Toutefois, les crises successives récentes ont suscité un intérêt pour l'analyse du rôle des institutions en tant que mécanisme générateur de déséquilibres. En d'autres termes, comme l'a mentionné Douglas North, " institutions matter ". La qualité des institutions peut potentiellement expliquer l'instabilité de la croissance (voir [23]). [24] soulignent que la présence d'institutions faibles précède les crises et peut prolonger leur durée. Notre intérêt pour le rôle de la qualité institutionnelle s'avère donc tout à fait pertinente pour les pays de la zone euro qui ont traversé une profonde récession en raison des récentes crises.

0.2 Le contexte des crises

La problématique des crises est l'une des principales préoccupations du 21ème siècle. En effet, l'économie mondiale a connu plusieurs crises successives. La crise des " subprimes " qui a pris naissance aux Etats-Unis à partir de juillet 2007 s'est transformée en une crise financière et économique mondiale. La crise financière mondiale est devenue une crise de la dette européenne. Notre étude des conséquences des déséquilibres précédemment définis se fera donc dans un contexte de crises où la perception des marchés financiers revêt une grande importance.

0.2.1 De la crise des "subprimes" à la crise financière

Les " subprimes " représentaient une forme de crédits destinés à des ménages exclus du système de prêts ordinaires (dit "primes") parce que ne disposant pas des garanties nécessaires. Ces prêts hypothécaires permettaient à ces ménages d'avoir accès au marché immobilier. Cependant, ces prêts étant à haut rendement, comportaient un risque de défaut élevé pour les emprunteurs. Dès lors, pour limiter ce risque, les prêteurs avaient pour objectif d'augmenter les prix immobiliers afin de revendre le bien immobilier avec une plus-value en cas de défaut.

Les banques n'ont pas gardé ces créances "subprimes" dans leur bilan. En effet, celles qui détiennaient ces crédits les ont revendus à des investisseurs sur le marché des "titres". On a donc assisté à un transfert du risque sur ces créances, de la banque vers les investisseurs (des fonds d'investissements, des Etats ou encore d'autres banques). Cette méthode de diversification des risques a servi d'assurance tant que les défauts de paiement se produisaient de façon isolée. Toutefois, lorsqu'ils sont devenus massifs et simultanés, par contagion, la titrisation a étendu le risque à l'ensemble du système financier. Ce fut le cas en 2007 aux Etats-Unis lorsque la valeur de l'immobilier s'est effondrée. Les emprunteurs se sont retrouvés insolvables, les crédits n'ont pas été remboursés et les investisseurs ont tout perdu. On a alors assisté à l'explosion de la bulle immobilière. La crise a atteint son apogée en septembre/octobre 2008 lorsque les autorités américaines ont décidé de ne pas empêcher la faillite de la banque d'investissement Lehman Brothers.

0.2.2 De la crise financière à la crise économique mondiale

La crise de 2007-2010 a mis à mal le secteur bancaire mondial. Au niveau européen, les banques espagnoles et irlandaises ont connu des pertes très importantes du fait qu'elles avaient investi massivement dans les titres subprimes. En nourrissant des bulles financières et immobilières, elles obtenaient une partie importante de leurs profits sur ces marchés, tout en y risquant leurs fonds propres. Ce contexte créa de l'incertitude sur le marché financier et suscita un climat de méfiance. Les banques arrêtèrent de se prêter entre elles, ce qui gela le marché interbancaire.

0.2.3 De la crise financière à la crise de la dette européenne

La crise financière a participé à une détérioration très importante des finances publiques dans la zone euro. En effet, la récession de 2009 a considérablement diminué les recettes publiques. Pourtant, les Etats ont dû intervenir pour sauver les banques à travers des plans de relance coûteux. Le niveau de la dette publique dans la zone euro est passé de 65% à 85% du PIB entre 2007 et 2010. De ce fait,

aucun des pays membres de la zone n'a pu respecter le Pacte de Stabilité et de Croissance (PSC).

Face à cette situation, la solvabilité de certains pays de la zone euro a été remise en question très rapidement par les marchés, ce qui a mis à mal leur capacité de refinancement. Dès lors, ces pays pour se refinancer sur les marchés furent soumis à des taux d'intérêts plus élevés ; ce qui a rendu leurs dettes de moins en moins soutenables. A partir d'avril 2010, on a observé une divergence entre les taux d'intérêt sur les emprunts publics en défaveur des pays tels que le Portugal, l'Irlande, l'Italie, la Grèce, l'Espagne; connus sous l'acronyme anglais PIIGS. A titre d'exemple, les taux de la Grèce et de l'Irlande étaient respectivement quatre et trois fois plus élevé que le taux allemand en décembre 2010. Outre les spéculateurs qui pariaient sur la défaillance souveraine de ces pays, les agences de notation en dégradant leurs notations ont joué un rôle important dans l'aggravation des doutes sur la viabilité financière des PIIGS.

La crise de la dette souveraine a accentué les difficultés des banques dans la mesure où les dettes publiques qu'elles détenaient sont devenues des actifs risqués. Une interdépendance apparaissait donc entre les difficultés des finances publiques et celles des banques. Plus la qualité de la dette publique d'un pays devenait - douteuse, plus les banques de ce pays se trouvaient fragilisées dans la mesure où elles en détenaient généralement une grande quantité. Les marchés s'attendaient alors à ce que les Etats viennent en aide à leurs banques, ce qui accentuait les craintes sur leur solvabilité propre et sur leur capacité à soutenir effectivement les établissements bancaires. Ces nombreuses incertitudes nourrissent un cercle vicieux incontrôlable dans les marchés financiers. C'est dans ce contexte qu'ont été adoptés en décembre 2010, les accords de Bale III pour réguler, renforcer le système financier et garantir un niveau minimum de capitaux propres, afin d'assurer la solidité financière des banques. En juin 2012, face à l'inefficacité des mesures prises depuis 2008, les doutes sur la solidité des banques européennes sont une nouvelle fois apparus. Dans un premier temps, les demandes d'aide des banques augmentent l'inquiétude des marchés sur la solidité des bilans bancaires (en particulier espagnoles). Ensuite, de nombreux déposants européens ont commencé à réduire leurs dépôts dans les banques de leur pays .

Les déposants sont soumis à une asymétrie d'information dans la mesure où ils ne connaissent pas avec certitude l'état de santé du système bancaire. Cette asymétrie d'information en pleine crise bancaire, accentue la contagion de la panique et pousse les épargnants à retirer massivement leurs dépôts. Ceci est susceptible de créer une crise de liquidité qui peut se transformer en une crise de solvabilité ; qui pourrait à son tour contaminer l'ensemble du système bancaire. Or plus le risque de faillite des établissements bancaires augmente, plus la confiance sur le marché interbancaire baisse, ce qui conduit à une diminution de l'offre de prêt interbancaire. Tout ceci pèse sur l'économie réelle étant donné que les crédits aux ménages et les investissements des entreprises en pâtissent. Dès lors, une solution pour éviter les paniques bancaires (à part fournir la liquidité dont ces banques ont besoin), est de garantir les dépôts. C'est ce qui explique que la BCE a mis en place un système de garantie des dépôts qui protège les épargnants en leur remboursant leurs dépôts jusqu'à un certain plafond, en cas de défaillance de leur banque. Un niveau de garantie commun aux Etats membres de la zone, a donc été fixé pour éviter que certains Etats puissent attirer les dépôts de leurs voisins en offrant une garantie plus importante (totale) des dépôts. Compte tenu des différences de niveau de vie, la part des dépôts couverts est très différente d'un pays à l'autre ; ce qui crée quand même une disparité entre les états membres. En effet, malgré la mesure collective, l'Irlande a préféré garantir en totalité les dépôts de ses banques. Ceci a augmenté la crainte des autres pays européens à faire face à une fuite de l'épargne vers des banques situées dans des pays offrant une garantie totale.

Enfin, lorsqu'on regarde de plus près les pays tel que la Grèce et Chypre qui ont été gravement touchés par la crise de la dette, les plans de sauvetage (connue sous le nom de troïka) financés conjointement par le Fonds Monétaire International (FMI), la Commission Européenne et la Banque Centrale Européenne (BCE) se caractérisent par de l'austérité budgétaire et des réformes structurelles. Or, la mise en place de ces politiques dépend aussi fortement de la qualité des institutions et de la gouvernance. En effet, la crise de la dette a montré au-delà d'une crise de soutenabilité, un manque de transparence de la Grèce lors de son entrée - dans la zone euro sur la présentation de sa dette, des problèmes structurels et

des difficultés dans la collecte des impôts. En conséquence, la profondeur des faiblesses institutionnelles de la Grèce, a été sous-estimée. Cette crise met aussi en évidence des problèmes institutionnels et économiques sous-jacents, dans certains pays membres de la zone euro. D'après [25], "Il ne suffit pas de recommander une bonne politique financière à un pays - ou pour le FMI de consentir des prêts à un pays conditionnellement à une bonne politique fiscale - si ... les institutions ne sont pas là pour soutenir la politique".

0.3 Contributions de la thèse

Notre thèse cherche à contribuer au débat actuel sur les liens entre déséquilibres macroéconomiques et crises. Plus particulièrement, elle cherche à répondre aux questions suivantes: D'abord, face à l'ampleur des récences crises successives, n'est-il pas possible de mieux anticiper les épisodes de stress budgétaire ? Si oui, quels pourraient être les indicateurs d'alerte précoces de ces épisodes dans la zone euro ? Ensuite, dans quelle mesure la mise en place d'un système de garantie des dépôts bancaires pourrait-elle aider à freiner les retraits de dépôts dans un contexte où les investisseurs tiendraient compte du risque de défaut souverain ? Enfin, comment une meilleure qualité des institutions/de la gouvernance peut aider à améliorer la croissance de long terme d'une économie contrainte sur le marché international des capitaux?

Notre premier chapitre cherche à identifier les déséquilibres macroéconomiques qui auraient pu exposer les pays de la zone euro à des épisodes de stress budgétaire; et ce avant le déclenchement de la crise de la dette de 2012. L'approche utilisée en général dans la littérature consiste à définir le stress budgétaire en terme de soutenabilité fiscale. Mais, nous avons opté pour une approche de marché qui permet de tenir compte de la perception que les marchés ont du risque de défaut souverain. Les épisodes de stress budgétaire sont donc définis comme étant les épisodes de durcissement des conditions de refinancement des Etats sur le marché de la dette souveraine. Ensuite, nous avons considéré comme indicateurs d'alerte précoce, les indicateurs de la Procédure de Déséquilibres Macroéconomiques (PDM) et les indicateurs composant l'Indice de Stress Financier (ISF).

L'analyse par l'approche des signaux souligne l'importance de la prise en compte de la perception que les marchés ont du risque de défaut souverain pour définir les épisodes de stress budgétaires. Il semblerait que les marchés sont très sensibles à l'évolution des déséquilibres macro-financiers en période de vulnérabilité budgétaire. Ils prêteraient attention aux "petits" déséquilibres macroéconomiques compte tenu des différentes valeurs de seuil obtenues pour les variables d'alerte précoce.

Après l'analyse empirique par les modèles Probit/Logit sur données de panel, nous constatons également que les épisodes de stress budgétaires ont été influencés par les indicateurs définis dans le PDM et par des variables de vulnérabilité financière (ISF). Il ressort aussi qu'un épisode budgétaire de stress ne dépend pas forcément de l'état précédent. Autrement dit, les déséquilibres macro-financiers ne sont pas systématiquement corrigés en cas de doute de la vulnérabilité des finances publiques. Ensuite, les résultats montrent qu'en plus des déséquilibres macroéconomiques de la PDM, la détresse bancaire, le risque des obligations des sociétés, les risques de liquidité sur le marché interbancaire ou la volatilité du prix des actions semble être des indicateurs d'alerte précoce statistiquement significatifs.

Notre second chapitre s'intéresse à la manière dont une prime de risque sur le rendement des dépôts bancaires peut affecter le comportement des épargnants et l'économie. Notre principale hypothèse stipule que le rendement sur les dépôts bancaires croît avec la prime de risque. Cette prime de risque par hypothèse, augmente avec la probabilité de défaut souverain et diminue avec une garantie sur les dépôts. Autrement dit, quel est l'impact de la garantie sur les dépôts et de la probabilité de défaut souverain sur les variables économiques et sur les mouvements de dépôts des pays à risque vers les pays plus sûrs? L'approche utilisée est celle de la modélisation d'un modèle DSGE à deux pays que nous simulons. Ensuite, pour introduire les notions de régulation bancaire, nous avons également modélisé des banques contraintes, qui cherchent à maximiser une utilité.

Dans un premier temps, nos simulations confirment le rôle stabilisateur de la garantie sur les dépôts dans le secteur bancaire. En effet, elle aiderait à réduire

les retraits de dépôts bancaires après une hausse de la probabilité de défaut souverain. Dans un deuxième temps, nos résultats soulignent qu'une hausse de la garantie sur les dépôts pourrait miner les profits des banques tout en améliorant la production des firmes; ce grâce à la réallocation des ressources effectuée par les investisseurs. Dans un troisième temps, il semblerait qu'une augmentation de la régulation du système bancaire et de la garantie sur les dépôts bancaires peuvent avoir des effets négatifs sur le secteur bancaire et/ou sur la production des pays à risques.

Notre troisième chapitre s'intéresse à l'effet de la perception que les marchés ont de la qualité des institutions/gouvernance et de la capacité à collecter les taxes sur la croissance à long terme. Pour ce faire, nous nous sommes basés sur le modèle d'une Petite Economie Ouverte (PEO) avec générations imbriquées proposé par [1]. Dans ce chapitre, la confiance des marchés est reflétée par l'accès de l'économie au marché international des capitaux.

Notre principale hypothèse repose sur le fait que l'accès au marché international des capitaux augmente avec un paramètre de qualité institutionnelle/gouvernance et avec la production d'un bien public qui est financé par la collecte d'impôts. Autrement dit, une augmentation des recettes fiscales rend compte de la capacité d'un Etat à collecter les impôts; ce qui est aussi synonyme de bonne gouvernance/qualité institutionnelle du point de vue des investisseurs étrangers. Ensuite, nous introduisons du capital humain, pour créer une dynamique de croissance endogène. Enfin, nous introduisons une différenciation entre biens échangeables et non échangeables pour tenir compte du lien entre les avoirs extérieurs nets, le taux de change réel et la croissance.

Après simulation du modèle, nous constatons premièrement que dans une économie contrainte à forte productivité dans le secteur échangeable, une meilleure capacité à percevoir les impôts et de meilleurs institutions apprécient le taux de change réel et augmentent les entrées de capitaux. Toutefois, cette hausse des entrées de capitaux n'aide pas à améliorer la croissance à long terme. Deuxièmement, lorsque l'économie est non contrainte, un choc positif sur la productivité du secteur échangeable et une hausse des recettes fiscales dans le secteur échange-

able augmentent l'investissement étranger, apprécient le taux de change réel et favorisent la croissance à long terme. Troisièmement, les résultats confirment l'effet Balassa-Samuelson, uniquement lorsque l'économie est non contrainte.

Chapter 1

Macroeconomic imbalances, financial stress and fiscal vulnerability in the euro area before the debt crises: A market view. [1]

1.1 Introduction

Following the height of the European debt crises from 2012 onwards, concerns have risen about the global nature of these crises. Rather than focusing on debt ratio and fiscal balance alone, the European Commission has set up a scoreboard of indicators that defines the "Macroeconomic Imbalance Procedure"[2] (MIP). This is conceived as an early warning system that alerts policymakers on the build-up of macroeconomic imbalances. The variables defining the MIP are designed to provide an early detection of fiscal stress in the euro area countries. Policy-makers consider that the debt crises in European countries have been brought by the vulnerabilities associated with the current account imbalances, lack of price competitiveness, over-indebtedness in the private sector, weak economic growths.

[1] This chapter is an article co-written with Gilles Dufrénot and Karine Gente.

[2] The new Excessive Imbalance Procedure (EIP) was set up in November 2011 in EU Regulation 1176/2011.

This view is echoed in recent empirical papers. For instance, [26] and [27] show that some of the MIP indicators provide a good explanation of fiscal vulnerability in the European countries. Their approach goes beyond the paper of [28], [29] which focus on fiscal variables alone as a source of fiscal stress.

Our paper looks back in time (before 2012 onwards, the years corresponding to the height of the debt crises in Europe). Macroeconomic imbalances had already risen concerns among investors in the sovereign bond markets, in spite of the fact that they were not yet incorporated in the multilateral surveillance mechanism by policymakers. The markets' view of fiscal vulnerabilities differs from the policymakers'. The latter seek to keep sovereign debt sustainable over a medium-to-long-term horizon. In contrast, the former have short-term motivations and pay attention to whether governments service their debt in due time, whether they face credit or illiquidity risks. The markets' view needs to be taken into account in the exercise of monitoring fiscal vulnerabilities for several reasons. Firstly, governments can face more stringent financing constraints that degenerate into a future debt crisis. Secondly, since sovereign debts are financed in the bond markets, investors pay attention to the share of interest in the governments' fiscal revenues (interest burden). A large share increases the probability that a government faces a higher liquidity risk on debt coming due. Thirdly, the exposition to sovereign debts in the euro area concerns both sovereign and private lenders. The recent experience of the Greek default suggests that private investors are the front runners in the debt crises. Markets' sentiments can therefore alert the policymakers about forthcoming debt vulnerability.

Against this background, this paper suggests that policymakers should make their judgment about their fiscal vulnerability by monitoring "market-based" indicators.

The recent literature resurrected the idea that fiscal stress and fiscal vulnerability in Europe were the consequence of adverse market participants' sentiment, thereby implying too high sovereign rate spreads compared with their "fundamental" value (see, [30], [31], [32], [33]). Therefore, there is a need to consider variables of fiscal vulnerability reflecting markets' sentiment.

Our contribution to the existing literature is threefold.

The paper's first contribution is to interpret fiscal stress as the result of investors' behavior in the bond markets (rather than in terms of fiscal sustainability). We do not consider fiscal stress as reflecting "extreme" situations like a risk of default, debt restructuring, or debt unsustainability. Here, fiscal stress is understood as a worsening of the financing conditions in the sovereign bond markets."[3]

The second contribution of the paper concerns the variables used as advanced indicators of fiscal stress. A first set of variables includes macroeconomic variables that have been already used in the recent literature. The MIP indicators are considered to summarize different facets of macroeconomic imbalances: competitiveness, private sector indebtedness, potential bubble in asset markets, fiscal and current account imbalances, etc. In addition to these variables, we consider financial stress indicators.

Our paper intends to examine which types of financial stress can be associated with higher fiscal vulnerability. The next section provides all the details about the choice of these financial variables.

Our third contribution concerns the methodology. A methodology which is common in the literature addressing the fiscal stress issue in Europe is the non-parametric signals approach ([26], [28], [29]). It consists in examining i) which variables send a signal prior to a fiscal stress event and ii) the state of the economy and financial markets in which a fiscal distress is triggered. The advantages of the signal-based approach are its simplicity and parsimony (in the sense that this method does not require minimum number of observations with a "1" value in the dependent variable, or a minimum number of explanatory variables). Meanwhile, it does not lead to an analysis of the significance of the variables' influence. Neither does it take into account correlations between the variables. Another widely used approach is the logit/probit model. Many works have been proposed using this

[3]For robustness, we consider different measures of fiscal stress. These variables are extensively described in the next section.

model with regard to different types of fiscal stress, but little on the link between fiscal stress and its determinants in Europe. This paper adopts both approaches to account for different features in the data.

The signals approach can be viewed as a first step in order to obtain a ranking of the variables that are likely to pre-announce a fiscal stress. Then, one needs to get an idea about the "confidence" of the predictions. The logit/probit models are helpful since they give information about the marginal effect of a change in a given variable on the probability of fiscal vulnerability. Unlike the previous literature using this type of models to predict fiscal stress, we report estimates based on random error component models rather than on pooled models.

The findings of this paper highlight the importance of capturing fiscal vulnerability through the investors' perception of fiscal risk (as reflected by price bond convexity, duration, skewness and kurtosis). It seems that they pay attention to "small" macroeconomic imbalances. This is seen from different threshold values obtained for the explanatory variables leading to fiscal vulnerability. This result accords with the so-called wake-up calls view by which investors in the markets are very sensitive to changes in macro-financial imbalances during times of fiscal vulnerability (the interesting feature is that we find such a sensitive reaction even during non-crisis periods since our data cover the years before the 2012 European debt crises).

Secondly, it is also apparent from our results that a fiscal stress episode does not depend upon the state of the previous period. This finding accords with the common wisdom idea that corrections of macro-financial imbalances were not systematically enacted when the vulnerability of public finances were in doubt. Even when higher financial stress and worse macroeconomic conditions put further strain on government finances, fiscal policies were not necessarily successful in bringing about a reduction of fiscal stress.

A third finding of the paper suggests that, when evaluating the marginal effects of the determinants of fiscal vulnerability, controlling for the influence of financial markets stress on fiscal vulnerability improves strongly the predictive accuracy of

fiscal stress events. Comparing our best models with FSI variables with the models with only the MIP variables leads to drastic changes in the value and significance of some variables. This could mean that regressions with only the macro-financial imbalances of the MIP would suffer from omission bias.

The remainder of the paper proceeds as follows. Section 2 provides a brief overview of the literature on the source of fiscal vulnerability in the euro area and the details about the choice of variables. Section 3 presents our early warning signals model of fiscal stress. Section 4 presents the data and discusses our main findings with signals approach. Section 5 contains our estimations of probit models. Section 6 concludes.

1.2 Choice of the variables and related literature

While this paper attempts to empirically identify variables that can presumably be considered as early signals of fiscal vulnerability [4] (or fiscal stress) in the short-term, our choice of the endogenous and exogenous variables is motivated by an existing literature suggesting a handful of variables whose informational content can help predict sovereign spreads, the dynamics of debt service and the pricing of sovereign credit risks.

First, we define a situation of fiscal stress as a context of sovereign risk in the short-term, as perceived by the sovereign bonds holders ("the markets"). Several measures of such a risk have been proposed in the literature. Common variables used are the sovereign rate spreads, the CDS spreads, the interest burden to fiscal revenues ratio, risk-premia. In the wake of both the 2009 financial crisis and the European debt crises that erupted in the mid-2011, the recent literature has been concerned with improving the understanding of the main determinants of sovereign spreads in the euro area. The backbone of the paper is the identification of indicators susceptible to pre-announce fiscal stress and the channels that are likely to amplify unseen precursor imbalances. Though our paper is not concerned with fiscal crises, we wonder whether the identified determinants of the latter also

[4] Throughout this paper, though the literature sometimes distinguishes between fiscal stress and fiscal vulnerability, we shall use both terms interchangeably.

contain information about fiscal vulnerability/stress reflected by more stringent short-term refinancing in the sovereign markets. In this respect, we briefly review the main arguments provided in the literature to explain the dynamics of the euro area spreads and the pricing of sovereign risk in the euro area.

The theoretical workhorses in the analysis of sovereign spreads are threefold. Firstly, the empirical models are consistent with international asset pricing models of market integration or segmentation à la [34]. Secondly, credit risk models based on Cox-Ingersoll-Ross diffusion equations have also proved useful to derive the market price of sovereign bonds (see, for instance, [35]). Thirdly, market price of sovereign risks is modelled as term premia and interest rates from affine models à la [36], [37] and [38]. However, in order to demonstrate how different factors affect fiscal stress, the bulk of the literature has focused on empirical approaches and the estimated equations can be considered as reduced-form of these theoretical models [5].

The main conclusions that can be drawn from the abundant empirical literature are the following. i) Sovereign debt markets react to a multitude of fundamental factors when investors penalize for the yields. The financing cost of new debt depends on fiscal imbalances (public debt ratio, primary deficit), external sector vulnerabilities (current account deficits, competitiveness, exchange rate over-fluctuations), financial market risks (credit and liquidity risks, bank risks), global macroeconomic environment (inflation, growth, foreign spreads). ii) Bond liquidity premium depends on market' sentiment and market microstructure (self-fulfilling expectations, transaction costs, investment opportunities). iii) The literature is still inconclusive about the factors which can be considered as the dominant drivers of sovereign spread (macroeconomic fundamentals, financial conditions, international common risk factors, or the risk-taking behavior in the markets). One reason is that the different factors alter in sovereign risk pricing over time. iv) A sizable share of spread fluctuations is liquidity-driven. v) Before the debt crises, sovereign debt risks were under-estimated by the markets.

[5] For recent contributions, the reader can refer to [39], [40], [41], [30], [42], [43], [44], [45], [46], [47], [48] [49], [50], [51], [52], [53], [54].

Aside from the 2008 financial crisis and the height of the European debt crises, the euro area countries have experienced few fiscal crises since 1999 (in the form of debt default, debt restructuring and rescheduling, fire sales in the sovereign bond markets). However, periods of fiscal stress/vulnerability have occurred more frequently involving changes in spreads and prices beyond a certain "normal threshold" (not necessarily corresponding to abrupt changes). Such periods can be thought of as times of “market pressure”. In this paper, we use market indicators about fiscal vulnerability reflected by the re-financing conditions of public debts. We wonder whether the usual determinants of sovereign spreads in the literature are suggestive of an important role for macroeconomic imbalances and financial vulnerabilities in causing sovereign debt market pressure. Common with the usual literature is our choice of sovereign spreads as a first measure of such a pressure. We however go beyond, by considering additional indicators of market pressure on sovereign bond markets.

We consider the interest paid to sovereign debt holders, as share of fiscal revenues. This measures how large is the fiscal income raised by a government in excess of the debt interest payments to the holders of public bonds. Credit rating agencies, which influence the investors’ perception of sovereign risk, use this variable to make a judgment on the likelihood that a country will or not easily meet its financial commitments. An increase in this ratio is generally interpreted as a sign that government fiscal resources will not necessarily be forthcoming to make interest payments timely. If the agencies’ rating worsens, then the investors’ appetite to hold foreign debt may wane, thereby implying higher pressures on the risk-premia and therefore higher fiscal vulnerability. To the best of our knowledge, the ratio of debt repayments to fiscal revenues has been widely used to study fiscal risk in the emerging and developing countries, but not on the European industrialized countries which were not supposed, till the 2011 debt crises, to face illiquidity problems to refinance their debt. We try to fill this gap by interpreting fiscal stress/vulnerability as a situation in which a government is not fiscally healthy enough to pay back the debt interest.

We additionally consider two measures of bond risks as reflected by the curvature of the price-yield curve. Specifically, we measure the attractiveness of

sovereign bonds by bond price duration and convexity. Our idea is that market pressure may illustrate the degree of exposure of bond holders to shifts in interest rate spreads.

Besides, the vulnerability of sovereign bond markets relates to the bond return distribution. Large negative excess returns are more likely in less li-quid markets. Large increases in spreads are more likely than sharp declines (or vice-versa) for several reasons: positive and negative events do not have the same informational content for investors, the diffusion of news spillover in the sovereign debt markets occurs in an asymmetric manner: some price changes are muted while other are accentuated. Thick and fat tails are also likely to characterize bonds, just as they describe the distribution of equities. The distribution of sovereign spreads and sovereign bond prices influence the financing of governments' debts, because they have implications for asset pricing and risk management (investors' price skewness and kurtosis[6]). The above arguments suggest that fiscal stress/vulnerability conveyed by the markets could be investigated by considering the skewness and kurtosis of sovereign bond prices.

Our selection of explanatory variables (the determinants of fiscal vulnerability) is based on the recent literature examining the leading indicators of fiscal stress in the European countries ([26], [27], [55]). Both macroeconomic and financial imbalances are now considered as potential factors of budgetary risks in Europe and have been integrated in the European system of multilateral budgetary surveillance. So far, the focus has been on the implications for fiscal sustainability and fiscal crises. But the global imbalances could also be factors of short-term refinancing vulnerability. In this paper, two types of variables will serve as indicators for identifying fiscal vulnerability. As first possible determinants, we consider the Macroeconomic Imbalances Procedure (MIP) indicators. They form the macroeconomic fundamentals used in the most recent studies within a European context. As shown by Table 1, the variables that can trigger fiscal stress relate to imbalances in external sector, imbalances in the real estate and private sectors, and financial

[6]There is a vast literature in finance relating portfolio optimization and selection to higher moments than the first two in the distribution of asset prices. Utility maximizing portfolio models incorporates preference for kurtosis, kinked utility functions in which investors favor or dislike skewness and kurtosis.

market vulnerabilities.

We enlarge the set of financial variables considered by the MIP, which focuses on private sector indebtedness and house price increases. Broader financial market situation need to be taken into account: build-up of vulnerabilities in the banking sector, price fluctuations in exchange rate and stocks markets, funding difficulties in corporate bond markets. We draw from a rapidly growing literature examining the fiscal costs of financial distress. Papers investigate the fiscal impact of the banking sector vulnerabilities, the collapse in tax revenues in the wake of financial crises leading to downturns, the consequences of financial imbalances in terms of higher debt ratio[7]. Our choice of financial stress indicators reflects the choice of similar variables in the literature. In detail, we consider corporate bond spreads, beta of the banking sector, inverted term spread and ted spread, volatility of nominal exchange rate and stocks markets.

1.3 An early warning model of fiscal stress in the euro area

The design of an early warning signal model requires considering (4) steps. Firstly, we define fiscal stress episodes. Secondly, we define the explanatory variables (the "indicators"). Thirdly, we estimate threshold values on these indicators to define when they can issue a signal of fiscal stress. Fourthly, we aggregate the different indicators into a composite early warning global indicator (called "index") and we estimate threshold values above which these aggregate variables signal a situation of fiscal stress. All these steps are described in details below.

1.3.1 A definition of fiscal stress episodes

A situation of fiscal vulnerability occurs when a government faces a risk not to be able to service its debt. We adopt the [55]'s approach, according to which fiscal stress can be defined as the short-term risk of facing a sovereign liquidity crisis. In this paper we consider several variables that capture the cost of short-term

[7]See [56], [57], [58], [59], [60].

financing of new debts and the price of sovereign bonds in the secondary markets. We use six variables of fiscal stress: sovereign bond spreads, year-on-year change in the sovereign yield as share of fiscal revenue and four variables of bond price reaction to interest rate change in the bond markets.

Sovereign bond spreads are commonly used in the literature to capture fiscal vulnerability since they release information about risk-premia and any penalization for the yields. We define:

$$BS_t^i = r_t^i - r_t^{US} \tag{1.1}$$

where BS_t^i and r_t^i are respectively country i' s sovereign bond spread and bond yield at time t, r_t^{US} is the US bond yield at time t (the latter is considered as the benchmark rate to compare the European countries' spreads).

A second variable relates to how burdensome service of debt is for public finance. This is the debt burden to tax revenue ratio:

$$DBR_t^i = DebtBurden_t^i / Rev_t^i$$

where Rev_t^i is the fiscal income in country i at time t. The debt burden ratio DBR is defined as the interest payments ($DebtBurden$) as a share of fiscal revenues. We define the year-on-year change of debt burden to fiscal income ratio as:

$$Yoy_{DBR_t^i} = \frac{(DBR_t^i - DBR_{t-1}^i)}{DBR_{t-1}^i} * 100 \tag{1.2}$$

Next, we consider two measures of risk for a sovereign bond. The average term in which a government must face its debt service is captured by bond duration and convexity. Fiscal vulnerability is therefore captured by the impact on prices that are the result of interest rate changes, or how much the value of bond will change following a x% interest rate variation. Since duration is valid only for infinitesimal changes in yields, we also consider convexity which is a better indicator of the curvature of the relationship between prices and yields when there are large shocks. We define:

$$D_t^i = -\frac{1}{P_t^i}\frac{\Delta P_t^i}{\Delta r_t^i} \tag{1.3}$$

and

$$C_t^i = -\frac{1}{P_t^i} * \frac{\Delta^2 P_t^i}{\Delta r_t^{i^2}} \tag{1.4}$$

where D_t^i and C_t^i are respectively the duration and convexity of a sovereign bond price P_t^i at time t.

We finally consider two proxies for credit risk. The issuer credibility is not the same when negative variations in bond prices arise and when prices go up. Besides, losses in bond portfolios are more likely during extreme stress events. For this reason, the expected yield depends on the distribution of bond prices. We therefore consider both the skewness and kurtosis of bond prices.

To detect episodes of fiscal stress, we define a signal variable denoted by S_t^{ij}, where $i = 1, ..., 8$, denotes the country, $j = 1, ..., 6$, denotes the type of endogenous variable considered (BS, Yoy_{DBR}, D, C, skewness and kurtosis of bond prices), and t the period such that

$$S_t^{ij} = \begin{cases} 1, & \text{if } y_t^{ij} \geq c^{ij} \\ 0, & \text{otherwise} \end{cases} \tag{1.5}$$

with the threshold c^{ij} given by

$$c^{ij} = \mu^{ij} + \lambda\sigma^{ij}$$

μ^{ij} and σ^{ij} are respectively the mean and the standard error of the endogenous variable y_t^{ij} which stands alternatively for the different measures j of the fiscal stress in country i. λ is an arbitrary weight whose choice involves a trade-off. The selection must be done taking into account a compromise between obtaining too many or to few values of 1. On the one hand, one might be looking for some values that do not "smooth out" the information on the occurrence of fiscal stress episodes (which happens with large values of λ). On the other hand, we want to reduce the number of "false" signals of fiscal vulnerability (that happens with small values of λ). Therefore, we may need to contend ourselves with a "suboptimal" choice of this parameter. To reduce this caveat, we compare the obtained values 1 with the occurrence of “effective” vulnerability situations defined as a period in which the rating agency Standard and Poor’s downgraded a country domestic currency, though we are well aware that these downgrades are not indisputable.

The best fit is obtained with $\lambda = 0.5$. For purpose of robustness, we also examined the frequency of fiscal stress episodes for other values of $\lambda = 0.5$ ($\lambda = 1$, $\lambda = 1.5$). The results are available upon request to the authors.

1.3.2 Explanatory variables used for the early detection of fiscal stress

We consider 9 indicators of the European Commission (EC) MIP scoreboard (see Table 1). Here, we do not consider the EC's thresholds but we estimate them endogenously.

INSERT Table 1 ABOUT HERE

A first set of indicators refers to external imbalances with the current account balance. A second set of variables reflects the competitiveness of the country (export market share, nominal unit labor costs and real effective exchange rate). A third set of indicators concerns internal imbalances, based on private sector debt, public debt, private sector debt flow, changes in the house price index and unemployment rate. These indicators reflect "global" imbalances that could be potentially harmful for public finance and induce fiscal vulnerability. An additional indicator concerns the financial sector liabilities. This latter will be replaced here by other financial variables that cover different aspects of financial stress.

The financial stress indicators we consider are taken from [14] and [61]. These indicators capture: health of the banking system (beta of banking sector[8] and Inverted yield spread[9]), large asset prices shifts (stock market returns), abrupt risk/uncertainty increases (stock and foreign exchange volatility[10]), abrupt liquidity shifts (treasury eurodollar (or ted) spreads[11]) and corporate bond spread[12]. For a detailed description of the indicators, see Table A.1.

[8] The Beta of the banking sector captures the relative banking sector risk.

[9] Inverted term spread defines a situation in which the difference between the long-term and the short-term yields on financial instrument is negative.

[10] Higher volatility is a sign that markets are "nervous".

[11] The ted spread measures the pressure on the interbank markets (proxy for counterparty risk). It is an indicator of creditworthiness and interbank market liquidity.

[12] Defined as the gap between corporate bond yields and long-term government bond yields. This indicator is used as a proxy of corporate debt market risk.

1.3.3 Computation of the critical thresholds

Using a standard nonparametric signal approach, we want to see which of the MIP and FSI variables would have been useful for detecting fiscal vulnerability episodes, if had they been used in the past years, before the height of the European debt crisis in 2012. To compute the threshold values of these variables that trigger a vulnerability or stress signal, we consider the different (10) quantiles of their distribution and we define, for each quantile q, type I (false positive: false stress periods) and type II (false negative: missed stress periods) errors.

We first compute the following set of indicators for each endogenous variable j and each exogenous variable k:

- TP^j_{qk}: true positive. The explanatory variable signals a fiscal stress that indeed occurs;
- FP^j_{qk}: false positive. The explanatory variable signals a fiscal stress that never occurs;
- TN^j_{qk}: true negative. The explanatory variable does not signal the occurrence of a fiscal stress, and no fiscal stress is observed;
- FN^j_{qk}: false negative. The explanatory variable misses a fiscal stress that occurs.

Secondly, we compute the noise-to-signal ratio (NSR) and the total misclassified errors (TME[13]) according to:

$$NSR^j_{qk} = \frac{FP^j_{qk}/Nf^j_{qk}}{TP^j_{qk}/FS^j_{qk}} \tag{1.6}$$

and

$$TME^j_{qk} = \frac{FP^j_{qk}}{Nf^j_{qk}} + \frac{FN^j_{qk}}{FS^j_{qk}} \tag{1.7}$$

where $FS^j_{qk} = TP^j_{qk} + FN^j_{qk}$ represents the total number of fiscal stress episodes recorded in the data and $Nf^j_k = FP^j_{qk} + TN^j_{qk}$ is the number of "no-fiscal" stress

[13]TME approach consists in computing the sum of type I and type II errors.

recorded in the data. Thirdly, we select, for each explanatory variable k, the *optimal* quantile as the quantile q at which the NSR is minimal and/or the quantile at which the TME is also minimal[14]. Let x^k denote the exogenous variable of type k and Z_q^{jk} be a variable such that

$$Z_q^{jk} = \begin{cases} 1, & \text{if } x^k > x_{jq}^k \\ 0, & \text{otherwise} \end{cases} \tag{1.8}$$

where x_q^k represents the quantile q of the exogenous variable x of type k, $k = 1, ..., 10$. This holds for all exogenous variables except for current account, export market share and inverted curve yield where

$$Z_q^{jk} = \begin{cases} 1, & \text{if } x^k \leq x_{jq}^k \\ 0, & \text{otherwise} \end{cases} \tag{1.9}$$

Finally, for each *optimal* quantile, we compute the following two statistics:

$$Probstress_k^j = \frac{TP_k^j}{TP_k^j + FP_k^j} \tag{1.10}$$

and

$$StressCalled_k^j = \frac{TP_k^j}{TP_k^j + FN_k^j} \tag{1.11}$$

where $Probstress_k^j$ is the probability that a fiscal stress situation on endogenous variable j occurs given that the explanatory variable k is signaling that it does. $Stresscalled_k^j$ is the probability that a fiscal stress situation on endogenous variable j is correctly predicted by explanatory variable k when it occurs.

1.3.4 Global indexes

We combine the different explanatory variables to obtain some composite early warning indicators of fiscal vulnerability. We consider three aggregate indices, called $Index^{MIP}$, $Index^{FSI}$ and $Index^{O}$, depending upon whether the aggregate

[14]The TME approach gives a greater weight to misclassifying fiscal vulnerability events (type I and type II false signals) than the NSR approach which gives a greater weight to the fiscal stress episodes that are correctly predicted.

index consists of the weighted average of the MIP, FSI or both types of variables. These indices for each endogenous variable j are :

$$MIPindex : Index_j^{MIP} = \sum_{k=1}^{n1} \frac{1}{NSR_k^j} \hat{Z}^{jk} \tag{1.12}$$

$$FSIindex : Index_j^{FSI} = \sum_{k=1}^{n2} \frac{1}{NSR_k^j} \hat{Z}^{jk} \tag{1.13}$$

$$Globalindex : Index_j^{O} = \sum_{k=1}^{n3} \frac{1}{NSR_k^j} \hat{Z}^{jk} \tag{1.14}$$

with

$$\hat{Z}_q^{jk} = \begin{cases} Z_q^{jk}, & \text{if } NSR_k^j < 1 \\ 0, & \text{otherwise} \end{cases} \tag{1.15}$$

and $n1 = 9$ denotes the 9 indicators of MIP, $n2 = 7$ denotes the 7 FSI indicators, and $n3 = n1 + n2$. We replicate the exercise of the preceding sections to see whether the aggregate indexes are early warning indicators of fiscal stress (see Tables 1 and 2).

1.4 Data and results based on early warning indicators

1.4.1 Data

We consider a panel of 8 euro area countries (Austria, Belgium, Finland, France, Germany, Italy, the Netherlands and Spain) over a period from 1998 to 2011. The dataset is restricted to the eight countries for which we have complete information on FSI. The frequency of data is annual. We predict fiscal vulnerability at time t, using the information in the explanatory variables at time $t - 1$. A detailed description of the data and their sources is given in Appendix A (Table A1).

1.4.2 Main results from the early warning indicator models

Performance of the indicators in predicting fiscal vulnerability

For purpose of illustration, and to save place, Table B1 in Appendix B shows the performance of the individual indicators when fiscal stress is measured by sovereign bond spreads. Other tables where fiscal stress is defined by year-on-year interest burden to fiscal revenue ratio, duration, convexity, skewness and kurtosis of bond price, are available upon request to the authors. Table B2 shows the best performing individual and aggregate indicators for each fiscal stress variable according to criteria 1, 2 and 3 (respectively the lowest NSR, the highest $Stresscalled$ and the highest $Probstress$).

These tables suggest that the composite indexes (combinations of the indicators) provide more information to signal a situation of fiscal vulnerability than do the individual variables. Indeed, the NSR of the aggregate indexes ($Index_j^{MIP}$, $Index_j^{FSI}$, and $Index_j^{O}$) is lower than those of the individual indicators. They always send less false signal, compared to their individual components. Moreover, the probability of correctly predicting a stress event ($Probstress$) with the aggregate indexes is higher than the probability obtained with the individual variables (see the last column of Table B1). We find that the composite FSI index and the global index predict a higher percentage of "true" fiscal stress episodes ($Stresscalled$) than when the MIP variables are considered alone as leading indicators of a stress (0.72 and 0.65 against 0.15). Then, from the analysis of Table B2, the results suggest that fiscal vulnerability can be caused by different factors, depending on how we measure fiscal stress and on the criteria used to rank the explanatory variables in terms of their predictability power.

When fiscal stress is measured by sovereign bond spreads, the unemployment rate and house price index are the best leading indicators insofar as they have the lowest NSR. Table B2 shows that private sector debt has a good explanatory power when the fiscal stress variable is the year-on-year change of debt burden to fiscal income ratio.

When the variables used to define fiscal vulnerability are bond price duration, convexity, skewness or kurtosis (see Table B2), a forthcoming fiscal stress can be gauged mainly through private sector debt, changes in house price index and export market share. These indicators also have the best predictive power, when

considering the third criterion ($Probstress$). These findings suggest chain reactions. The risk premium on sovereign debt is first conditioned by economic policy variables, specifically the way in which governments succeed in tackling unemployment. Then, the markets' reactions to changes in interest rates are affected by risk factors inherent to the private sector imbalances: firms' and households' over-indebtedness, and external competitiveness as reflected by export market share.

Next consider the second criteria, e.g. the percentage of situation of fiscal vulnerability correctly predicted ($Stresscalled$) for each endogenous variable. Among the factors signaling a future occurrence of a fiscal stress, many reflect financial imbalances: liquidity risks, as reflected by ted spreads, stock market volatility, corporate bond spreads. Fiscal vulnerability is thus related to financial imbalances, specifically to pressure in credit markets, sharp changes in stock market volatility.

Turning to the performance of the aggregate indicators in Table B2, the results show that MIP and the global index give the best scores based on criteria 1 and 3 (lowest NSR and highest $Probstress$) (except for sovereign bond spread and bond price kurtosis). The FSI index has usually the highest percentage of correctly reported situations of fiscal vulnerability (criteria 2).

A look at the thresholds estimated for the different indicators (see Table 2) shows that the markets' view about the financial imbalances leading to fiscal stress situations sometimes differs substantially from the European Commission's view. To show this, we report the EC's thresholds for the MIP indicators and our own estimated thresholds. A comparison of the numbers in columns 5, 6, 7, 8 and 9 with the thresholds defined by the EC (column 2) suggests that fiscal stress (as captured by the bond price reactions to changes in the interest rates and by the first two moments of bond price distribution) can arise following "small" macroeconomic imbalances, e.g. (i) a current account deficit below 4% (interestingly, markets takes into account both sides of imbalances, since a surplus above 3.7% or 5.3% is also interpreted as a source of fiscal vulnerability for the euro area), (ii) a low unemployment rate (below 10%), (iii) a private sector debt lower than 160% of GDP (except for column 8).

This suggests differences of perception of a fiscal vulnerability situation, between policymakers and investors in the bond markets. The latter relates a situation of fiscal stress to the conditions for financing debt, in general over short-term horizons. Risk-adverse investors holding government bonds are sensitive to small

macro-financial imbalances. The finding of thresholds values below those of the European Commission for the MIP indicators, could illustrate that the market price of risk associated with the MIP variables is high (a small imbalance is considered as a big source of risk).

INSERT Table 2 ABOUT HERE

1.5 Results based on Probit models

1.5.1 The estimated equations

We consider four specifications of Probit models. The first equation is based on the Mundlak-Chamberlain estimator to correct for biases due to the correlation between the effects and the explanatory variables in the random effects model[15]. Such a correlation is captured by an equation relating the random individual fixed effects to the mean group of the variables. Specifically, the estimated model consists of the following two equations:

$$\begin{aligned} Prob(y_{it} = 1/X_{it}, Z_{it}) &= \Phi(\alpha_i + X_{it}^{'}\beta + Z_{it}^{'}\gamma) \\ \alpha_i &= \alpha + \bar{X}_{it}^{'}\delta + \bar{Z}_{it}^{'}\rho + u_i \end{aligned} \tag{1.16}$$

Φ is the cumulative density function (CDF) of the standard normal density. X and Z are the vectors of the MIP and FSI variables. β, γ are the parameters of interest. $\delta = \rho = 0$ produces the standard Probit random effect model. Equation (1.16) is estimated by applying the Buttler-Moffit method and choosing a number of nodes equals to 15 in the Gauss-Hermite polynomial for integration. The standard-errors are computed using robust sandwich covariance matrix estimation. We test the null hypothesis that $\delta = \rho = 0$ (random effect model) using a joint Wald test.

A natural competitor to the random effect model is the fixed effect model. A simple formulation is based on the latent variable representation:

[15] See [62] and [63]

$$
\begin{aligned}
y^*_{it} &= \alpha_i d_{it} + X^{'}_{it}\beta + + Z^{'}_{it}\gamma + \epsilon_{it} \\
y_{it} &= \begin{cases} 1, \text{ if } y^*_{it} > 0 \\ 0, \text{ otherwise} \end{cases}
\end{aligned} \tag{1.17}
$$

where $i = 1, ..., N$ and $t = 1, ..., T$. d_{it} is a dummy variable that takes the value 1 for country i at time t and zero otherwise. To correct for potential bias due to incidental parameter problem, we estimate this model by conditional likelihood estimator and call it conditional fixed effects estimator (CFE).

As a third specification, we consider a model in which some of the exogenous variables are assumed to be endogenous in the sense that they could be correlated with the error term. Formally, the model is defined in terms of a latent variable y^*_{it} and is written as follows:

$$
\begin{aligned}
y^*_{it} &= \omega^{1'}_{it}\mu_1 + \omega^{2'}_{it}\mu_2 + \epsilon^1_{it}, \\
\omega^1_{it} &= \omega^{2'}_{it}\lambda_1 + \omega^{3'}_{it}\lambda_2 + \epsilon^2_{it} \\
y_{it} &= \begin{cases} 1, \text{ if } y^*_{it} > 0 \\ 0, \text{ otherwise} \end{cases}
\end{aligned} \tag{1.18}
$$

where $i = 1, ..., N$ and $t = 1, ..., T$. ω^1_{it} is a vector of endogenous explanatory variables. ω^2_{it} is a vector of exogenous explanatory variables and ω^3_{it} is a vector of instrumental variables. μ_1 and μ_2 are vectors of structural parameters, while λ_1 and λ_2 are reduced-form parameters. The vector $(\epsilon^1_{it}, \epsilon^2_{it})$ is assumed to be multivariate normal with variance-covariance matrix:

$$
\begin{pmatrix} 1 & \Sigma^{'}_{12} \\ \Sigma_{12} & \Sigma_{22} \end{pmatrix} \tag{1.19}
$$

The model is estimated using the Newey's efficient two-step estimator.

Fourthly, we consider a dynamic specification, since the probability of a fiscal stress at time t can depend upon the state observed in the preceding period. We

estimate a first-order unobserved effect model:

$$Prob(y_{it} = 1/X_{it}, Z_{it}, \Omega_{it}) = \Phi(\alpha_i + X_{it}^{'}\beta + Z_{it}^{'}\gamma + \Omega_{it}^{'}\delta + \rho y_{it}) \tag{1.20}$$

X_{it} is the vector of MIP variables, Z_{it} is the vector FSI variables and Ω_{it} is the vector of instrumental variables. The main problem with this model is the correlation between the initial value y_{i1} and α_i (initial condition problem). Several estimators have been proposed in the literature [16]. In this paper, we use the Wooldridge estimator by applying maximum likelihood to the following model:

$$\begin{aligned} &Prob(y_{it} = 1/X_{it}, Z_{it}, \Omega_{it}, y_{i1}) = \\ &\Phi[(2y_{it} - 1)(\alpha_0 + X_{it}^{'}\beta + Z_{it}^{'}\gamma + \Omega_{it}^{'}\delta + \rho y_{it-1} + \eta y_{i1} + \bar{\Omega}_{it}^{'}\tau + \epsilon_{it})] \\ &t = 1, ..., T. \end{aligned} \tag{1.21}$$

1.5.2 Data

Endogenous variable

Our endogenous variable is a "synthetic" indicator of the 6 fiscal stress variables used in the previous sections. The sovereign bond spread, interest burden, convexity, duration, kurtosis and skewness of price bonds are considered jointly and used to obtain a series of zeros and ones (with 1 defining a regime of fiscal vulnerability during which at least two out of six variables cross their benchmark value computed as their mean plus 0.5 times their standard deviation. An alternative approach would consist in defining a fiscal stress episode as a situation in which the majority of our six individual endogenous variables signals a stress. However, doing this leads a vector with very few "1". For instance, with $\lambda = 0.5$ we obtain 14 entries with "1" over more than one hundred observations. This criterion therefore leads a high number of missed stress signals (zeros when "1" should be observed). For instance, the indicator does not show the fiscal stress episodes in France and Germany during the years which preceded the reform of Stability and Growth Pact in 2005. With our criterion, we avoid such a caveat.

Figures C1 to C8 (see Figure 1.1 and Figure 1.2) show the historical episodes

[16] See, among others, [64], [65], [66],[67].

of fiscal stress as well as the vulnerability episodes signaled by the composite MIP and FSI variables. Interestingly, the aggregate indicator appears to trace out fiscal stress episodes that tracks some historical patterns of fiscal vulnerability in the euro area countries. For purpose of illustration, we begin with the case of Germany. Figure C5 suggests that this country experienced many fiscal stress episodes from 1999 until 2006. This conforms with the conclusions of previous studies on the historical analysis of German public finances (see, among others, [68], [69]). The deficit-GDP ratio was -1.5% in 1999, turning to a positive surplus of 1.3% in 2000, and then regularly evolved above the limit allowed by the Stability and Growth Pact. The budget deficit was -2.8% in 2001, 3.9% in 2003, -3.2% in 2005 and still stayed negative to -1.7% in 2006. These bad performances were closely related to the drop in the economic growth in the early 1990s, followed by severe economic weaknesses from 2001 onwards. But Figure C5 also suggests that fiscal stress could have reflected negative financial shocks factoring into fiscal developments (the FSI variables appear as good leading indicators of fiscal stress). This finding is consistent with the literature on macro-financial linkages in the European economy, which shows that the beginning 2000s were years of heightened financial stress in the European countries, including Germany (see, [70], [71]). Firstly, uncertainty about growth prospects resulted into funding stress as manifest in a rise in several spreads and increased volatility of stock prices. Secondly, in a context of large waves of banking and industrial restructing, the investors showed an appetite for private corporate bonds at the expense of sovereign bonds. And thirdly, merging and acquisition transactions made long-term bond with fixed yield less attractive than short-term securities. This has led the countries to borrow at a higher rate than the level at which they could have borrowed otherwise.

Figures C1 to C8 suggest that the German case is part of a broader context of fiscal stress across the euro area countries, especially during the early 2000s. However, there are differences between countries. The Netherlands seems to have been more insulated from fiscal vulnerability, since only three years of fiscal stress are observed corresponding to 2006, 2007 and 2008. In contrast, stressful fiscal episodes were more frequent, as in Germany, in Belgium, France and Italy. In Belgium and Italy, fiscal vulnerability was attributable to MIP imbalances, more than in the other countries. This observation is taken to suggest that in these countries fiscal vulnerability was partly of a macroeconomic nature. In the case

of Spain, it seems that the governments were able to avoid fiscal stress as there are only two years in which fiscal vulnerability appears. As is known from the literature, Spain has been capable of sustaining its fiscal situation at the expense of other macro-financial disequilibrium (trade deficits, credit and housing bubbles).

Finally, one might point out that, for all the countries except Finland, the FSI indicators signals fiscal stress from 2007 onwards, although this is neither evidenced by the endogenous variable, nor signaled by the MIP variables. Given what is known about the debt crises that eventually occurred after 2011, the FSI variables could be viewed as better leading indicators of forthcoming fiscal vulnerability than the recommended MIP indicators by the European Commission. Moreover, though Germany has been the least affected by the debt crises, the fact that the FSI also signal a stress for this country could be interpreted as an indirect contagion effect since most of its economic partners were victims of a fiscal stress.

Exogenous variables and instruments

We consider two types of regressions. Firstly, we use the MIP indicators as explanatory variables. And, secondly, we add the FSI variables. Our aim is to see whether these additional variables help improving the predictibility of fiscal stress episodes. For the IV estimator and dynamic models, we choose our instruments among the following variables selected according to their degree of correlation with the explanatory variables and to the results of the exogeneity tests for the IV Probit models: Financial sector balance sheet (liabilities), GDP deflator relative to the rest of 37 industrial countries, Average annual hours worked per person employed, Output-gap, current tax burden: total economy, Terms of trade (goods and services), Total factor productivity (total economy), Marginal efficiency of capital (total economy), Net primary income from the rest of the world, Net capital transactions with the rest of the world, Bank non-performing loans to total gross loans, S&P global equity index.

More details about the sources of these variables are provided in Appendix A (Table A2). We prefer these macroeconomic and financial variables, which are linked to our macro-financial explanatory variables, rather than considering lags of the explanatory variables as is often done in the literature.

1.5.3 Regression results

We present the average partial effects estimated from the four models in Tables 3 and 4. For the Mundlak-Chamberlain estimator, we also report the Wald test of the null hypothesis of no correlation between the individual effects and the explanatory variables. For both the Chi-squared and F-test, we reject the null hypothesis (the significance level of the test is small and lower than 5%). We also show the Wald test of exogeneity of the instruments for the IV Probit model. The null hypothesis cannot be rejected as the estimated significance level is higher than 5%.

INSERT Tables 3 and 4 ABOUT HERE

Comparing the models

If we consider the performance of the models in terms of predictability as a goodness-of-fit measure, we see that the dynamic model is outperformed by the static models (Mundlak-Chamberlain, Conditional FE logit and IV Probit). Indeed, the probability of correctly predicting a situation of fiscal stress, or a regime of no stress, is lower for this model compared with the other three alternative models. In order to assess whether adding the FSI variables delivers a significant improvement to MIP indicators, we conduct a Likelihood ratio test. We obtain, for all specifications, p-values (significance levels) lower than 0.05. This indicates that the models with all MIP and FSI predictors fit significantly better than those with only the MIP indicators.

The estimates of the dynamic model suggest that a fiscal stress event today does not affect the occurrence of a future fiscal stress. Indeed, the coefficient of the lagged endogenous variable is non-significant. There is no path-dependence, but only a sensitivity to initial conditions as shown by the significant estimates of the coefficient of initial endogenous variable. This suggests that better information about fiscal stress is provided by a static model with unobserved heterogeneity among countries (idiosyncratic initial fiscal stress). We therefore focus on the first three models. Comparing these models, the results on the predictive accuracy of fiscal stress episodes suggest that a specification with FSI variables always outperform a specification with the MIP indicators only (see the percentage of

stress episodes correctly predicted). For instance, a IV Probit model with the MIP variables accounts for 70% of the observed fiscal stress episodes. Adding the FSI variables improves this statistic up to 80%.

Since the coefficients of these variables are statistically significant in Table 4, leaving them out in the regressions of Table 3 leads a problem of omitted variables. Indeed, since the FSI variables are significant variables to predict fiscal stress, their omission would lead to over- or underestimate the effects of the MIP variables. This omitted-variable bias occurs because the MIP and FSI variables are correlated (see the matrix of correlation in Table B3 in Appendix B). Such correlations illustrate the hypothesis of global imbalances affecting public finances. In this case, estimating a Probit or Logit model without FSI variables induces a correlation between the MIP variables and the error term, unless we use instrumental variables. In this regard, the IV Probit estimator in Table 3 is the most reliable. However, given the fact that the models with FSI give the best predictions of both stress and no stress episodes, we will focus our comments on the results in Table 4. As suggested by [67], leading competitors to correlated random effect models are fixed effect methods. We therefore compare the Mundlak-Chamberlain estimates with conditional fixed effect estimators. We consider "conditional" estimators to deal with the usual problem of incidental parameters in fixed effect models. Finally, as some of our regressors may be endogenous, we further consider an instrumental variable models. The three models are presented for purpose of robustness, specifically to check that the sign of the coefficient does not change with different estimators.

Impact of the MIP and FSI variables on fiscal stress

We start by examining the influence of MIP variables. The results provide some support for a lower likelihood of fiscal stress when the current account surplus improves (negative coefficients), in case of a higher export market share (negative coefficients), when the ratio of public debt diminishes (positive coefficient), or in a context of decreasing unemployment rate (positive coefficient). An increase in the house price leads to higher fiscal vulnerability (positive coefficient). This is in support of the view that an upward trend in house markets poses risks to fu-

ture financial stability and consequently to public budget in case of government's intervention to safeguard the housing sector. A depreciation of the real effective exchange rate (an increase in REER) implies a higher fiscal vulnerability as evidenced by the positive coefficients in Table 4. The reasons are twofold. Firstly, it creates fears of higher inflation and thus drives up the inflation risk-premium as a compensation for bearing inflation risk. Secondly, increases in inflation following a real depreciation is associated with expectations of higher nominal interest rates (because inflation is the main target of the European Central Bank's policy). If monetary policy obeys the Taylor principle, then real interest rates are expected to increase. The adverse effects on economic growth may result into higher fiscal deficits (through lower fiscal revenues), which in turn can lead to rising costs of borrowing in sovereign bond markets.

Depending on which channel dominates, an increase in nominal unit labor costs leads to higher or lower fiscal vulnerability. A first channel relates nominal wages to inflation (through the wage-price loop) and results into a higher fiscal risk through higher interest rate premium. A second channel works through the current account balance. It is of relevance to explain higher imbalances of current account positions due to the deterioration of competitiveness, leading to higher interest rates to avoid capital outflows. Both these channels should ultimately lead to a positive sign of the coefficient related to unit labor cost since they increase fiscal vulnerability. This is not the case here. There is a third channel whose impact on fiscal stress plays in the opposite direction. This corresponds to the so-called "catch-up channel". From 1999 to 2011, higher wages in some countries of the euro area reflected a catch-up dynamics in the sense that their growth rates allowed per-capita output in the peripheral euro area countries to catch-up with those of the other countries. Increases in nominal unit labor costs therefore accompanied higher growth rates, which fueled investors' sentiment that the economic and fiscal situation in the countries were sound thereby implying a reduced fiscal stress. The negative sign of the unit labor cost coefficients in our regressions suggests that this third channel could have been at play in the euro area.

We now turn to the explanatory power of those variables capturing vulnerabilities in the financial sector (FSI variables). The ted spread is defined as the

difference between the 3-month Libor rate and government short-term rate. A decrease in the latter relative to the Libor rate reflects a lower perceived risk of default associated with short-term government bond. This makes the refinancing of short-term debt less costly and therefore reduces fiscal vulnerability. Thus, the estimated coefficient of this variable enters the regressions with a negative sign. The inverted term spread (short-term minus long-term interest rates) captures markets 'sentiment about the long –term outlook. An increase is associated with a signal on expectations of pending recessions with lower long-term returns on sovereign bonds. One would expect larger inverted term spread to rise fiscal vulnerability, since an economic depression involves a decrease in fiscal revenues, thereby implying that the sovereign debt appears more risky than before. The finding of a positive sign of the coefficient of this variable in Table 4 accords with this explanation.

A larger coefficient of the beta in the banking sector reflects rising risk of investing in the banking sector (either because share prices are volatile or the cost of equity increases). This makes banks less investible and investors may increase the portion of their portfolio in risk-free assets (for instance in sovereign bonds). In this case, we expect lower fiscal stress and therefore a negative sign of the beta coefficient as is evidenced in our regressions. The corporate spread (defined as corporate bond yield minus government long-term yield) is taken as a proxy of perceived international financial risk, as is usually done in the empirical literature on the determinants of sovereign bond spreads (see, for instance, [72]). The positive sign of the estimated coefficients accords with the usual finding in the empirical literature that the international risk factor is an important determinant of bond yields and prominent in the countries with high debt levels, as was already the case in the euro area before the 2010 debt crises (see, among many others, [40]). Finally, a decline in equity market returns raises fiscal vulnerability (as suggested by the negative sign of the coefficient of this variable), while exposure to tail risk (captured here by the squared returns) has no significant impact on fiscal stress. The reason why a decline in equity returns can result into a higher likelihood of fiscal stress is simply that governments have both explicit and implicit equity ownerships. Explicit ownership means that investing funds into risky corporate equity is part of governments' social security management policy to sus-

tain benefits for the payment of future social security retirement benefits, health or unemployment benefits. Implicit ownership means that governments have position in the equity markets through their claim to future tax revenues. A decrease in asset prices can therefore negatively affect the present value of governments' revenues, thereby implying that the financing of public spending will be supplemented by other resources than taxes, in particular by a higher public debt. In this case, fiscal positions may appear to be less sustainable.

1.6 Conclusion

The goal of this paper was to investigate the macro-financial imbalances that exposed the Euro area countries to fiscal stress before the outbreak of the debt crises in Europe. This issue was ignited in the academic and policy circles in the wake of the debt crises. We shed some further light on this debate, but from a different perspective. Our analysis applies to normal times, with data covering the years before the recent debt crises. Unlike previous studies, we adopt a "market-based view". We therefore investigate the determinants of fiscal stress/vulnerability understood as changes in the sovereign credit pricing by investors.

Our results indicate that financial stress substantially improves the predictibility of fiscal vulnerability. MIP indicators alone should not be considered as leading indicators of changes in the perception of sovereign bond pricing by market participants. Though the focus up until now has been on fiscal sustainability from a macroeconomic viewpoint, it may also be helpful to monitor the risk inherent to public finances by using market indicators. Our empirical exercise suggests looking at variables such as the exposure to tail risk, investors' perceived risk of default associated with short-term bonds, investors' trade-off between corporate and sovereign bonds, the return of equity indexes relative to bond prices. This paper thus suggests the construction of databases and indicators, in the euro area, that could come as additional variables to the MIP indicators. This is done in order to go beyond the issues of fiscal sustainability in the medium-term, but also to have a more careful look at fiscal vulnerability stress as perceived by the holders of sovereign debts. This could help open the "black box" of the grade agencies since their upgrades and downgrades are not necessarily indisputable.

This paper could be extended in at least two directions. First, the econome-

tric framework could be extended to explore other aspects of the links between market-based variables of short-term fiscal vulnerability and their forewarning indicators. For instance, time-varying and non-linear models would help detecting structural instability in the relationships between the endogenous and explanatory variables. Secondly, other measures of financial distress could be considered, for instance those involving the investors' reaction to policy communications and initiatives. In this respect, an interesting study could consist in testing the approach proposed by [73] by extending the period to the years before the European debt crises.

Tables

Table 1: Description of MIP Indicators

MIP Indicators	Transformation Formula
Current account balance (CA)	3 year backward moving average of the CA in % of GDP, threshold: lower bound -4%, upper bound: 6%.
Nominal unit cost of labor (NULC)	3 years % change in NULC, threshold : 9% for euro area countries.
Export market shares	5 years % change of export (share of world exports), threshold: -6%.
Real effective exchange rate (REER)	3 years % change of the REER (15 European countries) based on double export weights deflators, threshold: +/- 5% for euro area countries.
Private sector debt	Private sector debt in % of GDP, threshold: 133%.
Private sector credit flow	Private sector credit flow in % of GDP, threshold: 15%.
Public debt	General government sector debt in % of GDP, threshold: 60%.
Real House price index (HPI)	Year-on-year change in deflated house prices, threshold: 6%.
Unemployment rate	3 year backward moving average of unemployment rate, threshold: 10%.

Table 2: Estimated thresholds for the indicators with Signal approach

Threshold	With	Sovereign bond spread	Yoy debt service/ revenu	Bond's price duration	Bond's price convexity	Bond's price skewness	Bond's price kurtosis	Total Stress
MIP indicators	European Commission							
Current Account	-4%	6.50	-0.51	3.70	-3.57	5.33	1.94	2.83
Unemployment	10%	11.32	7.16	7.16	8.37	4.03	4.80	7.16
Export Marke Share	-6%	6.45	-17.37	-10.10	-6.93	-13.39	6.45	-17.37
NULC	9%	6.45	10.78	10.78	8.87	1.15	1.15	-0.58
Public debt	60%	106.10	106.10	95.56	95.56	106.10	95.56	106.10
REER	5%	-5.87	2.90	6.09	6.09	-5.87	-0.63	-5.87
HPI	6%	9.78	0.16	9.78	9.78	3.36	2.26	0.16
Private sector debt	160%	103.40	211.00	122.10	103.40	150.60	191.00	103.40
Private sector debt flow	15%	10.20	1.30	20.50	20.50	5.40	12.20	20.50
MIP index	-	7.98	9.26	6.2	5.24	6.43	7.56	6.34
FSI indicators	[74]							
Beta	≥ 1	-0.03	0.81	-0.33	-0.46	-0.33	0.81	0.52
Ted Spread	≥ 0.5	0.94	0.15	-0.73	-0.79	-0.19	-0.52	-0.52
Inverted Curve Yield	≤ 0	-0.08	-1.26	-0.73	-0.84	-0.73	-1.26	-0.73
Corporate Spread	≥ 0	-1.13	-0.13	0.01	-1.13	0.09	-1.13	-0.13
Stock return	-	-0.25	0.63	0.34	-0.25	0.03	0.03	-0.18
Rsq Stock return	-	-0.68	0.63	-0.68	-0.68	-0.68	1.07	-0.36
Rsq REER change	-	-0.49	-0.05	-0.27	-0.27	0.07	-0.49	0.07
FSI index	-	5.10	7	4.90	4.57	3.90	2.25	3.34
Global index	-	9.12	15.63	8.94	8.48	11.10	10.92	9.97

Note: REER is the real effective exchange rate. NULC is the nominal unit labor cost. HPI is the real house price index. Rsq Stock Return is the volatility of stock market returns and Rsq REER change is the volatility of real effective exchange rate.

Table 3: Probit models with the MIP indicators as explanatory variables.

	RE Probit Mundlak-Chamberlain		Conditional FE Logit		Two-step IV Probit		Dynamic Probit for panel data	
	Coeff	Std	Coeff	Std	Coeff	Std	Coeff	Std
Current Account	-2.56***	0.14	-1.13	1.26	-0.76***	0.15	0.33	0.69
Unemployment	-0.41	0.91	-0.20	0.40	-0.13	0.39	-1.64***	0.01
Export Market Share	7.76***	0.74	1.97**	1.13	2.37***	0.79	-5.23***	0.85
NULC	6.21***	0.78	5.86***	2.65	6.71***	0.88	-2.14***	0.32
Public debt	-10.36***	0.15	-11.28***	1.76	-11.69***	0.06	-3.25*	1.85
REER	-0.36*	0.26	0.16*	0.11	0.22	0.26	-1.88***	0.48
HPI	2.96***	0.79	2.53***	0.57	2.48***	0.01	-1.85***	0.41
y_{i1}	-	-	-	-	-	-	-6.79***	0.77
Lagged endogenous	-	-	-	-	-	-	-0.05	0.25
% correct (y=0)	89		87		89		81	
% correct (y=1)	75		80		70		61	
	Wald test : $\chi^2(7) = 294.256$ or $P - value = 0.00$				Wald test of exogeneity: $\chi^2(7) = 4.86$ $P - value = 0.67$			

Note: The coefficients reported are partial effects. *,**,***: Statistically significant at 10%, 5% and 1% level of significance. NULC: nominal unit labor cost. REER: real effective exchange rate. HPI: Real house price index. Wald test for RE Probit: the null hypothesis is $\delta = \rho = 0$ (random effect model) in Equation (1.16) and p-value is the significance level of the test. Wald test for IV Probit: the null hypothesis is the exogeneity of the instruments and p-value is the significance level of the test.

Table 4: Probit models with the MIP and FSI indicators as explanatory variables

	RE Probit Mundlak-Chamberlain		Conditionnal FE Logit		Two-step IV Probit		Dynamic Probit for panel data	
	Coeff	Std	Coeff	Std	Coeff	Std	Coeff	Std
Current Account	-4.45***	0.11	-2.34***	0.85	-2.44***	0.11	-0.18	1.08
Unemployment	-0.14	0.47	-0.54*	0.35	-0.57***	0.23	-1.16***	0.01
Export Market Share	4.58***	0.42	1.21***	0.50	1.20***	0.61	-9.81***	0.9
NULC	1.15***	0.41	2.61	2.75	3.31***	0.69	5.22***	0.09
Public debt	-4.88***	0.11	-6.90***	2.79	-7.60***	0.05	-13.74***	0.80
REER	1.08***	0.14	0.56***	0.13	0.54***	0.19	-1.08***	0.26
HPI	2.04***	0.01	1.99***	0.40	2.08***	0.02	-1.02***	0.14
Beta	-0.11***	0.02	-0.15***	0.05	-0.14***	0.03	0.02	0.04
Ted Spread	-0.29***	0.02	-0.14*	0.10	-0.15***	0.02	-0.21***	0.03
Inverted Curve Yield	0.11***	0.01	0.14***	0.03	0.14***	0.01	-0.10***	0.03
Corporate Spread	0.24***	0.03	0.16***	0.04	0.15***	0.04	-0.07	0.06
Stock return	-0.45***	0.01	-0.53***	0.22	-0.49***	0.01	0.56***	0.02
Rsq Stock return	-0.05	1.20	-0.03	0.02	-0.01	0.01	0.17***	0.01
y_{i1}	-	-	-	-	-	-	-6.27***	0.76
Lagged endogenous	-	-	-	-	-	-	-0.03	0.11
% correct (y=0)	92		87		90		86	
% correct (y=1)	88		91		80		74	
	Wald test: $\chi^2(7) = 358.15$ $P-value = 0.00$				Wald test of exogeneity: $\chi^2(13) = 9.62$ $P-value = 0.724$			
	LR test: $\chi^2(12) = 32.66$ $P-value = 0.00$		LR test: $\chi^2(6) = 26.84$ $P-value = 0.00$		LR test: $\chi^2(6) = 27.79$ $P-value = 0.00$		LR test: $\chi^2(6) = 15.13$ $P-value = 0.02$	

Note: The coefficients reported are partial effects. *,***: Statistically significant at 10%, 1% level of significance. Beta: banking sector Beta. NULC: nominal unit labor cost. REER: real effective exchange rate. HPI: Real house price index. Wald test for RE Probit: the null hypothesis is $\delta = \rho = 0$ (random effect model) in Equation (1.16) and p-value is the significance level of the test. Wald test for IV Probit: the null hypothesis is the exogeneity of the instruments and p-value is the significance level of the test. Likelihood Ratio (LR) test: the null hypothesis is the unrestricted model (with MIP+FSI indicators) fit the data significantly better than the more restrictive model (with only MIP indicators). This statistic is distributed chi-squared, with degrees of freedom equal to the number of parameters that are constrained.

1.7 Description of the variables.

Table A1: MIP and FSI variables

Name of the variables	Indicators	Sources
Current account	CA % GDP	WEO
Nominal unit labor cost of labor	NULC: ratio of compensation per employee to real GDP per person employed (Eur:2005=100)	AMECO
Export market share	% share of exports of goods and services over world exports	OECD
Real effective exchange rate	Performance relative to the rest of the former EU-15 (double export weights)	OECD
Private sector debt	% of GDP	Eurostat
Private sector credit flow	% of GDP	Eurostat
Public debt	% of GDP	Fiscal monitor and IMF (2010)
House price index	HPI (2010=100)	ECB
Residential property prices	All dwellings, Pure price, Q-all, NSA	ECB
Unemployment rate	% of total labor force	WEO
Bond yields	10 year bond yield	Datastream
Beta of banking sector	12-month rolling beta	IMF
Ted spreads	3-month LIBOR or commercial paper rate minus government short-term rate	IMF
Equity market index	Annualized monthly stock returns	IMF
Volatility of equity prices	Annualized 6-months rolling squared returns	IMF
Foreign exchange volatility	Annualized 6-months rolling squared change in the exchange rate	IMF
Inverted yield curve	Inverted term spread	IMF
Corporate bond spread	Corporate bond yield	IMF

Table A2: Instrumental variables.

Name of the variables	Indicators	Sources
Financial Liabilities (PASSIFFIN)	Liabilities of the overall financial sector, unconsolidated - annual data	OCDE
Price deflator (PDGDP)	Price deflator gross domestic product: Performance relative to the rest of 37 industrial countries: double export weights (National currency: 2010 = 100)	AMECO
Average hours worked (AAHWP)	Average annual hours worked per person employed	AMECO
Output gap	Gap between actual and potential gross domestic product at 2010 reference levels (Percentage of potential gross domestic product at constant prices)	AMECO
Current tax burden (CTB)	Current tax burden: total economy : - ESA 2010 Mrd EURO-BEF	AMECO
Terms of trade (TTGS)	Terms of trade goods and services (National accounts) (2010 = 100)	AMECO
Taxes (TIPC)	Taxes on income, profits and capital gains (% of total taxes)	AMECO
TFP	Total factor productivity: total economy (2010 = 100)	AMECO
Marginal efficiency of capital (MEC)	Marginal efficiency of capital: total economy (Change in GDP at constant market prices of year T per unit of gross fixed capital formation at constant prices of year T-.5.)	AMECO
Primary income (NPIRW)	Net primary income from the rest of the world (National accounts) Mrd EURO-BEF	AMECO
Capital transactions (NCTRW)	Net capital transactions with the rest of the world (National accounts) Mrd EURO-BEF	AMECO
Bank non-performing loans (BNPLTGL)	Bank non-performing loans to total gross loans	WEO WEO
SP Global Equity Indices (SPGEI)	S&P Global Equity Index	WEO
Private debt (HNPISHS)	Households and NPISHs - All sectors - Market value - Percentage of GDP - Adjusted for breaks	WEO

1.8 Early warning indicators results

Table B1: Performance of the indicators. Endogenous variable: Sovereign bond spreads.

Threshold = Mean + $0,5\times$ standard deviation							
Advance Indicator	Threshold quantile	FS = TP+FN	Nfs = FP+TN	Number of fiscal stress called (TP)	Noise to Signal Ratio =((FP/Nfs))/ ((TP/FS))	% of fiscal stress correctly called = TP/(TP+FN)	P (fiscal stress/ signal) = TP/(TP+FP)
MIP Indicators							
Current Account	Q9($\leq$)	32	72	30	0.93	0.94	0.32
Unemployment	Q9	32	72	6	0.37	0.19	0.54
Export Market Share	Q9($\leq$)	32	72	24	1.28	0.75	0.26
NULC	Q1	32	72	24	1.29	0.75	0.25
Public debt	Q9	32	72	4	0.77	0.12	0.36
REER	Q1	32	72	27	1.10	0.84	0.29
HPI	Q9	32	72	6	0.37	0.19	0.54
Private sector debt	Q1	32	72	26	1.16	0.81	0.28
Private Sector Debt Flow	Q6	32	72	20	0.49	0.62	0.48
MIP index	Q9	32	72	5	0.18	0.16	0.71
FSI Indicators							
Beta	Q5	32	72	20	0.71	0.62	0.38
Ted Spread	Q2	32	72	27	0.94	0.84	0.32
Inverted Curve Yield	Q6($\leq$)	32	72	25	0.66	0.78	0.40
Corporate Spread	Q1	32	72	28	1.05	0.87	0.3
Stock return	Q2	32	72	20	1.42	0.62	0.29
Rsq Stock return	Q1	32	72	26	1.16	0.81	0.28
Rsq REER change	Q1	32	72	31	0.90	0.97	0.33
FSI index	Q8	32	72	23	0	0.72	1
Global index	Q8	32	72	21	0.06	0.66	0.87

Note. Column 1 reports the name of the indicators and of the aggregate indexes. Column 2 shows the quantiles corresponding to the minimum noise-to-signal ratio (NSR) for each indicator. ($\leq$) specifies that this is a lower bound quantile. Column 3 reports the total number of fiscal stress episodes recorded in the data (FS). Column 4 reports the number of "no-fiscal" stress recorded in the data (Nfs). Column 5 reports the number of fiscal stress episodes that indeed occur (TP). Column 6 reports the minimum NSR. Column 7 shows the percentage of fiscal stress episodes correctly predicted (the variable called Stresscalled in the main text). Column 8 contains the probability that a fiscal stress situation occurs given that the explanatory variable is signaling that it does (the variable called Probstress in the main text). MIP, FSI and Global indexes refer to the composite indicators when one considers, the MIP, FSI, and both MPI and FSI variables together.

Table B2: Best performing individual and aggregate indicators with $\lambda = 0.5$.

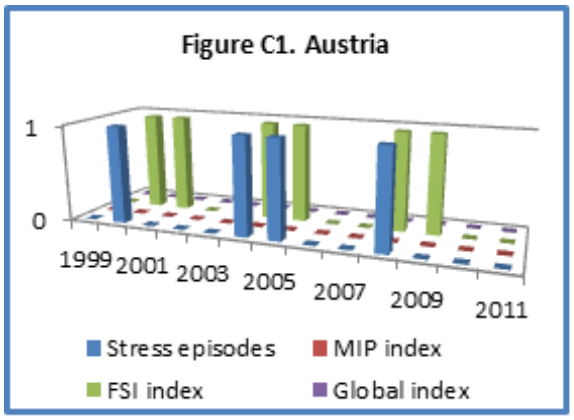
Endogenous variables	1st criterion: Lowest NSR	2nd criterion: Highest Stresscalled	3rd criterion: Highest Probstress
		Individual exogenous indicators	
Bonds spread	Unemployment rate, House price index	NEER volatility	Unemployment rate, House price index
Interest burden / fiscal income	Private sector debt	Private sector debt flow	Private sector debt
Bond price duration	Export market share	Current Account, Unemployment rate, Stock market volatility	Export market share
Bond price convexity	House price index, Private sector Private sector	Ted Spread	House price index, Private sector debt flow
Bond price skewness	Export market share	Stock market volatility	Export market share
Bond price kurtosis	Private sector debt flow	Corporate spread	Private sector debt flow
Total Stress	Public debt	Private sector debt	Public debt
		Aggregate exogenous Indicators	
Bonds spread	FSI index	FSI index	FSI index
Interest burden	MIP index	MIP index	MIP index
fiscal income	MIP index	MIP index	MIP index
Bond price duration	Global index	Global index	Global index
Bond price convexity	MIP index	Global index	MIP index
Bond price skewness	MIP index	FSI index	Global index
Bond price kurtosis	Global index	FSI index	Global index
Total Stress	MIP index	FSI index	MIP index

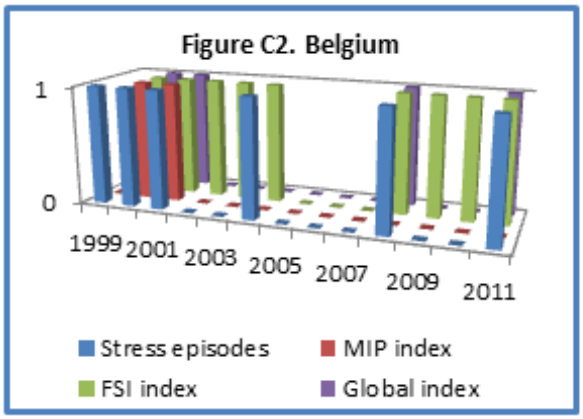
Table B3: Correlation matrix between the MIP and FSI variables.

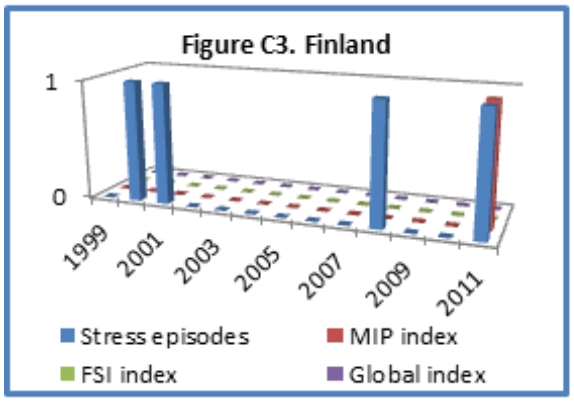
	Beta	Ted Spread	Corporate Spread	Inverted Curve Yield	Stock return	Rsq Stock return	Rsq REER change
Current Account	0.141	-0.004	0.076	0.133	-0.036	0.306	0.027
Export Market Share	-0.327	0.014	0.028	0.326	-0.247	-0.299	0.069
Unemployment	0.286	-0.234	-0.171	-0.314	0.037	0.252	-0.453
REER	0.125	0.041	-0.063	-0.152	0.154	0.105	0.035
NULC	0.335	-0.103	-0.117	-0.361	0.201	0.366	-0.184
Public debt	0.418	-0.040	-0.049	-0.464	0.068	0.306	-0.335
HPI	-0.099	-0.304	-0.372	-0.003	-0.025	-0.130	-0.424

1.9 Stress episodes and variables signaling a forthcoming situation of fiscal vulnerability

Figure 1.1: Stress episodes and signals given by early warning composite MIP and FSI variables (1)







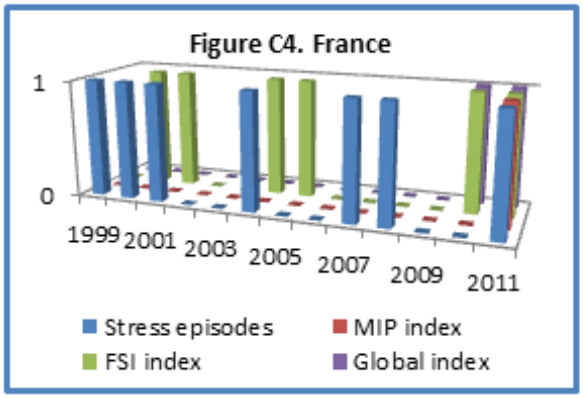
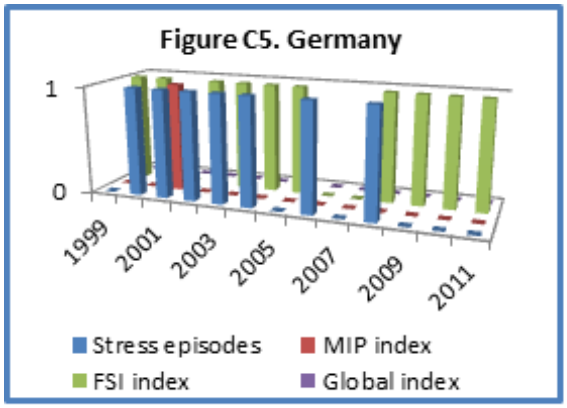
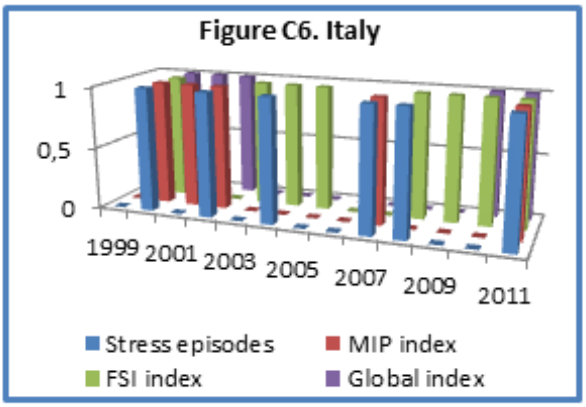
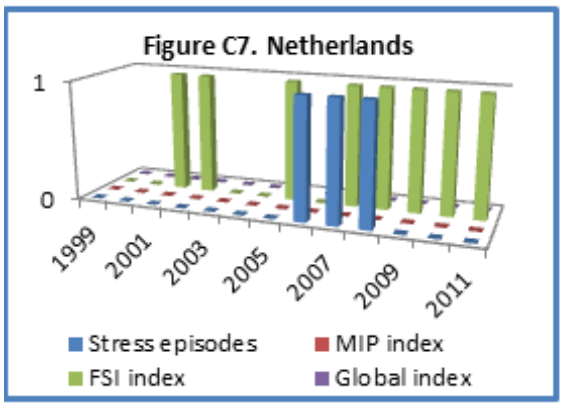
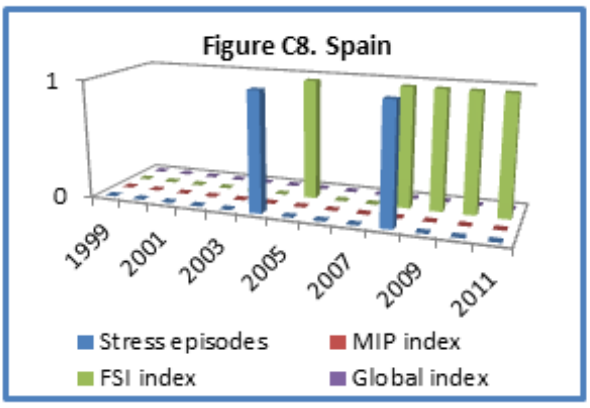


Figure 1.2: Stress episodes and signals given by early warning composite MIP and FSI variables (2)









Chapter 2

Impacts of risk premium on investors' behavior and economy: a calibrated DSGE model.

2.1 Introduction

Bank deposits are one of the economic and financial pillars. Indeed, European households have substantial savings of about one third of financial wealth. The banking system is based on this accumulation of savings and on their circulation or transfer to investments.

Recent financial crisis and new regulation such as Basel III have brought the issue of financial market discipline in the Eurozone, back to the center of debate. Given the inefficiency of the measures taken since the 2008 financial crisis and the 2012 European sovereign debt crisis, doubts about the soundness of European banks have emerged. Indeed, the European debt crisis accentuates the European banks' difficulties insofar as they hold public debt which have become risky assets. Thus, an interdependence appears between the difficulties of public finances and banks' solvency. The more doubtful the quality of public debt gets, the more weakened banks become and the more markets expect for a government intervention. It is in this context that Bale III agreements were adopted in December 2010 by the Basel Committee on Banking Supervision, to strengthen the regulation, super-

vision and risk management of the banking sector.

Market uncertainties fuel a vicious circle and affect depositors' behavior. On the one hand, households reduced their deposits to protect their savings leading to a flight to certainty. For instance, during the first half of 2012, bank deposits fell by 5.6% in Greece, by 12% in Ireland and by 4.5% in Portugal. The Spanish bank deposits also fell by 90 billion euros during summer 2012. Even, low real returns about -6% in the last three years (2013-2015) did not stop deposits flight. On the other hand, to reduce the risk of bank runs, governments have designed a European deposit guarantee scheme, but its implementation remains difficult. Therefore, bank deposits have become the pawn in the complex financial game played by households, banks and governments.

The goal of this paper is to better understand and anticipate the impact of risk premium on depositors' behavior and the economy. Our contribution is threefold. Firstly, this paper seeks to contribute to such discussions through a two-country DSGE model. Secondly, we assume that the risk premium depends on deposit guarantee and on probability of sovereign default. Thirdly, to capture the role of regulatory-driven and market-driven capital requirements, we also model active banks which maximise an utility and are constrained.

The interest of this framework is threefold. Firstly, unlike in developing countries, the massive deposit flight is a new phenomenon in European countries, especially since the establishment of the Eurozone. This explains the need to better understand the implications of the deposit guarantee and capital constraint on the European deposit flight. Secondly, huge deposit withdrawals would have a negative effect on the banks' balance sheet, given the interbank market constraint since the European debt crises. Indeed, this could induce bank failures in risky countries. The direction of deposit flows will affect the depositors retention, financial stability and the profitability of banks. Thirdly, a large-scale deposit flight in Europe would create an inefficient allocation of capital, which may impact on the investment.

Our findings confirm the stabilizing role of deposit guarantee in banking sec-

tor. Indeed, it could help to reduce deposit withdrawals after a positive shock to sovereign default probability. Moreover, our result highlights that higher deposit guarantee could undermine banks' profits and promote production sector due to investors' reallocation of resources.
Furthermore, when banks maximise an utility and are constrained, our finding indicates that, more regulatory-driven capital requirements in banking sector could reassure investors, help to reduce deposit withdrawals and enhance production.
Therefore, it seems that the regulatory-driven capital requirements and deposit guarantee could have negative effects on banking and/or production sector.

These findings could be relevant for policymakers and banks. Firstly, this framework could help in the design of rescue strategies of banking system in case of bank runs. Secondly, the deposit flight makes it difficult for banks to find the right balance between deposit stability and bank profitability. Therefore, this framework could help banks to better understand the dynamics of depositor behaviour considering the probability of sovereign default, the deposit guarantee and the bank capital constraint.

The remainder of the paper proceeds as follows. Section 2 provides a brief overview of the literature on deposit withdrawals, deposit insurance, bank runs and sovereign debt crisis. Section 3 presents our DSGE model. Section 4 presents the simulations and discusses our main findings. Section 5 concludes.

2.2 Related literature

Recent research has shown the importance of the level of confidence in the financial decisions of investors in general (see [75] and [76]). Also, the recent financial crisis highlights the importance of the regulatory and the market discipline in banking and public finance sectors. Therefore, many studies have focused on the link between deposit withdrawals and deposit insurance according to investors' confidence in management of banks and public finance. We briefly discuss the relation of our paper to these strands of literature.

Firstly, this paper relates to frameworks which link deposit insurance and bank

run by implementing experimental investigations (see [77], [78], [79], [80]) or by using diverse empirical approaches (see [81], [82], [82], [83], [84]). By focusing on the preventive effect of deposit insurance on depositors' behaviour, [77] suggests that full coverage of bank deposits can effectively prevent bank runs. This result is also found by [84] who use a conjoint analysis approach to study the effectiveness of implementing deposit insurance at the beginning of a banking crisis. Indeed, to some extent at least, more generous insurance schemes are more effective at reducing these excess withdrawals and the funding risks. [79] add to the discussion, the importance of the degree of observability of investors. They find that the preventive effect of deposit assurance is likely to increase when depositors do not observe other depositors' decisions. Moreover, [80] analyse Russian data and suggest that introducing deposit insurance reduces the sensitivity of households to bank capitalization. By differentiating insured and uninsured depositors, [82] use a unique micro-level depositor data on banks that faced a run, to understand how deposit insurance affects depositor behaviour. Mainly, they find that deposit insurance is partially effective to help the insured depositors to be less likely to run. Finally, some authors among whom [85], [86], [87], [88], and [89], [77] also point out the potentially destabilizing effect of the deposit insurance. Indeed, a full insurance may create moral hazard on banks insofar as it can distort depositors' incentives to differentiate between sound and unsound banks.

Regarding the curative effect of deposit insurance, the results of [78] indicate that the deposit insurance can help lessen the severity of bank runs regardless of the level of coverage. In addition, [81] argue that depositors discipline banking sector by withdrawing deposits and by requiring higher interest rates. However, the extent of market discipline appears not to be impacted by deposit insurance. [90] highlight the time-varying characteristics of market discipline. Indeed, they find that prior to the crises in the United States and the European Union, depositors discipline the market. Nevertheless, that market discipline is mostly decreasing during the crises except for small US banks, and varied between the US and the EU depending on the size of the banking organization. Further, results of [83] show that experiencing a systemic banking crisis influences financial decisions of investors. But, the presence of deposit insurance mitigates the impact of a crisis on investors' behavior.

Secondly, this paper is related to frameworks which introduce macroeconomic risk into the analysis of depositor behavior. Using evidence from 2000-2002 bank runs in Argentina and Uruguay, [91] find that macroeconomic risk affects deposits regardless of bank-specific characteristics. Moreover, difference in deposit withdrawals can be influenced by bank exposure to macroeconomic factors. Their results are in line with the findings of [92] which find that a deterioration in the macro fundamentals rather than a bank run, has caused the Argentina crisis from 2000 to 2001. [93] use a quarterly panel dataset of Greek banks from June 2005 to September 2012, to investigate the effect of the Greek macroeconomic crisis on depositors' behaviour. Controlling for bank-specific characteristics, this paper shows that the sovereign risk rather than the idiosyncratic indicators of bank health, can mainly explain the deposit withdrawals at the outbreak of the crisis. This framework contributes to the literature by showing that this effect is present not only in emerging markets, but also in Eurozone countries as Greece. Their main hypothesis is that unlike the pre-crisis period, depositors react more to the sovereign risk than to the idiosyncratic indicators of bank health during the sovereign debt crisis.

Against this background, our first contribution relates to the methodological approach. We build a two-country DSGE model that helps to analyze the short and long run effects of some macroeconomics shocks on depositors' behaviour. Our second contribution assumes that the expected return on deposits depends on a risk premium which increases with a probability of sovereign default and decreases with a deposit guarantee.

2.3 Theoretical Model

The world economy consists of two (domestic (H) and foreign (F)) countries which have symmetric preferences and technology. In each country, there are infinitely lived households, producers and bankers. It is assumed that all agents of a given type are homogeneous.
In a first step, we consider a model where bankers have passive financial intermediary behavior. In a second step, bankers are assumed to have active financial

intermediary behavior in the sense that they maximise an utility. In what follows, we concentrate on the description of the domestic economy (H).

2.3.1 Model with passive financial intermediary behavior of bankers

Households

The economy is populated by risk-averse and infinitely lived households. As commonly used in the literature (see [94], [95]), households are divided into two groups: patient and impatient households. They differ about their discount factor. Savers are identified by superscript s and their discount factor is β_s. Borrowers identified by superscript m, are made of more impatient households, such as $\beta_m \leq \beta_s$. Thus, in equilibrium, the patient households save and the impatient households borrow.

Savers Indexed by $s \in [0; \chi_H]$, the representative saver derives utility from consumption, labor and wealth (investment in physical capital and deposits) as [96]. Then, the utility from consumption is assumed to have a standard CRRA form to account for the risk aversion of savers. Then, the parameter $\eta_H > 1$ denotes the intertemporal elasticity of substitution in domestic country. Wealth in the utility function which was used by many authors like [97], refers to a "capitalist spirit" specification. It can represent a number of different saving motives as a reduced form for precautionary savings in case of uninsurable lifetime shocks. Another interpretation is that the direct utility is derived from the prestige, power and social status conferred by wealth.

In the model, wealth takes three forms: physical capital ($K_{H,t}$) held from period t to $t+1$ and financial investments, like deposits ($d^H_{H,t}$ and $d^F_{H,t}$) held in domestic and foreign banks from t to $t+1$. Utility from deposits and physical capital is assumed to have a log-form, commonly with studies of money demand. Then, the

lifetime CRRA utility function of savers is as follows:

$$U^s_{H,t} = E_t\left[\sum_{i=0}^{\infty}(\beta^s_H)^i\left[\frac{(C^s_{H,t+1})^{1-\eta^s_H}}{1-\eta^s_H} - \phi^s_H\frac{(l^s_{H,t+1})^{1+\nu^s_H}}{1+\nu^s_H} + \vartheta_H \log d^H_{H,t} + \varrho_H \log d^F_{H,t} + \mu_H \log K_{H,t}\right]\right] \quad (2.1)$$

where $0 \leq \beta \leq 1$ denotes the discount rate of domestic savers. C^s_H denotes the domestic consumption of goods. l^s_H represents the labor provided by domestic savers to domestic firms. $d^H_{H,t}$ represents the amount of deposits held by domestic savers in domestic banks and $d^F_{H,t}$ is the amount of deposits held by domestic savers in foreign banks. $K_{H,t}$ represents the physical capital used as input in the domestic production sector. Finally ϑ, ϱ and μ denote respectively the utility weight for $d^H_{H,t}$, $d^F_{H,t}$ and $K_{H,t}$.
Pr_H is assumed to follow an AR(1) process such as:

$$Pr_{H,t} = \rho_{Pr_H,t} Pr_{H,t-1} + \epsilon_{Pr_H,t} \quad (2.2)$$

where $\rho_{Pr_H,t} > 0$ and $\epsilon_{Pr_H,t} \sim N(0; \sigma^2_{Pr_H})$.

The representative saver maximizes the previous utility function according to the following budget constraint:

$$C^s_{H,t} + d^H_{H,t} + d^F_{H,t} + K_{H,t} = w_{H,t} l^s_{H,t} + R^d_{H,t} d^H_{H,t-1} + R^d_{F,t} d^F_{H,t-1} + R^k_{H,t} K_{H,t-1} \quad (2.3)$$

Where $w_{H,t}$ represents the wage in domestic country. $\bar{R}$ captures the risk free interest rate, which is exogenous and common in both countries.
We assume that the domestic expected return on deposit $R^d_{H,t}$, increases with a risk premium $\Omega_{H,t}$ on domestic deposits. In addition, we assume that $\Omega_{H,t}$ increases with the probability of sovereign default Pr_H and decreases with a domestic deposit guarantee ψ_H .

The idea is that the sovereign default risk can influence banks' balance sheets. Banks may be riskier by holding increasingly risky public debt. Consequently,

depositors have less confidence in their banks and ask for higher risk premium, which increases the expected return on deposits. From the depositors' point of view, deposit guarantee protects (totally or partially) their financial wealth from bank failures. From the financial stability perspective, this guarantee prevents depositors from making panic withdrawals from their bank, thereby preventing severe economic consequences.

Therefore, we define the expected return on deposit as follows:

$$R^d_{H,t} = \bar{R}(1 + \Omega_{H,t}) = \bar{R}(1 + (1 - \psi_H)Pr_{H,t}) \tag{2.4}$$

$$R^d_{F,t} = \bar{R}(1 + \Omega_{F,t}) = \bar{R}(1 + (1 - \psi_F)Pr_{F,t}) \tag{2.5}$$

Combining the first order conditions regarding consumption, labor, domestic deposits ($d^H_{H,t}$), foreign deposits ($d^F_{H,t}$) and domestic physical capital ($K_{H,t}$), we obtain the following equations:

$$w_{H,t} = \phi^s_H (C^s_{H,t})^{\eta^s_H} (l^s_{H,t})^{\nu^s_H} \tag{2.6}$$

$$d^H_{H,t} = \frac{\vartheta_H (C^s_{H,t})^{\eta^s_H}}{1 - \beta^s_H R^d_{H,t+1} \Lambda^s_{H,t,t+1}} \tag{2.7}$$

$$d^F_{H,t} = \frac{\varrho_H (C^s_{H,t})^{\eta^s_H}}{1 - \beta^s_H R^d_{F,t+1} \Lambda^s_{H,t,t+1}} \tag{2.8}$$

$$K_{H,t} = \frac{\mu_H (C^s_{H,t})^{\eta^s_H}}{1 - \beta^s_H R^k_{H,t+1} \Lambda^s_{H,t,t+1}} \tag{2.9}$$

where

$$\Lambda^s_{H,t,t+1} = \left(\frac{C^s_{H,t}}{C^s_{H,t+1}} \right)^{\eta^s_H}$$

Borrowers The representative impatient household indexed by $m \in [0; \chi]$, derives its utility from consumption C^m_H and labor l^m_H such as:

$$U^m_{H,t} = E_t \left[\sum_{i=0}^{\infty} (\beta^m_H)^i \left[\frac{(C^m_{H,t+1})^{1-\eta^m_H}}{1 - \eta^m_H} - \phi^m_H \frac{(l^m_{H,t+1})^{1+\nu^m_H}}{1 + \nu^m_H} \right] \right] \tag{2.10}$$

Each borrower maximizes the previous utility under the following budget constraint:

$$C^m_{H,t} + R^m_{H,t} b^m_{H,t-1} = b^m_{H,t} + w_{H,t} l^m_{H,t} \tag{2.11}$$

where b^m_H represents the amount of loans granted by domestics banks. R^m_H denotes the return on loans. Combining the first order conditions regarding consumption, labor and loan, we obtain the following equations:

$$w_{H,t} = \phi^m_H (C^m_{H,t})^{\eta^m_H} (l^m_{H,t})^{\nu^m_H} \tag{2.12}$$

$$R^m_{H,t} = \beta^m_H \Lambda^m_{H,t,t+1} \tag{2.13}$$

where

$$\Lambda^m_{H,t,t+1} = \left(\frac{C^m_{H,t}}{C^m_{H,t+1}} \right)^{\eta^m_H}$$

Firms

The production function of representative firm has a Cobb-Douglas form. The inputs are labor (l_H) and physical capital (K_H) such as:

$$Y_{H,t} = A_{H,t} K^{\alpha_H}_{H,t} l^{1-\alpha_H}_{H,t}, \qquad 0 < \alpha < 1 \tag{2.14}$$

where $A_{H,t}$ is the time varying factor of productivity, which is given by:

$$A_{H,t} = \rho_{A_H,t} A_{H,t} + \epsilon_{A_H,t} \tag{2.15}$$

$\rho_{A_H,t} > 0$ and $\epsilon_{A_H,t} \sim N(0; \sigma^2_{A_H})$.
We can rewrite equation (17) as:

$$y_t = A_{H,t} k^{\alpha_H}_{H,t} \tag{2.16}$$

where k_H represents the intensity of capital (ratio of physical capital to labor) which is

$$k_{H,t} = \frac{K_{H,t}}{l_{H,t}}$$

Investment transforms a unit of good into a unit of installed physical capital. The latter is partly depreciated after one period at a depreciation rate $\delta_H \in [0; 1]$. Then, the dynamics equation of physical capital is as follows:

$$K_{H,t+1} = (1 - \delta_H)K_{H,t} + I_{H,t} \tag{2.17}$$

The representative domestic firm maximizes the following profit function:

$$\Pi_{H,t} = Y_{H,t} - w_{H,t}l_{H,t} - R^k_{H,t}K_{H,t}$$

under the constraint given by the production function (see equation (17)). Then, the first order conditions are given by:

$$R^k_{H,t} = \alpha_H A_{H,t} k^{\alpha_H - 1}_{H,t} \tag{2.18}$$

$$w_{H,t} = (1 - \alpha_H)A_{H,t}k^{\alpha_H}_{H,t} \tag{2.19}$$

Bankers

In our model, commercial banks make one-period mortgage loans to borrowers at the lending rate R^m_H. They collect savers' deposits at R^d_H. The domestic commercial banks' balance sheet is as follows:

Assets	Liabilities
- Mortgages loans (b^m_H)	- Domestic deposits (d^H_H) - Foreign deposits d^F_H)

The profit function of the representative domestic bank is as follows:

$$Profit_{H,t} = R^m_{H,t}b^m_{H,t-1} - R^d_{H,t}(d^H_{H,t-1} + d^H_{F,t-1}) \tag{2.20}$$

Equilibium

The equilibrium in the capital market is as follows:

$$\chi_H d^H_{H,t} + \chi_F d^H_{F,t} = (1-\chi_H) b^m_{H,t} \tag{2.21}$$

The equilibrium in the goods market is given by:

$$Y_{H,t} = \chi_H C^s_{H,t} + (1-\chi_H) C^m_{H,t} + I_{H,t} \tag{2.22}$$

2.3.2 Model with an active financial intermediary behavior of bankers

Bankers

In addition to their previous banking activities, the commercial banks hold government bonds at the risk free interest rate $\bar{R}$. We assume that the value of public bonds ($(1-Pr_H)B^H_H$) is negatively affected by the sovereign default probability. Therefore, the domestic banks' balance sheet becomes:

Assets	Liabilities
- Mortgages loans (b^m_H)	- Domestic deposits (d^H_H)
- Domestic public bonds ($(1-Pr_H)B^H_H$)	- Foreign deposits (d^F_H)
- Foreign public bonds ($(1-Pr_F)B^F_H$)	

Following [98], we assume that the representative domestic banker maximizes an expected discounted utility such as:

$$U^B_{H,t} = E_t\left[\sum_{i=0}^{\infty}(\beta^B_H)^i\left[\frac{(C^B_{H,t+1})^{1-\eta^B_H}}{1-\eta^B_H} + \kappa^0_H \log(B^H_{H,t}(1-Pr_{H,t})) + \kappa^1_H \log(B^F_{H,t}(1-Pr_{F,t}))\right]\right] \tag{2.23}$$

under the following constraint:

$$C^B_{H,t} + b^m_{H,t} + B^H_H + B^F_H + R^d_{H,t} d^H_{H,t-1} + R^d_{H,t} d^H_{F,t-1} = R^m_{H,t} b^m_{H,t-1} + d^H_{H,t} + d^H_{F,t} + \bar{R}(1 - Pr_{H,t}) B^H_H + \bar{R}(1 - Pr_{F,t}) B^F_H \quad (2.24)$$

Moreover, we also introduce a capital constraint to capture both regulatory-driven and market-driven capital requirements. Indeed, bankers are subject to a capital constraint such that:

$$d^H_{H,t} + d^H_{F,t} \leq \gamma_L b^m_{H,t} + B^H_H + B^F_H \quad (2.25)$$

where $\gamma_L < 1$.

The capital constraint in equation 2.25 requires that, for each unit of loans granted, banks set aside $1 - \gamma_L$ units of goods as bank capital. In other words, loans and deposits are not perfect substitutes. Then, the utility provides by loans increases with γ_L.

Combining the first order conditions regarding consumption, domestic government bonds ($B^H_{H,t}$) and foreign government bonds ($B^F_{H,t}$), we obtain the following equations:

$$B^H_{H,t} = \frac{\kappa^0_H (C^B_{H,t})^{\eta^B_H}}{1 - \beta^B_H \bar{R}(1 - Pr_{H,t+1}) \Lambda^B_{H,t,t+1}} \quad (2.26)$$

$$B^F_{H,t} = \frac{\kappa^1_H (C^B_{H,t})^{\eta^B_H}}{1 - \beta^B_H \bar{R}(1 - Pr_{F,t+1}) \Lambda^B_{H,t,t+1}} \quad (2.27)$$

where

$$\Lambda^B_{H,t,t+1} = \left(\frac{C^B_{H,t}}{C^B_{H,t+1}} \right)^{\eta^B_H}$$

The equilibrium in the goods market becomes:

$$Y_{H,t} = \chi_H C^s_{H,t} + (1 - \chi_H) C^m_{H,t} + I_{H,t} + C^B_{H,t} \quad (2.28)$$

2.4 Simulations and Discussions

2.4.1 Calibration

Parameter	Description	Value	Sources
$\bar{R}$	Return to bonds (quarterly)	0.011	[99]
α_H	Private capital share in production	0.35	
χ_H	Size of savers	0.01	
β_s	Discount rate of savers	0.99	[100]
β_m	Discount rate of borrowers	0.985	[100]
η_H	Risk aversion	2	[99]
ϑ_H	Domestic deposit weight in utility function	0.3533	
ϱ_H	Forign deposit weight in utility function	0.3	
μ_H	Capital weight in utility function	0.3467	
ν_H	Inverse elasticity of labor supply	1.5	
A	Long run aggregate productivity	1	[99]
δ	Depreciation rate	0.025	
ρ_A	Persistence parameter	0.6750	[99]
c/y	Consumption to output ratio	0.6469	[99]
I/y	Private investment to output ratio	0.2130	[99]

2.4.2 Model with passive financial intermediary behavior of bankers

Figure 2.1 to Figure 2.10 plot the impulse responses to orthogonalized innovations in stochastic disturbances for a set of selected variables.

Shock to domestic productivity A_H

At $t = 0$, a positive shock to domestic productivity increases the domestic return on physical capital and reduces wage (see Figure 2.1 to Figure 2.4). Lower wage decreases the consumption of domestic savers and borrowers. Despite higher return on capital, domestic savers invest less in domestic physical capital which decreases domestic production. Moreover, due to lower wage, they also decrease their investment in domestic ($d^H_{H,t}$) and foreign ($d^F_{H,t}$) deposits. Lower domestic deposits ($d^H_{H,t}$) reduces loans granted to domestic borrowers ($b^m_{H,t}$). Thus, the latter works more to compensate for lower loans. This allocation of resources has a negative

impact on domestic banks' profits.
Foreigners invest more in domestic and foreign deposits. However, lower $d^F_{H,t}$ reduces loans granted to foreign borrowers ($b^m_{F,t}$). Therefore, they consume less and have more incentive to work, which explains the rise of total labor. This decreases wage and increases the return on physical capital. Thus, the investment in physical capital is more attractive. Consequently, foreign savers invest more in the physical capital which increases foreign production. Despite the improvement of the macroeconomic situation in the foreign country, banks' profits are also jeopardized. It seems that there is a certain disconnection between the dynamics of production and banks' profits in foreign country.

Shock to domestic default probability Pr_H

At $t = 0$, a positive shock to domestic default probability sends a negative signal to investors in the sense that domestic deposits are perceived as more risky than before (see Figure 2.5 to Figure 2.8). This increases the risk premium, which raises the expected return on domestic deposit. Due to higher expected return on domestic deposit, domestic savers invest more in domestic deposits ($d^H_{H,t}$). Moreover, they invest less in foreign deposits ($d^F_{H,t}$) and physical capital. In other words, they carry out deposit withdrawals from foreign banks in favor to domestic banks (higher $d^H_{H,t}$ and lower $d^F_{H,t}$). This allocation of resources reduces the profits of domestic banks.
In addition, higher $d^H_{H,t}$ increases loans granted to domestic borrowers who raise their consumption. The latter works less which decreases the total labor, lessens the domestic return on physical capital and enhances wage. Therefore, domestic savers have less incentive to invest in physical capital. Lower labor and investment in physical capital have a negative effect on production of domestic firms.

The rise of domestic default probability also affects foreign macroeconomic situations. Indeed, higher expected return on domestic deposits pushes foreign investors to increase deposit in domestic banks ($d^H_{F,t}$) and decrease deposit in foreign banks ($d^F_{F,t}$). Then, as in domestic country, there is an allocation of resources which induces deposit withdrawals from foreign banks in favor to domestic banks (higher $d^H_{F,t}$ and lower $d^F_{F,t}$). Consequently, loans granted to foreign borrowers are lessened. The investment in domestic deposits also increases at the expense of

physical capital investment which falls. Foreign borrowers work more to compensate for lower loans which improves the foreign production. This allocation of savers' resources also decreases foreign banks' profits.
In other words, higher domestic default probability increases the domestic risk premium which induces deposit withdrawals from (more risky) foreign banks in favor to domestic banks. This allocation of resources undermines foreign and domestic banks' profits. Domestic production is undermined while the foreign production is improved.

Higher domestic deposit guarantee leads to a reallocation of resources (see Figure 2.9 and Figure 2.10). Indeed, it reduces the domestic risk premium which decreases the expected return on domestic deposits banks. This pushes domestic and foreign savers to invest more in foreign deposits and physical capital at the expense of domestic deposits. Then, the rise of domestic deposit guarantee reduces deposit withdrawals from foreign to domestic banks, undermines domestic banks' profits but improves domestic production. It also enhances foreign banks' profits and lessens foreign production. To conclude, higher domestic deposit guarantee has a stabilizing effect in the sense that it reduces the attractiveness of investors to the most risky asset. Then, the latter invests more in safer assets (here physical capital and foreign deposits).

2.4.3 Model with an active financial intermediary behavior of bankers

Figure 2.11 to Figure 2.18 plot the impulse responses to orthogonalized innovations in stochastic disturbances for a set of selected variables.

Shock to domestic default probability Pr_H

At $t = 0$, a positive shock to domestic default probability increases the risk premium, which heightens the expected return on domestic deposits (see Figure 2.11 to Figure 2.14).
On the one hand, domestic savers invest less in domestic deposits ($d^H_{H,t}$), in foreign deposits ($d^F_{H,t}$ and in physical capital. In this case, banks and production sector don't benefit from the allocation of resources due to higher domestic default prob-

ability. On the other hand, foreign savers invest more in domestic deposits ($d^H_{F,t}$) and less in foreign deposits ($d^F_{F,t}$) and in physical capital. The allocation of resources is made in favor to domestic banks. Lower investment in physical capital undermines production in both countries. In addition, higher domestic probability of default pushes (domestic and foreign) banks to reduce their investment in domestic and foreign government bonds. Higher investment in domestic deposits by foreigners increases the amount of loans granted to domestic borrowers who consume more. They work less which decreases the marginal return on domestic physical capital and raises wage.

Lower investment in foreign deposits decreases the amount of loans granted to foreign borrowers. Despite lower loans, the latter consume more and work less. This increases the marginal return on foreign physical capital and decreases total labor and wage. In this case, higher domestic default probability leads banks and domestic savers to invest less in all types of assets. This might be due to the introduction of capital constraint. In other words, account for capital constraint might affect savers' allocation of resources and banks' portfolio allocation.

After a positive shock to the domestic probability of default, higher domestic deposit guarantee reassures investors and helps reducing deposit withdrawals (see Figure 2.15 and Figure 2.16). Indeed, higher domestic deposit guarantee reduces domestic risk premium which decreases the expected return on domestic deposits. On the one hand, higher deposit guarantee reassures domestic savers, who invest more in all types of assets (physical capital, domestic and foreign deposits), in spite of higher domestic probability of default. On the other hand, higher deposit guarantee induces reallocation of resources in favor of foreign deposits and physical capital. This explains the improvement of production in both countries. Furthermore, higher deposit guarantee also reassures banks. Indeed, they invest more in government bonds despite higher domestic probability of sovereign default.

Finally, after a positive shock to the domestic probability of default, lower capital constraint (higher γ_L) affects both depositors and banks behavior (see Figure 2.17 and Figure 2.18). Firstly, lower domestic capital constraint reduces the limit

on the leverage of banks. Therefore, banks increase their investment in domestic government bonds even if they are more risky. Secondly, lower capital constraint with high domestic probability of default does not reassure foreign savers who decrease the investment in deposits and physical capital. Deposit withdrawals from (domestic and foreign) banks increase and lower physical capital undermines foreign production. Thirdly, despite lower capital constraint with high domestic probability of default, domestic savers increase the investment in all types of assets (physical capital, domestic and foreign deposits).

2.5 Conclusion

The goal of this paper is to investigate how risk premium can affect depositors' behavior and economy. Therefore, we built a two-country DSGE model that we simulate according to different shocks on sovereign probability of default. In this model, the main assumption is that the risk premium on deposits increases with a sovereign probability of default and decreases with a deposit guarantee parameter.

Our findings are as follows. After a positive shock to the domestic sovereign probability of default, results indicate that higher domestic deposit guarantee by decreasing risk premium, induces investors' reallocation of resources. Indeed, higher domestic deposit guarantee reassures investors and helps reducing deposit withdrawals from foreign to domestic banks. This reallocation of resources could undermine banks' profits but improve production in domestic country.
To capture both regulatory-driven and market-driven capital requirements, we also model more active banks which maximizes a utility and are constrained. We find that, more capital constraint in banking sector could reassure investors, help to reduce deposit withdrawals and enhance production.

2.6 Graphs of Simulations

2.6.1 Model with passive financial intermediary behavior of bankers

Figure 2.1: Dynamic responses to shock to productivity A_H (1)

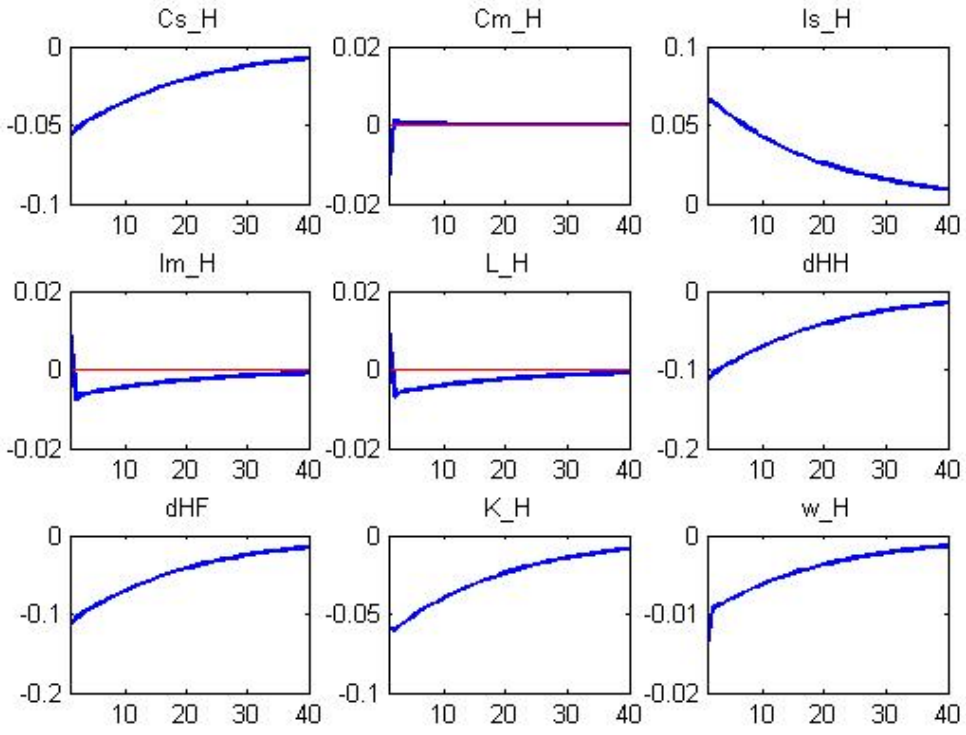


Figure 2.2: Dynamic responses to shock to productivity A_H (2)

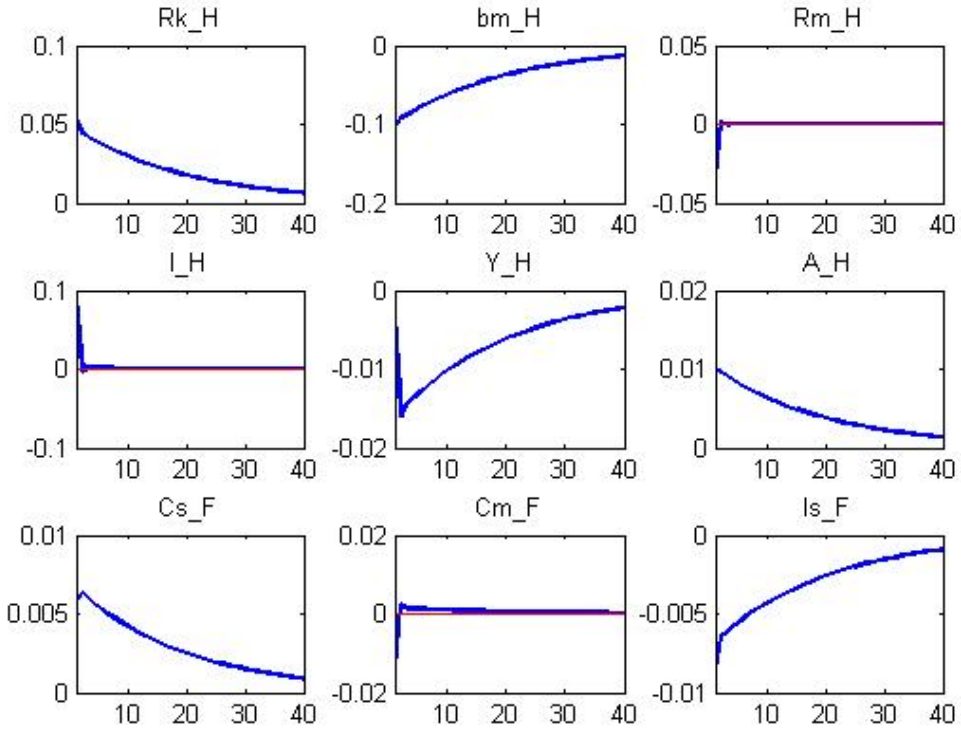


Figure 2.3: Dynamic responses to shock to productivity A_H (3)

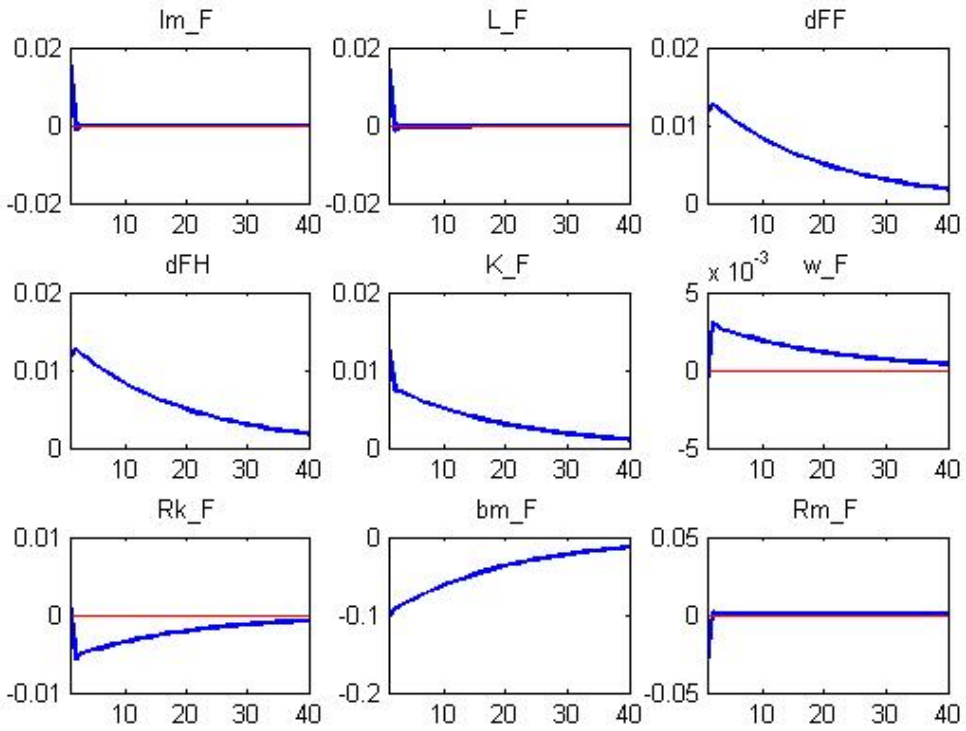


Figure 2.4: Dynamic responses to shock to productivity A_H (4)

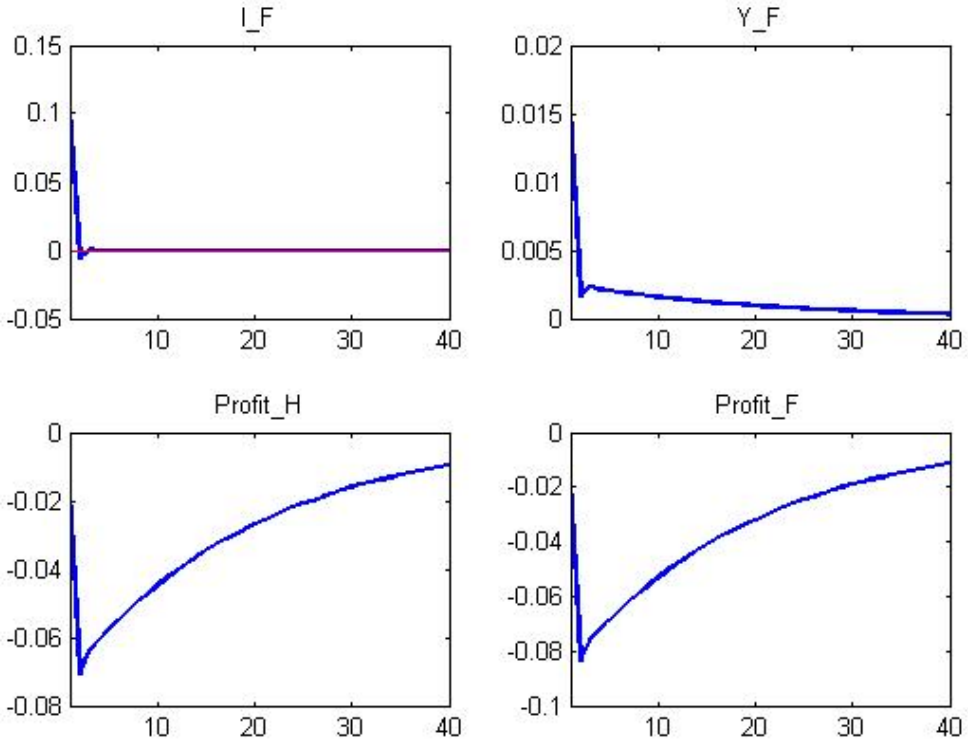


Figure 2.5: Dynamic responses to shock to domestic default probability Pr_H (1)

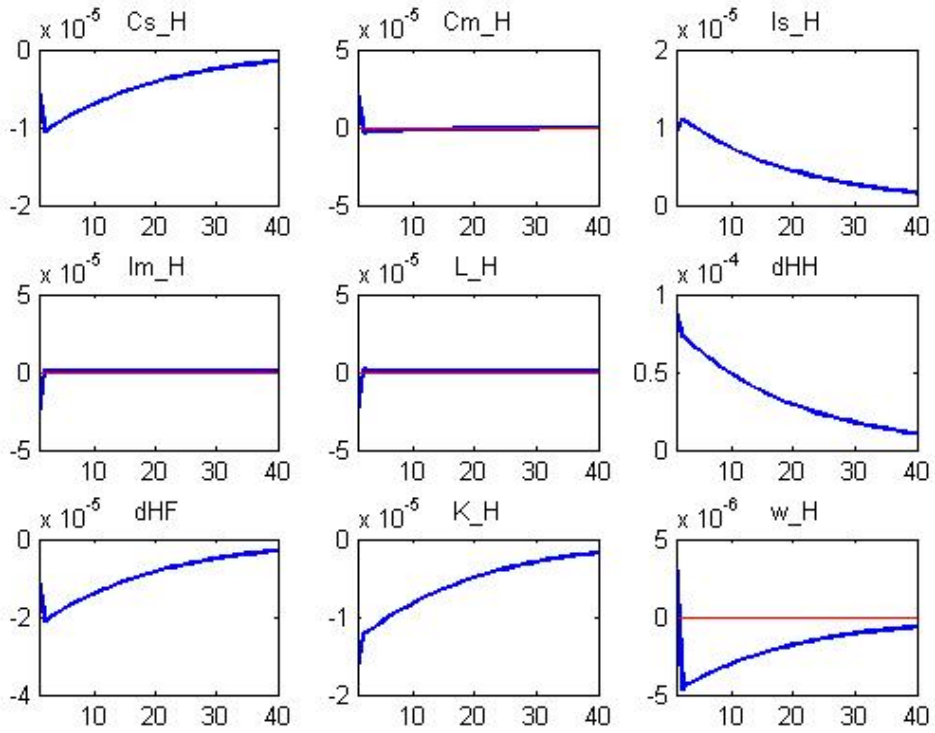


Figure 2.6: Dynamic responses to shock to domestic default probability Pr_H (2)

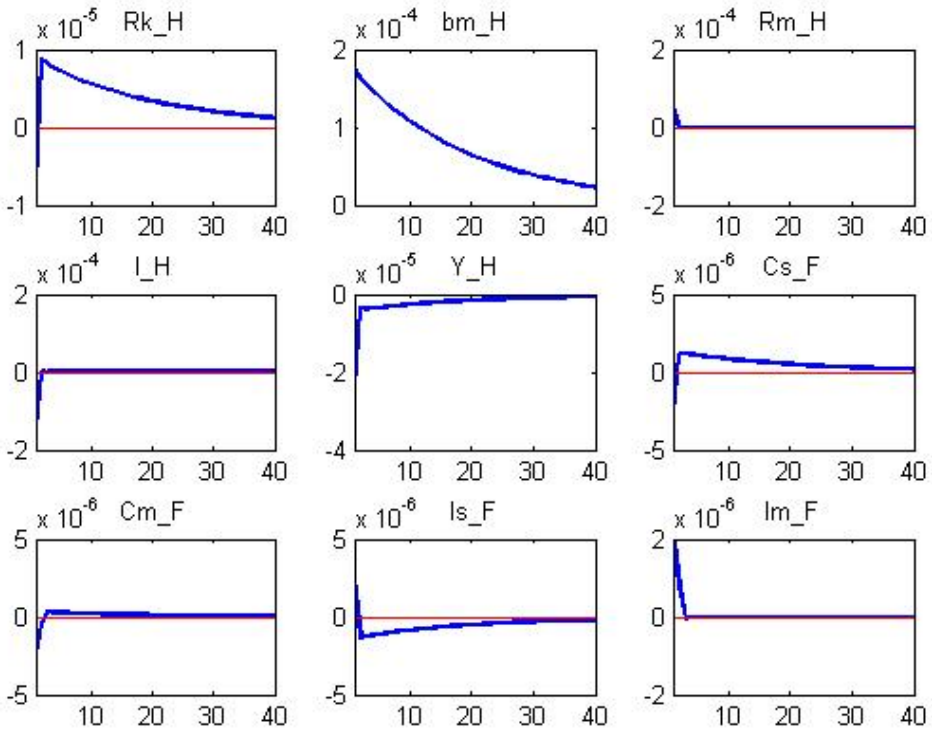


Figure 2.7: Dynamic responses to shock to domestic default probability Pr_H (3)

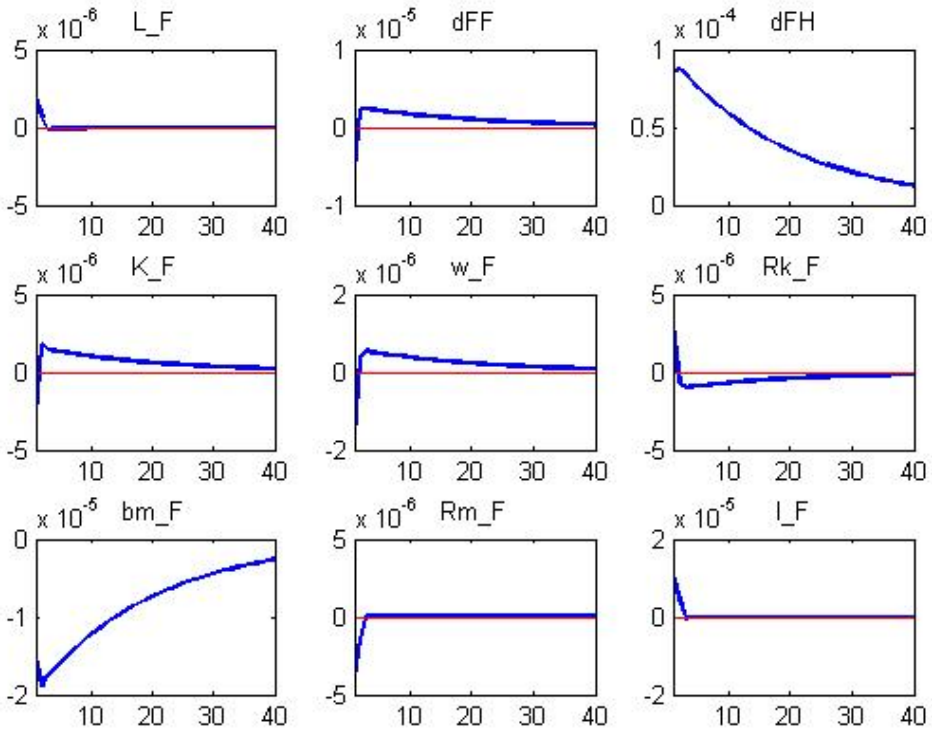


Figure 2.8: Dynamic responses to shock to domestic default probability Pr_H (4)

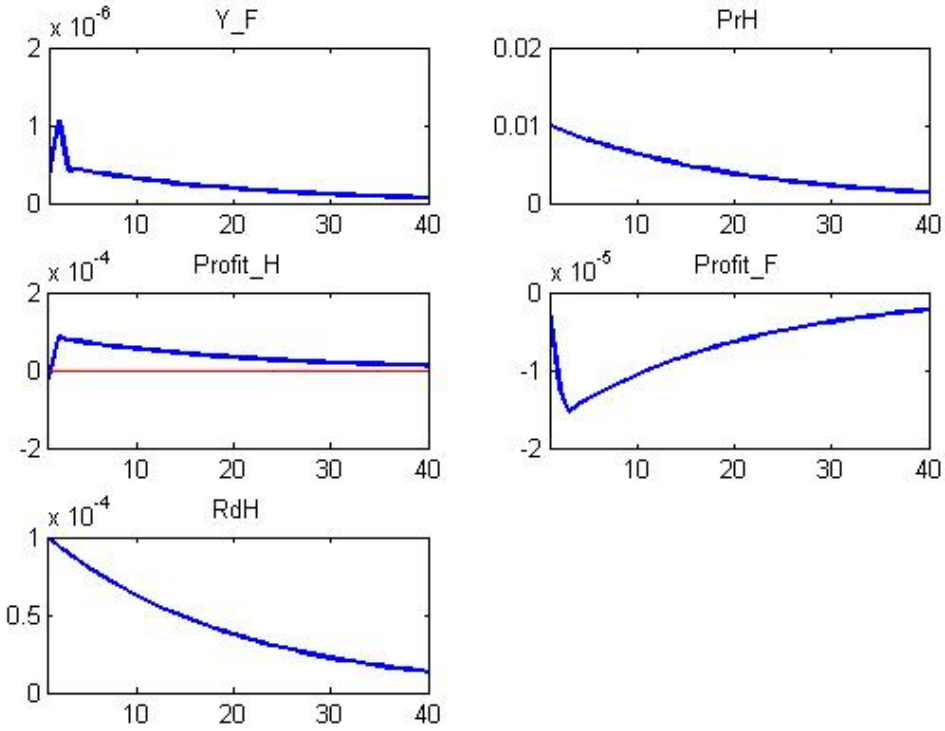


Figure 2.9: Dynamic responses to shock to domestic default probability Pr_H with different values of deposit guarantee ψ_H (1)

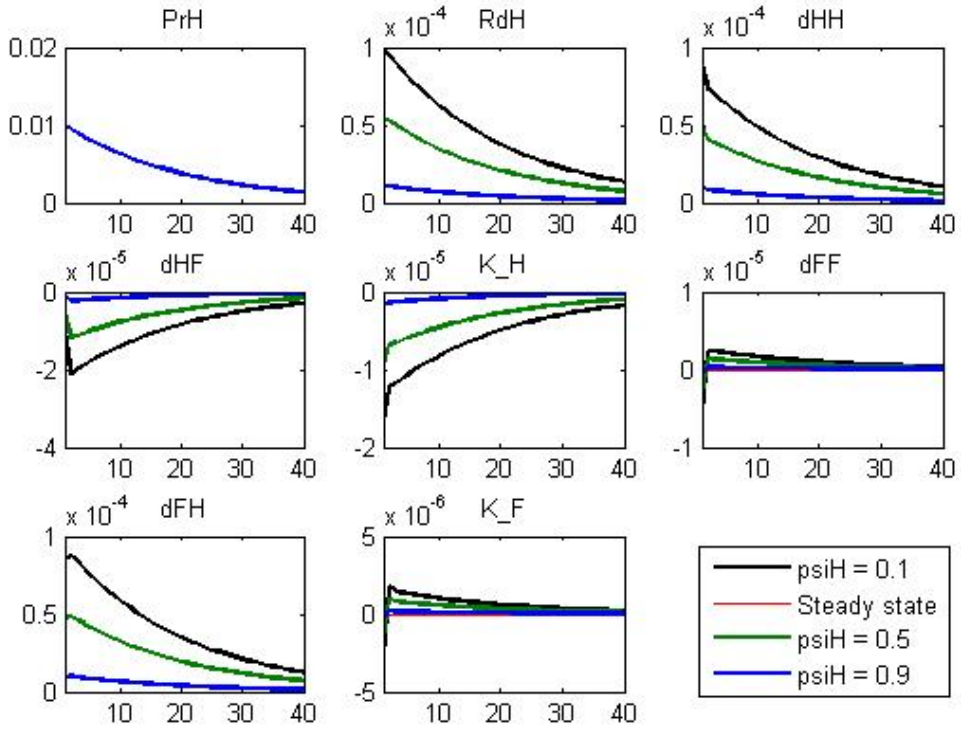
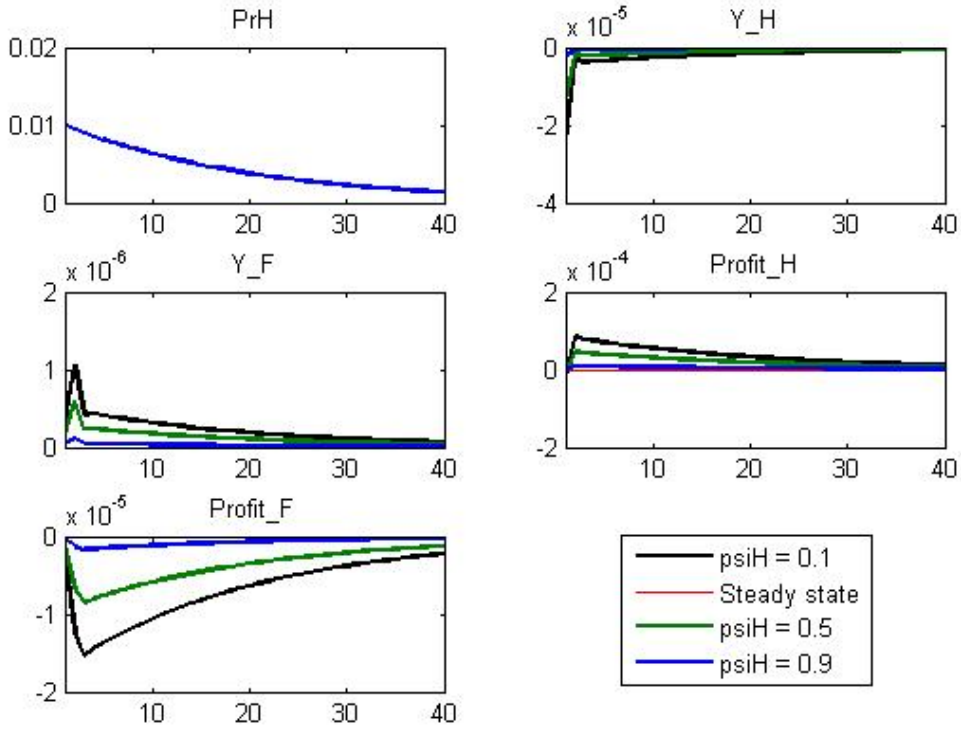


Figure 2.10: Dynamic responses to shock to domestic default probability Pr_H with different values of deposit guarantee ψ_H (2)



2.6.2 Model with active financial intermediary behavior of bankers

Figure 2.11: Dynamic responses to shock to domestic default probability Pr_H (1)

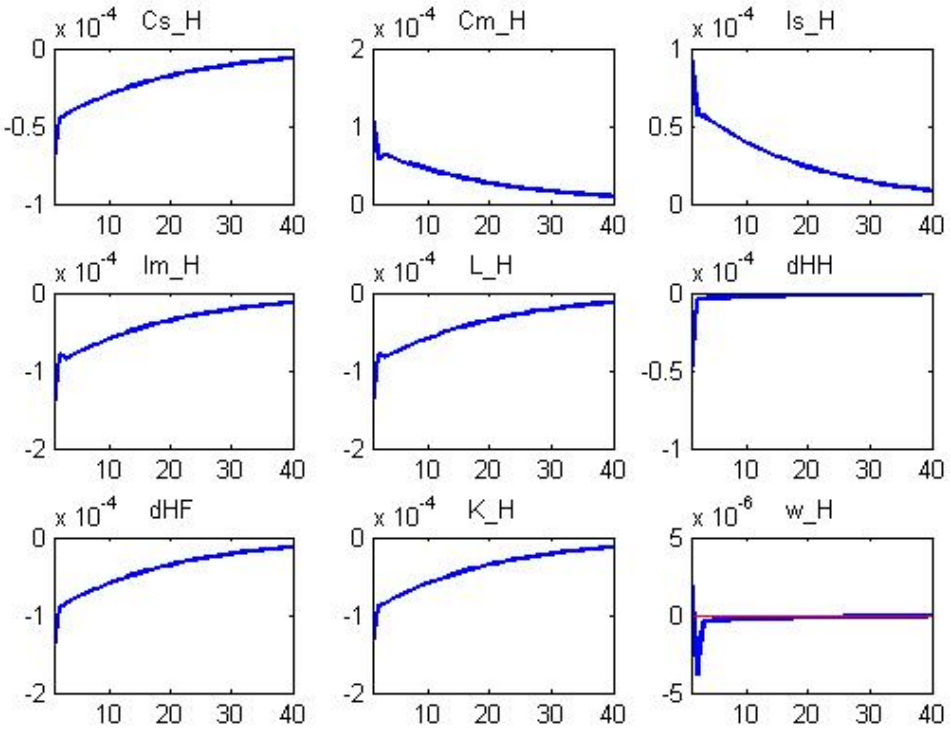


Figure 2.12: Dynamic responses to shock to domestic default probability Pr_H (2)

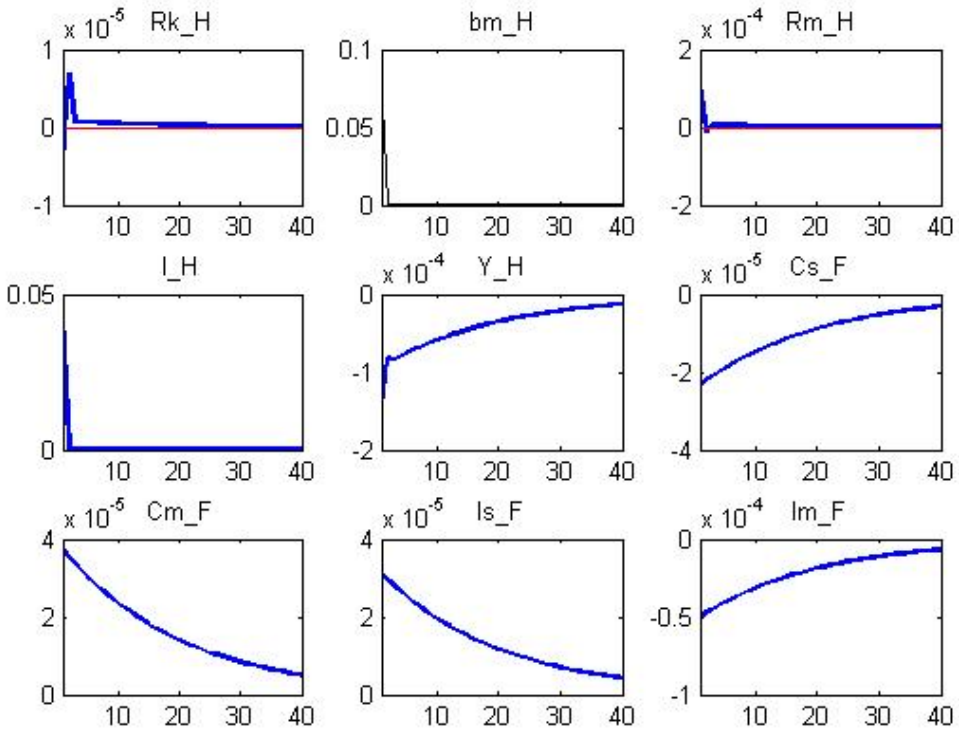


Figure 2.13: Dynamic responses to shock to domestic default probability Pr_H (3)

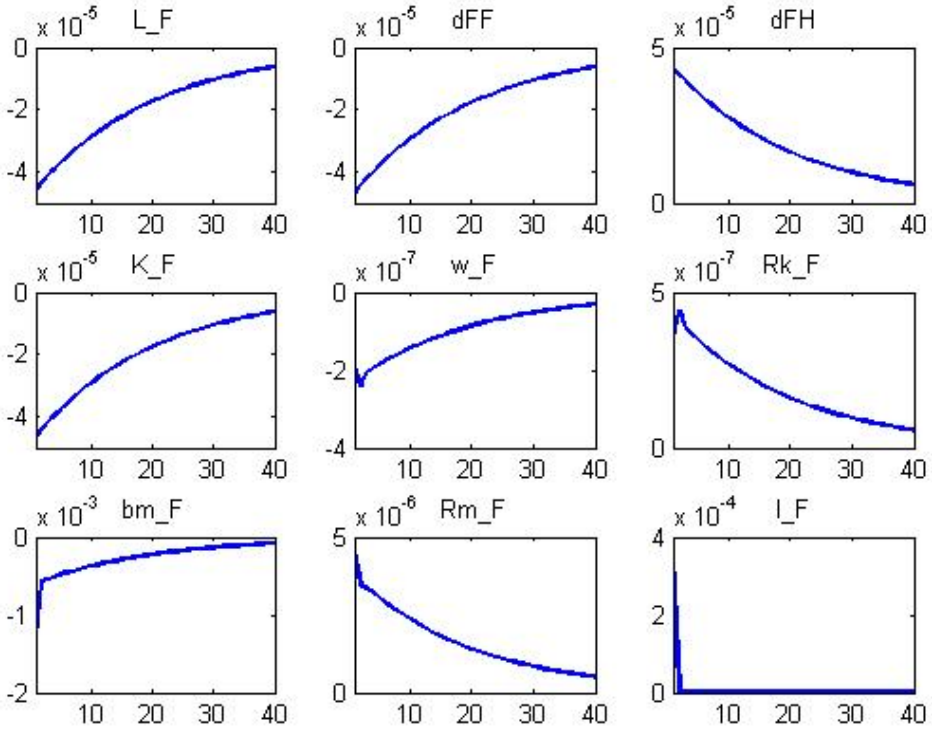


Figure 2.14: Dynamic responses to shock to domestic default probability Pr_H (4)

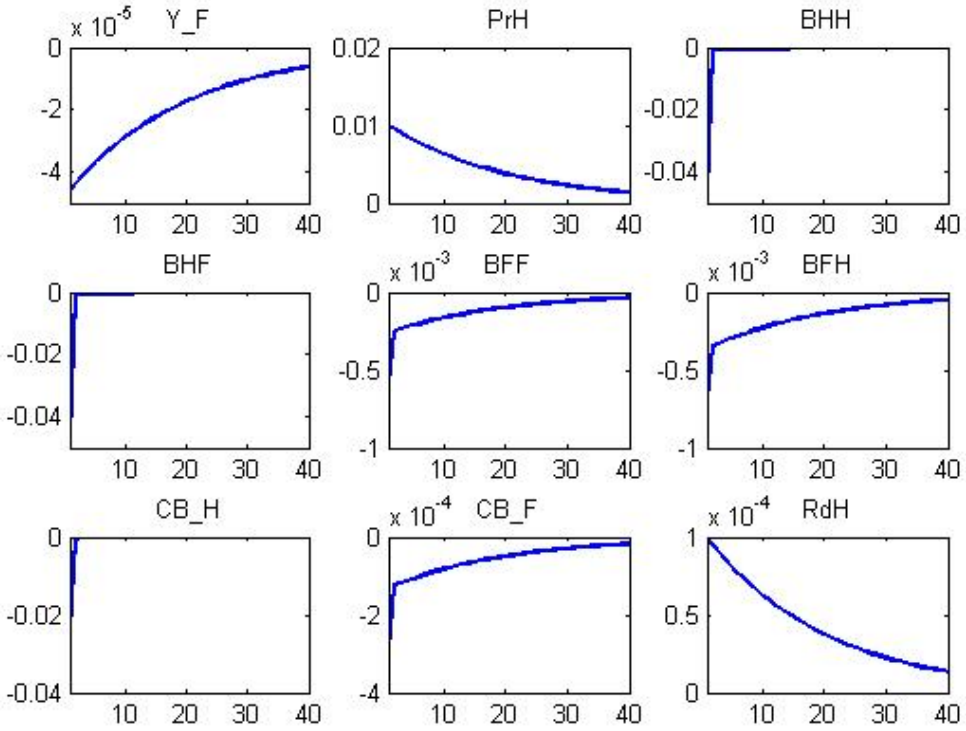


Figure 2.15: Dynamic responses to shock to domestic default probability Pr_H with different values of deposit guarantee ψ_H (1)

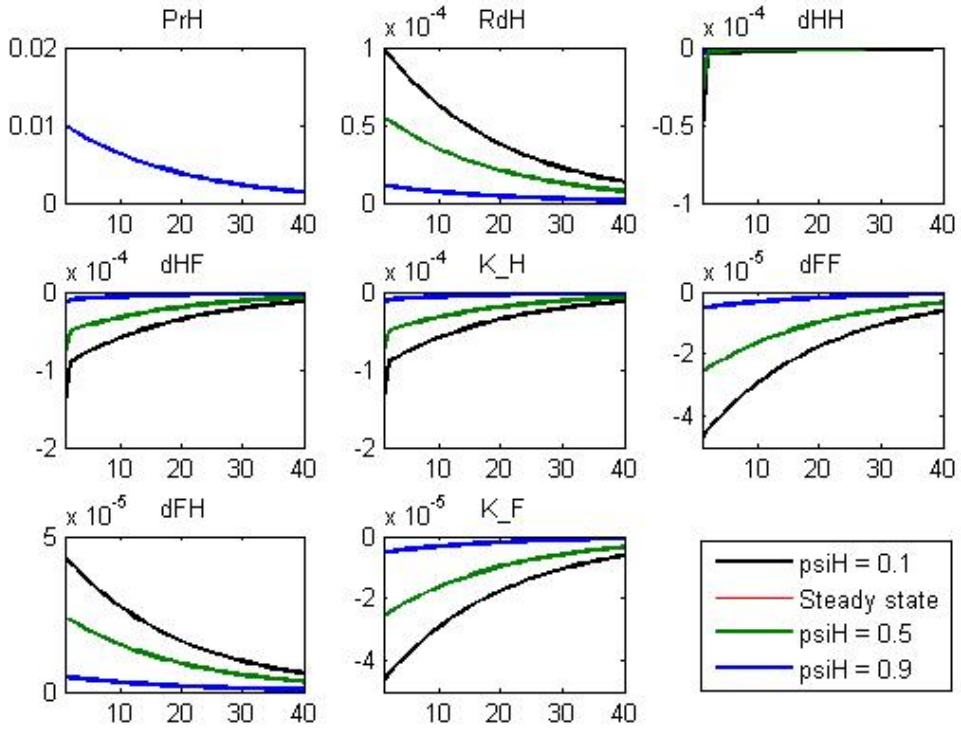


Figure 2.16: Dynamic responses to shock to domestic default probability Pr_H with different values of deposit guarantee ψ_H (2)

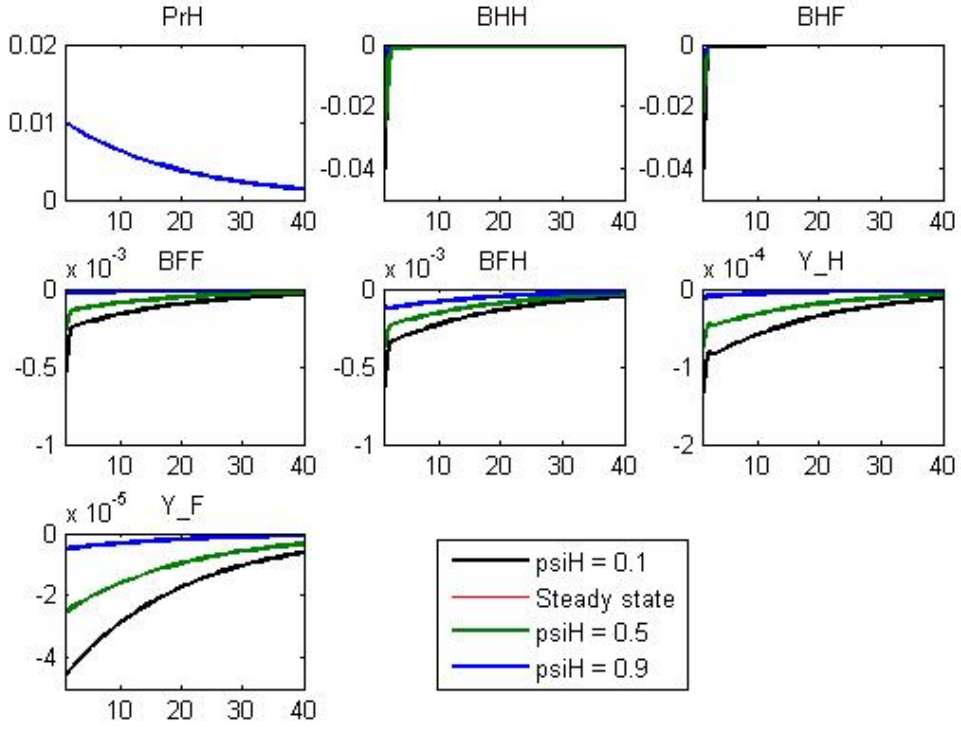


Figure 2.17: Dynamic responses to shock to domestic default probability Pr_H with different values of γ_L (1)

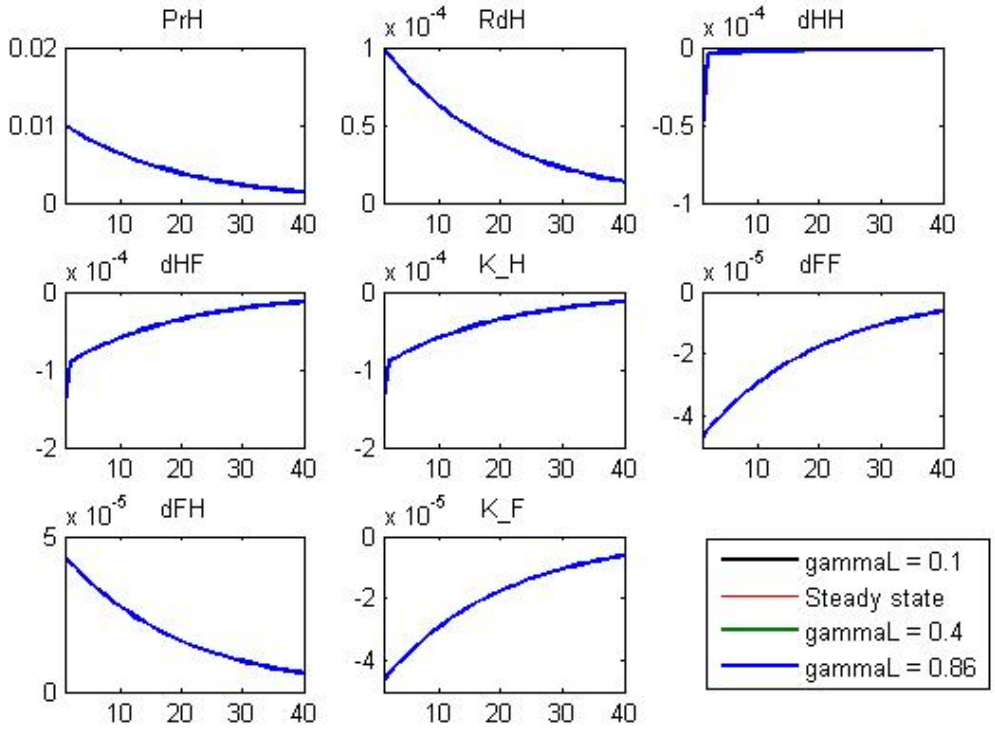
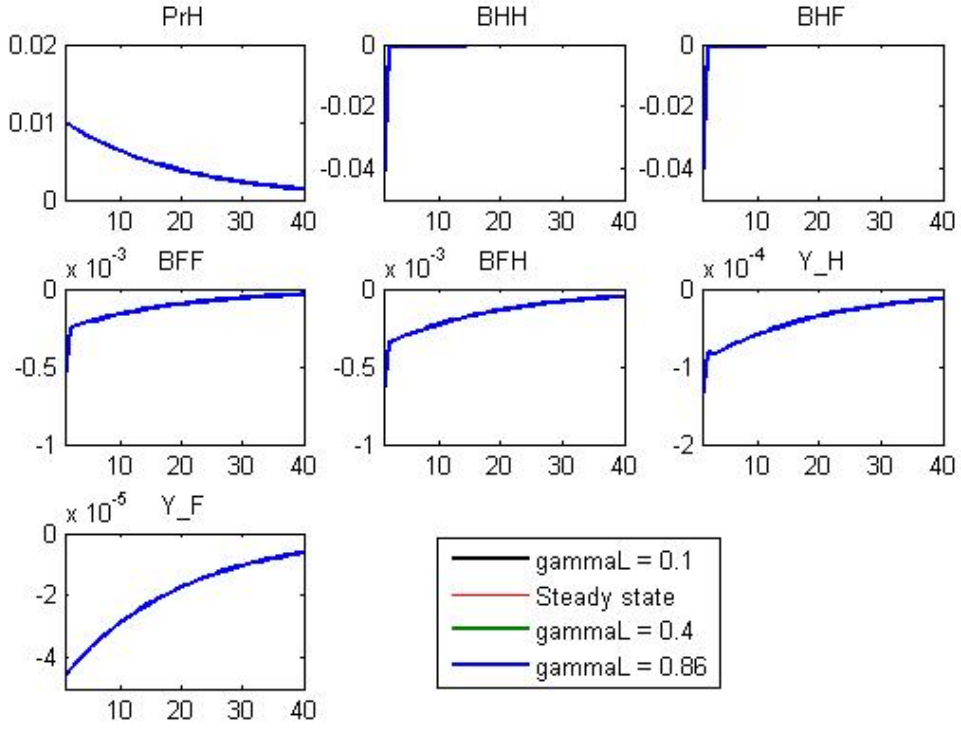


Figure 2.18: Dynamic responses to shock to domestic default probability Pr_H with different values of γ_L (2)



Chapter 3

Effects of borrowing constraint on capital inflows and long run growth: a calibrated SOE model.

3.1 Introduction

Many frameworks have been conducted on the determinants of capital flows and growth. Then, this paper is particularly interested in the impacts of debt constraint in the international capital markets on capital flows and long run growth.

Recently, beyond a crisis of debt sustainability, some institutional and economic issues have been highlighted by the Greek debt crisis. Indeed, the Greek debt crisis has shown a lack of transparency of Greece on the presentation of its debt since entering the Eurozone, some structural problems and some difficulties in collecting taxes. According to Frankel (2011): "It is not enough to recommend good fiscal policy to a country - or for the IMF to make loans to a country conditional on good fiscal policy - if ... institutions are not there to sustain the policy". Therefore, the implementation of efficient policies also depends on the quality of institutions and governance.

Against this background, we model in this paper a link between the ability of a state to borrow abroad, the quality of its institutions and its ability to collect taxes.

Therefore, we assume that the dynamics of capital inflows depend positively on the country's ability to collect taxes and its institutional quality/governance. The underling idea is that higher tax revenue and better institutional quality could promote long run growth rate through capital inflows. To analyse the implications of this relationship, we extend and simulate the [1]' overlapping generation setting of a constrained economy.

Firstly, this paper relates to the literature which links growth to institutions. During the past years, economics literature has progressively agreed about the key role played by economic and political institutions in growth (see [101], [102], [103]). Indeed, many frameworks point out the positive impact of institutional quality on economic development (see [104]; [105]; [106]; [107]). Furthermore, the results of [24] suggest that crises are preceded by weak institutions. They also find evidence that countries with strong institutions, experiment a shorter duration of crises. Besides, [108] find that future institutional improvements are more likely to occur in countries with poor economic performance than in those with a sustained growth.

Focusing on European countries, [109] conducted a panel analysis between 2001 and 2011 to study the link between the quality of political and economic regulations and economic performance. Results indicate that better political institutions and economic regulations affect the level of GDP. Further, low quality of political institutions seems to matter only when return on capital accumulation is high. [110] also provide empirical evidence on how cross-country institutional differences can explain the relative long-term GDP performance in Europe. They find that a country with an initial high level of sovereign debt (above 60-70%) and a low institutional quality (below the EU average) has a lower long-term real growth performance. Furthermore, they suggest that good institutions foster better conditions for euro-area countries' catching-up and for countries with fixed exchange rate. Finally, the authors account for the initial level of GDP per capita and the sovereign debt level, to define sub-groupings. They argue that when a country is deeply indebted and cannot use the exchange rate tool, good institutions may be particularly relevant to ensure long-term growth.

Secondly, our framework relates to the literature which links capital flows to institutions. To explain the "Lucas Paradox" [1], [111] investigate an empirical analysis and find that improving institutional quality increases investment from abroad. In addition, their results show that long-run development might be affected by institutions through foreign investment. [112] build an institutional quality index and test its relevance to explain the dynamics of both gross capital inflows and outflows. To do this, they use a panel of 56 countries and differentiate between high-income and low-income economies, over the period 1996-2012. Results indicate that investors tend to invest more in countries with good governance and public sector's credibility. They also argue that the behavior of (foreign and domestic) investors is affected by institutional quality. Moreover, good institutions encourage investors to build-up external assets in high-income countries which induces larger outflows in normal times. Thus, the repatriation of external assets is facilitated during periods of financial stress. In light of those previous empirical results, our model assumes an ad hoc borrowing constraint in the international capital markets, which increases with the quality of the institutions.

Thirdly, our framework relates to the literature which links net foreign assets to real exchange rate. [113] provide evidence of the impact of net foreign assets position on the real exchange rate through the relative price of non-tradable goods. By revisiting [114] results in the exchange rate dynamics, [115] develop a two-country monetary model with incomplete asset markets, net foreign assets, and endogenous monetary policy. Their results show that under flexible prices, the nominal exchange rate depends on the stock of real net foreign assets while under sticky prices, it also depends on the past GDP differential. To shed new light on the transfer problem[2], [116] present a simple theoretical framework. They test empirically the transfer problem by using cross-country data on real exchange rates and newly constructed dataset on countries' net external positions. On average, they find that in countries with net external liabilities, the real exchange rate is more depreciated, through the channel of the relative price of nontradable goods. Finally, [117] develop an exogenous growth model with two-sectors in which the real exchange rate depends on the amount that the country can borrow from

[1] It is the lack of capital flows from rich to poor countries.

[2] It represents the relationship between international payments and the real exchange rate

international capital markets. As their theoretical framework, their empirical analysis suggests that productivity and net foreign assets affect the dynamics of real exchange rate.

Our contribution to this huge literature is threefold. Firstly, we assume that the ability to borrow in international capital markets, increases with the production of a public good which is financed by collecting taxes. Indeed, our borrowing constraint shows that net foreign assets depend on institutional quality/governance and tax on tradable sector production. The rise of tax revenues, reflects good institutions/governance and the country's ability to collect taxes, which reassures foreigners and encourages them to invest more in the economy. Secondly, we introduce human capital (based on [118]' framework) in the model developed by [1] insofar as the institutional quality/governance plays a role in the accumulation of human capital and in the long run growth rate. Thirdly, we introduce non-tradable goods, to account for the link between productivity, net foreign assets, real exchange rate and growth.

Our results mainly show that in a constrained economy with high tradable sector productivity, better ability to collect taxes and quality of institutions/governance appreciate the real exchange rate and enhances capital inflows. However, higher capital inflows does not improve growth in the long run. When the economy is unconstrained, a positive shock to tradable sector productivity and higher tradable sector tax rate increase foreign investment, appreciate the real exchange rate and promote long run growth. Then, the results of this framework are favorable to the Balassa-Samuelson effect, only when the economy is unconstrained.

The remainder of the paper is subdivided as follows. Section 2 presents our constrained Small Open Economy (SOE) model with and without nontradable goods. Section 3 analyzes the simulations and Section 4 concludes.

3.2 The Model

The model is a variant of the [1]' overlapping generation model of a constrained economy, in which we introduce human capital and institutional quality/governance.

In the following subsections, we will present two versions of our model: without and with introduction of non-tradable goods.

3.2.1 Model with institutionnal quality and human capital market

Our model relies on a constrained small open economy with human capital which helps to introduce long-term growth and institutional quality. The government collects taxes to produce a public good Z_t using the following linear technology:

$$Z_t = \tau N_t Y_t$$

N_t is the size of the population, Y_t is the income and τ is the tax rate. Hence, $\tau N_t Y_t$ represents tax revenues, which are a proportion τ of the total income $N_t Y_t$. We define a borrowing constraint in the international capital markets such as:

$$B_{t+1} \geq -\eta Z_t \tag{3.1}$$

B_{t+1} denotes the net foreign assets (NFA) of the domestic country at time $t+1$. $\eta > 0$ denotes the proportion of tax revenues that the domestic country can borrow. In other words, it captures the ease of access that a country has to international capital markets. Thus, this crucial exogenous parameter reflects the quality of institutions/governance in the investors' point of view. Better quality of institutions/governance helps the country to borrow more in the international capital markets. Indeed, referring to equation (3.1), higher η increases the amount that the country can borrow (B_{t+1}). Such an assumption helps to link the borrowing constraint in the international capital markets to tax revenues and institutional quality.

Individuals

The economy is made up of a sequence of N_t identical individuals who constitute each generation at time t and live three periods. In the first period, they are receiving education. In the second period, they work and receive wages that will be shared between consumption, savings and investment in human capital. Savings

can be held in two forms, the physical capital stock and the net foreign assets. During their last period of life, they consume the return on their savings. The returns on the physical capital stock and on the net foreign assets are different, then agents choose both the amount of their savings and their allocation between these two types of assets. The intertemporal preferences of individuals are given by the following utility function:

$$U(c_t, d_{t+1}, e_t) = \beta ln c_t + (1-\beta) ln d_{t+1} + \gamma ln h_{t+1} \tag{3.2}$$

where c_t and d_{t+1} denote respectively the consumption of the second and third period. $0 \leq \beta \leq 1$ represents the relative weight given to present and future consumption, h_{t+1} is the child's human capital (human capital per capita) and γ is the altruism factor. The intergenerational altruism follows [119] who assume that the parental bequest is the quality of the education received by children.
Each individual maximizes their lifetime utility according to the consumption of second and third period and the human capital investment under the following constraints:

$$w_t h_t = c_t + e_t + h_{t+1} b_{t+1} + h_{t+1} k_{t+1} \tag{3.3}$$

$$d_{t+1} = R^k_{t+1} h_{t+1} k_{t+1} + \bar{R} h_{t+1} b_{t+1} \tag{3.4}$$

where e_t denotes resources that parents devote to their child's education. R^k_{t+1} represents the domestic return on physical capital, whereas according to the small open economy assumption, $\bar{R}$ is the fixed risk-free interest rate. b_{t+1} is the ratio of net foreign assets to human capital. k_{t+1} is the ratio of physical capital to human capital.
When the individual born at time t, becomes an adult, he gives h_{t+1} units of effective work such that:

$$h_{t+1} = \phi e_t \tag{3.5}$$

where $\phi > 0$ is a positive parameter that denotes the quality of training (e.g. the quality of university education). In other words, the higher this parameter is, the more efficient the human capital investment will be.
The optimal choice of each individual is characterized by the following first order conditions (FOC):

$$d_{t+1} = \frac{1-\beta}{\beta} R^k_{t+1} c_t \tag{3.6}$$

$$e_t = \frac{\gamma\phi}{\beta} c_t \tag{3.7}$$

The FOC (3.6) represents the optimal allocation of consumption over the agent' life cycle. The FOC (3.7) represents the optimal ratio between the investment in human capital and the first period consumption. Combining the FOC (3.6) and (3.7) and the constraints (3.3), (3.4) and (3.5), we obtain the following results:

$$c_t = \frac{\beta}{1 + \gamma\phi + \gamma\phi^2 b_{t+1}\left(1 - \frac{\bar{R}}{R^k_{t+1}}\right)} w_t h_t \tag{3.8}$$

$$d_{t+1} = \frac{1-\beta}{1 + \gamma\phi + \gamma\phi^2 b_{t+1}\left(1 - \frac{\bar{R}}{R^k_{t+1}}\right)} R^k_{t+1} w_t h_t \tag{3.9}$$

$$e_t = \frac{\gamma\phi}{1 + \gamma\phi + \gamma\phi^2 b_{t+1}\left(1 - \frac{\bar{R}}{R^k_{t+1}}\right)} w_t h_t \tag{3.10}$$

$$s_t = \frac{R^k_{t+1}}{\tilde{R}_{t+1}} \frac{1-\beta}{1 + \gamma\phi + \gamma\phi^2 b_{t+1}\left(1 - \frac{\bar{R}}{R^k_{t+1}}\right)} w_t h_t \tag{3.11}$$

where s_t is the individual' savings and $\tilde{R}_{t+1}$ represents the average return on savings.

Referring to the equations (3.8) and (3.9), altruism γ decreases consumption of the second and third period. In addition, savings decrease with the preference for the present β and with altruism γ (see equation (3.11)). More altruism and better quality of training, have two opposite effects on the resources devoted to the child's education (see equation (3.10)).

The rise of the domestic interest rate compared with the world interest rate, increases the interest rate differential. Then, higher interest rate differential improves the investment in human capital and the consumption of second and third period.

When foreigners invest more in domestic country, the net foreign assets [3] decrease (more negative b_{t+1}), which helps to promote the consumption of first and second period and the investment in human capital.

Production

The representative firm produces one type of good according to a Cobb-Douglas function. The inputs of this production function are human capital (H) and physical capital (K) such that:

$$Y_t = A_t K_t^{\alpha} H_t^{1-\alpha}, A > 0, 0 < \alpha < 1. \tag{3.12}$$

where

$$A_t = \rho_A A_{t-1} + \upsilon_{A,t}$$

Investment transforms a unit of good into a unit of installed physical capital. The latter is fully depreciated after one period such that $\delta = 1$. Therefore, the dynamics of physical capital are given by:

$$K_{t+1} = (1-\delta)K_t + I_t = I_t$$

We can rewrite equation (3.12) as:

$$y_t = A_t k_t^{\alpha} \tag{3.13}$$

where k represents the intensity of capital (the ratio of physical capital to human capital) which is:

$$k_t = \frac{K_t}{H_t}$$

The representative firm maximizes the following profit function:

$$\Pi_t = (1-\tau)Y_t - w_t H_t - R_t^k K_t$$

[3] Recall that net foreign assets represent the value of the assets hold by domestic country abroad minus the value of the assets hold by foreigners in the domestic country. Thus, the more negative b is, the more foreigners own domestic assets, reflecting increasing capital inflows in the domestic country.

under the constraint (11). The first order conditions are as follows:

$$R^k_{t+1} = \alpha(1-\tau)A_t k^{\alpha-1}_{t+1} \tag{3.14}$$

$$w_t = (1-\alpha)(1-\tau)A_t k^{\alpha}_t \tag{3.15}$$

where R^k denotes the domestic return on physical capital and w denotes the wage.

Macroeconomic Equilibrium

In each period, the labour market clears:

$$H_{t+1} = N_{t+1}h_{t+1} \tag{3.16}$$

We assume a constant population such as $N_{t+1} = N_t = N = 1$.

Knowing that savings can be held in two forms, the assets market equilibrium is as follows:

$$B_{t+1} + K_{t+1} = H_{t+1}k_{t+1} + H_{t+1}b_{t+1} = N_t s_t \tag{3.17}$$

with

$$B_{t+1} = H_{t+1}b_{t+1} = h_{t+1}b_{t+1} \tag{3.18}$$

and

$$K_{t+1} = H_{t+1}k_{t+1} = h_{t+1}k_{t+1} \tag{3.19}$$

where b_{t+1} is the net foreign assets per capita. Replacing (3.18) and (3.19) in (3.17), we obtain:

$$N_t s_t = s_t = h_{t+1}b_{t+1} + h_{t+1}k_{t+1} \tag{3.20}$$

Replacing equations (3.11), (3.7), (3.5) in (3.20), we obtain :

$$k_{t+1} + b_{t+1} = \frac{1-\beta}{\gamma\phi^2}\frac{R^k_{t+1}}{\tilde{R}_{t+1}} \tag{3.21}$$

Rewriting equations (3.4) (see more details in appendix), we have:

$$\tilde{R}_{t+1}s_t = R^k_{t+1}h_{t+1}k_{t+1} + \bar{R}h_{t+1}b_{t+1} \tag{3.22}$$

Replacing equation (3.21) in equation (3.22), the average return on savings is given by:

$$\tilde{R}_{t+1} = \frac{1-\beta}{1-\beta+\gamma\phi^2 b_{t+1}\left(1-\frac{\bar{R}}{R^k_{t+1}}\right)} R^k_{t+1} \tag{3.23}$$

The average return on savings increases with the domestic return on physical capital and decreases with the interest rate differential.

The equilibrium is characterized by two cases, depending on whether the economy is constrained or not (e.g. equation (3.1)) knowing that these two kinds of equilibria do not exist simultaneously.

Constrained Case When the economy is constrained, the domestic return on physical capital rate is higher than world interest rate such as $R^k_{t+1} \geq \bar{R}$. Based on the equation (3.1), the borrowing constraint in a counstrained economy is as follows:

$$b_{t+1} = -\eta\tau y_t \tag{3.24}$$

Replacing the equations (3.24), (3.23) and (3.13) in equation (3.21) gives the dynamics of the intensity of capital at equilibrium:

$$k_{t+1} = \frac{1-\beta}{\gamma\phi^2} - \frac{\bar{R}}{R^k_{t+1}} b_{t+1} = \frac{1-\beta}{\gamma\phi^2} + \frac{\bar{R}}{\alpha(1-\tau)A_t k^{\alpha-1}_{t+1}} \eta\tau A_t k^{\alpha}_t \tag{3.25}$$

Thus, in the constrained economy, the intensity of capital is financed by domestic savings and capital inflows. Given that $k_t = \frac{K_t}{H_t}$, it is straightforward to show that when parents are more altruist (increasing γ) and when the quality of training (ϕ) raises, the accumulation of capital k_{t+1} decreases.

Condition 1: The capital in $t+1$ is an increasing function of the capital in t if and only if:

$$\frac{\tau}{1-\tau} \leq \frac{\alpha}{1-\alpha}\frac{1}{\eta\bar{R}} \tag{3.26}$$

Condition 2: A local stability of steady state occurs if and only if:

$$\frac{\alpha}{\bar{R}\eta(1-2\alpha)} < \frac{\tau}{1-\tau} < \frac{\alpha}{\bar{R}\eta} \tag{3.27}$$

Based on Condition 1 and Condition 2, higher institutional quality relaxes the constraint (the country is able to borrow more). Then the intensity of capital at the steady state is given by:

$$k_c^* = \frac{1-\beta}{\gamma\phi^2}\frac{\alpha(1-\tau)}{\alpha(1-\tau)-\bar{R}\tau\eta} \tag{3.28}$$

Condition 3: $k_c^* \geq 0$ if and only if:

$$\frac{\tau}{1-\tau} \leq \frac{\alpha}{\bar{R}\eta} \tag{3.29}$$

Referring to equation (3.28), higher institutional quality and tax rate, increases the intensity of capital at the steady state. However, higher altruism has a negative effect on the intensity of capital.

Replacing equation (3.10) in equation (3.5) gives the human capital per capita:

$$h_{t+1} = \frac{\gamma\phi^2}{1+\gamma\phi+\gamma\phi^2 b_{t+1}\left(1-\frac{\bar{R}}{R_{t+1}^k}\right)} w_t h_t \tag{3.30}$$

Then, the growth rate is as follows:

$$\frac{h_{t+1}}{h_t} = 1 + g_t = \frac{\gamma\phi^2}{1+\gamma\phi+\gamma\phi^2 b_{t+1}\left(1-\frac{\bar{R}}{R_{t+1}^k}\right)} w_t \tag{3.31}$$

Equation (3.31) reveals two opposite effects of higher γ and ϕ on growth. On the one hand, the increase of the investment in human capital enhances growth. On the other hand, by reducing the accumulation of capital, higher investment in human capital lessens growth.

Higher tax rate has also two effects on growth rate. The increase of tax rate, reduces the domestic returns on production factors (w_t and R_{t+1}^k). On the one hand, the decrease of wage has a negative effect on growth, since it reduces human capital. On the other hand, the decrease of domestic return on physical capital has a positive effect on growth. Then, the overall impact on growth will depend on both effects.

Unconstrained Case When the economy has a perfect access to the international capital markets, the domestic return on physical capital converges to the world interest rate such that:

$$R_{t+1}^{k} = \bar{R} \tag{3.32}$$

In this case, the dynamics of capital depend only on the dynamics of productivity factor A_t such as:

$$k_{t+1} = \left(\frac{\alpha(1-\tau)}{\bar{R}} A_{t+1}\right)^{\frac{1}{1-\alpha}} \tag{3.33}$$

The intensity of capital at the steady state is given by:

$$k_{u}^{*} = \left(\frac{\alpha(1-\tau)}{\bar{R}} A^{*}\right)^{\frac{1}{1-\alpha}} \tag{3.34}$$

Condition 4: $k_u^* \geq 0$ if and only if:

$$\tau \leq 1 - \frac{\bar{R}}{\alpha A} \tag{3.35}$$

Referring to equation (3.34), higher tax rate and world interest rate decreases the intensity of capital at the steady state.

Combining the equations (3.32) and (3.23), the average return on savings also converges to the world interest rate such that:

$$\tilde{R}_{t+1} = \bar{R} \tag{3.36}$$

Replacing the equations (3.32) and (3.36) in equation (3.21), we obtain the dynamics of the net foreign assets in the unconstrained economy:

$$b_{t+1} = \frac{1-\beta}{\gamma\phi^2} - k_{t+1} = \frac{1-\beta}{\gamma\phi^2} - \left(\frac{\alpha(1-\tau)}{\bar{R}} A_{t+1}\right)^{\frac{1}{1-\alpha}} \tag{3.37}$$

In this case, foreigners invest more in the domestic country when the domestic productivity raises. Higher tax rate and world interest rate increases (b_{t+1}).

Replacing the equations (3.32) and (3.36) in equation (3.11), savings are given

by:

$$s_t = \frac{1-\beta}{1+\gamma\phi} w_t h_t \tag{3.38}$$

Savings decrease with the discount factor and with the quality of training and altruism. Moreover, higher tax rate decreases wage; which reduces savings.
Combining (3.32), (3.36) and (3.8), the second period consumption is given by:

$$c_t = \frac{\beta}{1+\gamma\phi} w_t h_t \tag{3.39}$$

The quality of training, altruism and the relative weight given to present and future consumption lessen the second period consumption. By reducing wages, the increase of tax rate decreases the second period consumption.
Replacing the equations (3.32) and (3.36) in equation (3.9), the third period consumption is given by:

$$d_{t+1} = \frac{1-\beta}{1+\gamma\phi} \bar{R} w_t h_t \tag{3.40}$$

The third period consumption increases with the world interest rate.
Combining the equations (3.32), (3.36) and (3.10), the investment in human capital is given by:

$$e_t = \frac{\gamma\phi}{1+\gamma\phi} w_t h_t \tag{3.41}$$

Higher tax rate decreases wage, which lessens the investment in human capital. Replacing equation (3.41) in equation (3.5), we obtain:

$$h_{t+1} = \frac{\gamma\phi^2}{1+\gamma\phi} w_t h_t \tag{3.42}$$

Then, the growth rate is as follows:

$$\frac{h_{t+1}}{h_t} = 1 + g_t = \frac{\gamma\phi^2}{1+\gamma\phi} w_t \tag{3.43}$$

As in the constrained case, better quality of training and more altruism have positive and negative effects on growth when the economy is unconstrained. Furthermore, the rise of tax rate decreases the physical capital accumulation. This increases the NFA, which reduces growth. Then, investors might not consider the rise of taxes as a security, but only as a growth reducer.

Critical threshold level of η We investigate the level of η which allows the country to switch from constrained to unconstrained steady state such that:

$$k_c^* = k_u^*$$

We will focus on the case where $k_0 < k_u^*$. Let $\tilde{\eta}$ be the critical threshold level of η defined as follows:

$$\tilde{\eta} = \frac{\alpha(1-\tau)}{\bar{R}\tau}\left(1 - \frac{1-\beta}{\gamma\phi^2}\left(\frac{A\alpha(1-\tau)}{\bar{R}}\right)^{\frac{1}{1-\alpha}}\right) \tag{3.44}$$

When tax rate increases, the critical level $\tilde{\eta}$ decreases, which means that the higher tax rate is, the less investors penalize countries with low institutional quality/governance. For an initially constrained country, higher level of tax makes the country less constrained. This means that producing more public good can make this country unconstrained.

Therefore, when $\eta \geq \tilde{\eta}$, the country converges to the unconstrained steady - state and we recover the standard small open economy setting. When $\eta \leq \tilde{\eta}$, the country converges to the constrained steady state and remains constrained in the long-run.

Our theoretical model reveals that investors penalize countries with bad institutional quality. Indeed, with low quality of institutions, the country is not able to borrow the amount it desires. In such a case, the economy converges towards the constrained steady state only when $\eta \leq \tilde{\eta}$. This threshold $\tilde{\eta}$ is crucial and reveals that a country with a low institutional quality should increase the tax rate in order to borrow more in the international capital markets. Indeed, increasing the tax rate reduces the threshold level $\tilde{\eta}$. This allows the country to converge towards the unconstrained steady state even with a low institutional quality.

3.2.2 Introducing of non-tradable goods

We assume that government produces a public good Z_t, which uses now two types of goods: the tradable (T) and the non-tradable (N). Therefore, we introduce

the real exchange rate (RER_t), the relative price of non-tradable goods relative to tradable goods in the previous model. The country faces a new constraint on capital inflows such that:

$$B_{t+1} \geq -\eta N_t Z_t \tag{3.45}$$

where

$$Z_t = \tau_T Y_{T_t}$$

Y_{T_t} represents the production of the tradable goods. τ_T denotes the tax rate in tradable sector.

Individuals

The maximization program of each agent born in period t is solved now in two steps. Firstly, each individual belonging to generation t maximizes the previous intertemporal utility (see equation (3.2)) according to the following constraints:

$$w_t h_t = \pi_t c_t + e_t + h_{t+1} b_{t+1} + h_{t+1} k_{t+1} \tag{3.46}$$

$$\pi_{t+1} d_{t+1} = R^k_{t+1} h_{t+1} k_{t+1} + \bar{R} h_{t+1} b_{t+1} \tag{3.47}$$

$$h_{t+1} = \phi e_t \tag{3.48}$$

$$b_{t+1} \geq -\eta z_t = -\eta(\tau_T y_{T_t}) \tag{3.49}$$

π_t represents the price index. c_t and d_{t+1} are respectively the consumption when adult and old. They are consumption baskets, composed of both tradables and non-tradables goods.

Secondly, the consumer also has cobb-douglas preferences of tradables and non-tradables goods. Each period consumer spends a constant share of its expenditures on each type of good (respectively x_{N_t} and x_{T_t}), and the intertemporal model solves for expenditures level in each period. Therefore, each individual maximizes the utility fonction:

$$u(x_{T_t}, x_{N_t}) = x^{\mu}_{T_t} x^{1-\mu}_{N_t}; 0 < \mu < 1 \tag{3.50}$$

under the following spending constraint:

$$\pi_t x_t = x_{T_t} + RER_t x_{N_t}$$

Hence, the allocation of total consumption spending between tradable and non-tradable goods at each period is respectively given by:

$$x_{T_t} = \mu \pi_t x_t$$

$$RER_t x_{N_t} = (1-\mu)\pi_t x_t$$

where the price index is $\pi_t = \mu^{-\mu}(1-\mu)^{\mu-1} RER_t^{1-\mu}$.

The optimal choice of an individual is characterized by the following first order conditions (FOC):

$$\pi_{t+1} d_{t+1} = \frac{1-\beta}{\beta} R^k_{t+1} \pi_t c_t \tag{3.51}$$

$$e_t = \frac{\gamma\phi}{\beta} \pi_t c_t \tag{3.52}$$

Solving the maximization problem under the previous constraints gives:

$$\pi_t c_t = \frac{\beta}{1+\gamma\phi+\gamma\phi^2 b_{t+1}\left(1-\frac{\bar{R}}{R^k_{t+1}}\right)} w_t h_t \tag{3.53}$$

$$\pi_{t+1} d_{t+1} = \frac{1-\beta}{1+\gamma\phi+\gamma\phi^2 b_{t+1}\left(1-\frac{\bar{R}}{R^k_{t+1}}\right)} R^k_{t+1} w_t h_t \tag{3.54}$$

$$e_t = \frac{\gamma\phi}{1+\gamma\phi+\gamma\phi^2 b_{t+1}\left(1-\frac{\bar{R}}{R^k_{t+1}}\right)} w_t h_t \tag{3.55}$$

$$s_t = \frac{R^k_{t+1}}{\tilde{R}_{t+1}} \frac{1-\beta}{1+\gamma\phi+\gamma\phi^2 b_{t+1}\left(1-\frac{\bar{R}}{R^k_{t+1}}\right)} w_t h_t \tag{3.56}$$

Altruism γ lessens savings and consumption of the second and third period (see equations (3.53) and (3.54)). Moreover, savings (see equation (3.56)) decrease with discount rate β. Referring to equation (3.55), higher altruism and quality of

training has two opposite effects on the investment in human capital.

Production

The representative firm produces in tradable (T) and non-tradable (N) sectors. The production in both sectors is characterized by a Cobb-Douglas function.
In the tradable goods sector, the production function is given by:

$$Y_{T_t} = A_{T_t} K_{T_t}^{\alpha_T} H_{T_t}^{1-\alpha_T}, \tag{3.57}$$

where

$$A_{T_t} = \rho_{A_T} A_{T_{t-1}} + \upsilon_{A_T,t}$$

represents the productivity of tradable (T) sector.
In the non-tradable goods sector, the production function is as follows:

$$Y_{N_t} = A_{N_t} K_{N_t}^{\alpha_N} H_{N_t}^{1-\alpha_N}. \tag{3.58}$$

where

$$A_{N_t} = \rho_{A_N} A_{N_{t-1}} + \upsilon_{A_N,t}$$

represents the productivity of non-tradable (N) sector.
We can rewrite equations (3.57) and (3.58) as:

$$y_{T_t} = A_{T_t} k_{T_t}^{\alpha_T}$$

$$y_{N_t} = A_{N_t} k_{N_t}^{\alpha_N}$$

where k represents the intensity of capital in each sector (T and N) such that:

$$k_{T_t} = \frac{K_{T_t}}{H_{T_t}}$$

$$k_{N_t} = \frac{K_{N_t}}{H_{N_t}}$$

We assume perfect capital mobility between sectors, such that:

$$h_{T_t} + h_{N_t} \leq 1 \tag{3.59}$$

$$k_{T_t} h_{T_t} + k_{N_t} h_{N_t} \leq k_t \tag{3.60}$$

Given the assumptions of perfect capital mobility and perfect competition, the representative firm maximizes the following profit function:

$$\Pi_t = (1 - \tau_T) Y_{T_t} + (1 - \tau_N) RER_t Y_{N_t} - w_t H_t - R_t^k K_t \tag{3.61}$$

under the constraints (3.57), (3.58) and :

$$K_{T_t} + K_{N_t} = K_t \tag{3.62}$$

$$H_{T_t} + H_{N_t} = H_t \tag{3.63}$$

Perfect competition among firms drives profits to zero. Given the assumption of perfect capital mobility, the first order conditions are given by:

$$R_{t+1}^k = \alpha_T (1 - \tau_T) A_{T_{t+1}} k_{T_{t+1}}^{\alpha_T - 1} = \alpha_N (1 - \tau_N) RER_{t+1} A_{N_{t+1}} k_{N_{t+1}}^{\alpha_N - 1} \tag{3.64}$$

$$w_t = (1 - \alpha_T)(1 - \tau_T) A_{T_t} k_{T_t}^{\alpha_T} = (1 - \alpha_N)(1 - \tau_N) RER_t A_{N_t} k_{N_t}^{\alpha_N} \tag{3.65}$$

$$k_{N_t}^{\alpha_T - \alpha_N} = \theta \frac{1 - \tau_N}{1 - \tau_T} RER_t \frac{A_{N_t}}{A_{T_t}} \tag{3.66}$$

where

$$\theta = \left(\frac{\alpha_N}{\alpha_T} \right)^{\alpha_T} \left(\frac{1 - \alpha_N}{1 - \alpha_T} \right)^{1 - \alpha_T} \tag{3.67}$$

and

$$k_{T_t} = \frac{\alpha_T}{\alpha_N} \frac{1 - \alpha_N}{1 - \alpha_T} k_{N_t} = \frac{\alpha_T}{\alpha_N} \frac{1 - \alpha_N}{1 - \alpha_T} \left(\theta \frac{1 - \tau_N}{1 - \tau_T} RER_t \frac{A_{N_t}}{A_{T_t}} \right)^{\frac{1}{\alpha_T - \alpha_N}} \tag{3.68}$$

An RER appreciation (higher RER) makes the non-tradable sector more attractive; which increases the investment in non-tradable sector capital. In the following, our analysis will focus on the case where the tradable sector is capital intensive ($\alpha_T > \alpha_N$).

Given the assumption of perfect intersectoral mobility, the tradable sector benefits from the rise of non-tradable sector capital. Therefore, an RER appreciation

enhances the investment in physical capital and production (in both sectors).

An RER appreciation has two opposite effects on the domestic return on physical capital. Indeed, the rise of the real exchange rate has a direct positive effect and an indirect negative effect (through the increase of the investment in non-tradable sector capital) on the domestic return on physical capital. Moreover, higher RER enhances wage (directly and indirectly through the increase of the investment in non-tradable sector capital).

The rise of tax rate in the tradable and non-tradable sectors respectively, increases and decreases the investment in non-tradable sector capital. Then, higher tradable sector tax rate has two effects on wage: when τ_T increases, there is a direct negative effect and an indirect positive effect (by increasing k_{N_t} and k_{T_t}) on wage. Moreover, higher tradable sector tax decreases the domestic return on physical capital.

The rise of non-tradable sector tax rate has two effects on the domestic return on physical capital: higher τ_N has a direct negative effect and an indirect positive effect (by increasing k_{N_t}). In addition, higher non-tradable sector tax decreases wage.

Recall that, given the perfect capital mobility, the equality between marginal productivities in both sectors should be maintained. Then, even when the rise of tax rate lessens the domestic return on physical capital, we can have an increase of the investment in physical capital.

Macroeconomic Equilibrium

In each period, the labour market clears:

$$H_{t+1} = N_{t+1} h_{t+1} \tag{3.69}$$

where

$$N_{t+1} = N_t = 1 \tag{3.70}$$

Therefore, the equilibrium in the non-tradable goods market is given by:

$$\pi_t c_t + \pi_t d_t = \frac{RER_t}{1-\mu} Y_{N_t} \tag{3.71}$$

The assets market equilibrium is as follows:

$$B_{t+1} + K_{t+1} = H_{t+1}k_{t+1} + H_{t+1}b_{t+1} = s_t \tag{3.72}$$

with

$$B_{t+1} = H_{t+1}b_{t+1} = h_{t+1}b_{t+1} \tag{3.73}$$

and

$$K_{t+1} = H_{t+1}k_{t+1} = h_{t+1}k_{t+1} \tag{3.74}$$

Replacing the equations (3.69), (3.70), (3.73), (3.74) in equation (3.72), we obtain:

$$s_t = h_{t+1}b_{t+1} + h_{t+1}k_{t+1} \tag{3.75}$$

Replacing equations (3.56), (3.52), (3.48) in equation (3.75), we obtain:

$$k_{t+1} + b_{t+1} = \frac{1-\beta}{\gamma\phi^2} \frac{R^k_{t+1}}{\tilde{R}_{t+1}} \tag{3.76}$$

Rewriting equation (3.47) (see more details in appendix) gives:

$$\tilde{R}_{t+1}s_t = R^k_{t+1}h_{t+1}k_{t+1} + \bar{R}h_{t+1}b_{t+1} \tag{3.77}$$

Replacing (3.76) in (3.77), the average return on savings is given by:

$$\tilde{R}_{t+1} = \frac{\beta}{1-\beta+\gamma\phi^2 b_{t+1}\left(1-\frac{\bar{R}}{R^k_{t+1}}\right)} R^k_{t+1} \tag{3.78}$$

The average return on savings decreases with the population growth rate.

Constraint Case With the introduction of non-tradable goods, the borrowing constraint in a constrained economy becomes:

$$b_{t+1} = -\eta(\tau_T y_{T_t}) \tag{3.79}$$

Recall that:
$k_{N_t}^{\alpha_T-\alpha_N} = \theta\frac{1-\tau_N}{1-\tau_T}RER_t\frac{A_{N_t}}{A_{T_t}}$ and $k_{T_t} = \frac{\alpha_T}{\alpha_N}\frac{1-\alpha_N}{1-\alpha_T}k_{N_t}$.

Given the assumption of perfect intersectoral mobility, higher RER increases the investment in physical capital and production in both sectors. Thus, the overall tax revenue is improved. Consequently, an appreciation of real exchange rate has a positive effect on the capital inflow in the constrained economy.

Replacing the equations (3.79), (3.78), (3.57) and (3.58) in equation (3.76), the dynamics of the equilibrium intensity of capital are given by:

$$k_{t+1} = \frac{1-\beta}{\gamma\phi^2} - \frac{\bar{R}}{R_{t+1}^k}b_{t+1} \tag{3.80}$$

Referring to equation (3.79), higher RER increases the foreign investors' incentive to invest in the constrained economy (more negative NFA). This has a positive effect on the intensity of capital invested in time $t+1$.

Let us focus now on the effects of tradable and non-tradable sectors tax rate on the dynamics of the intensity of capital.

	Effect on		
	b_{t+1}	R_{t+1}^k	k_{t+1}
Higher tradable sector tax rate τ_T	Positive	Negative	Positive
Higher non-tradable sector tax rate τ_N	Positive	Positive	Positive and Negative
		Negative	Positive

Replacing equation (3.55) in equation (3.48), we obtain:

$$h_{t+1} = \frac{\gamma\phi^2}{1+\gamma\phi+\gamma\phi^2 b_{t+1}\left(1-\frac{\bar{R}}{R_{t+1}^k}\right)}w_t h_t \tag{3.81}$$

Therefore, the growth rate is given by:

$$\frac{h_{t+1}}{h_t} = 1 + g_t = \frac{\gamma\phi^2}{1 + \gamma\phi + \gamma\phi^2 b_{t+1}\left(1 - \frac{\bar{R}}{R^k_{t+1}}\right)} w_t \tag{3.82}$$

Let us focus now on the effects of tradable and non-tradable sectors tax rate on the growth rate:

	Effect on			
	b_{t+1}	w_t	R^k_{t+1}	$1 + g_t$
Higher tradable sector tax rate τ_T	Positive	Positive	Negative	Positive and Negative
		Negative	Negative	Negative
Higher non-tradable sector tax rate τ_N		Negative	Positive	Negative
			Negative	Positive

Furthermore, the effects of RER appreciation on the growth rate are as follows:

	Effect on			
	b_{t+1}	w_t	R^k_{t+1}	$1 + g_t$
RER appreciation	Positive	Positive	Positive	Positive and Negative
			Negative	Positive and Negative

The overall impact will depend on which of these effects dominates for each case.

Unconstraint Case When the economy is unconstrained, the dynamics of physical capital in tradable and non-tradable sector are given by:

$$R^k_{t+1} = \bar{R} = \alpha_N(1 - \tau_N) RER_{t+1} A_{N_{t+1}} k^{\alpha_N - 1}_{N_{t+1}} \tag{3.83}$$

Then, the dynamics of physical capital in tradable and non-tradable sector are:

$$k_{N_{t+1}} = \left(\frac{\alpha_N(1 - \tau_N)}{\bar{R}} RER_{t+1} A_{N_{t+1}}\right)^{\frac{1}{1-\alpha_N}} \tag{3.84}$$

and

$$k_{T_{t+1}} = \frac{\alpha_T}{\alpha_N}\frac{1 - \alpha_N}{1 - \alpha_T} k_{N_{t+1}} = \frac{\alpha_T}{\alpha_N}\frac{1 - \alpha_N}{1 - \alpha_T}\left(\frac{\alpha_N(1 - \tau_N)}{\bar{R}} RER_{t+1} A_{N_{t+1}}\right)^{\frac{1}{1-\alpha_N}} \tag{3.85}$$

The appreciation of real exchange rate improves (as in constrained economy) the investment in both sectors. The increase of the non-tradable sector tax rate and the world interest rate, reduces the investment in intensity of capital. Combining the equations (3.65) and (3.83), the wage is as follows:

$$w_t = (1-\alpha_N)\left(\frac{\alpha_N}{\bar{R}}((1-\tau_N)A_{N_t}RER_t)^{1-\alpha_N}\right)^{(\frac{\alpha_N}{1-\alpha_N})} \tag{3.86}$$

Higher non-tradable sector tax rate and RER, respectively, decreases and increases wage in the unconstrained economy. Moreover, the rise of world interest rate lessens wage. Replacing equation (3.83) in equation (3.78), the average return on savings converges to the world interest rate such as:

$$\tilde{R}_{t+1} = \bar{R} \tag{3.87}$$

Replacing the equations (3.83) and (3.87) in equation (3.76), we obtain the dynamics of net foreign assets:

$$b_{t+1} = \frac{1-\beta}{\gamma\phi^2} - k_{t+1} \tag{3.88}$$

When the economy is not constrained, the investors' incentive to invest more in the country does not depend on the quality of institutions. Replacing the equations (3.83) and (3.87) in equation (3.56), savings are given by:

$$s_t = \frac{1-\beta}{1+\gamma\phi} w_t h_t \tag{3.89}$$

Replacing the equations (3.83) and (3.87) in equation (3.53), the second period consumption is given by:

$$\pi_t c_t = \frac{\beta}{1+\gamma\phi} w_t h_t \tag{3.90}$$

Replacing the equations (3.83) and (3.87) in equation (3.54), the third period consumption is as follows:

$$\pi_{t+1} d_{t+1} = \frac{1-\beta}{1+\gamma\phi} \bar{R} w_t h_t \tag{3.91}$$

Replacing the equations (3.83) and (3.87) in equation (3.55), the investment in human capital is given by:

$$e_t = \frac{\gamma\phi}{1+\gamma\phi} w_t h_t \tag{3.92}$$

The rise of the non-tradable sector tax rate and RER, respectively lessens and increases savings, investment in human capital and consumption of the second and third period. Replacing equation (3.92) in equation (3.48), we obtain:

$$h_{t+1} = \frac{\gamma\phi^2}{1+\gamma\phi} w_t h_t \tag{3.93}$$

Therefore, the growth rate is as follows:

$$\frac{h_{t+1}}{h_t} = 1 + g_t = \frac{\gamma\phi^2}{1+\gamma\phi} w_t \tag{3.94}$$

Combining the equations (3.86) and (3.94), we can show that higher non-tradable sector tax rate and RER, respectively reduces and increases growth rate in the unconstrained economy.

Moreover, the increase of world interest rate lessens growth rate. Investing at the world interest rate is less risky than investing at the domestic return on physical capital. When the latter raises, the return of the non risky investment increases, reducing the attractiveness of investing in the domestic country.

3.3 Analysis of Simulations

3.3.1 Model without nontradable goods

Figure 3.1 to Figure 3.11 plot the impulse responses to orthogonalized innovations in stochastic disturbances for a set of selected variables.

Calibration

Parameter	Description	Value	Sources
$\bar{R}$	Return to bonds (quarterly)	0.011	[99]
β	Discount rate	0.9891	[99]
α	Private capital share in production	0.3061	[99]
γ	Altruism factor	0.2	Set
ϕ	Quality of training parameter	1	[117]
ρ_η	Persistency parameter of η	0.95	Set
rho_A	Persistency parameter of A	0.675	[99]
A	Long run aggregate productivity	1	[99]
τ	Tax rate	0.33	[120]
η	Parameter of institutional quality:		
	Constraint case	0.1	[117]
	Unconstraint case	0.2	

Constrained case

We analyze the impact of positive shock to productivity when the economy is constrained at $t = 0$.

Referring to Figure 3.1 and Figure 3.2, a positive shock to productivity increases wage, the domestic return on physical capital and production. Higher wage and domestic return on physical capital help individuals to increase the overall consumption, savings and the resources devoted to child's education (e).
Higher production heightens tax revenue which sends a positive signal to foreigners who invest more in the constrained economy. This explains the rise of capital inflows (b becomes more negative). Higher capital inflows enhance the investment in physical capital and promotes growth rate. This result is in line with findings of the classic theory of growth (see [121], [122], [123], [124]) which supports that there is a positive link between capital flows and growth rate. In addition, [125], [126] and [127] also show a positive relationship between capital inflows and domestic investment. Indeed, capital flows liberalization develops domestic financial market by increasing the access to international capital market for low-income countries. This raises domestic savings and favors better allocation of resources and greater growth (see[128]).

In a constrained economy with high productivity, lower preference for the present, undermines growth rate and production (See figure 3.3). Lower production reduces tax revenue; which sends a negative signal to international capital market in our model. Therefore, capital inflows decrease (less negative b) and reduce national savings and the investment in domestic physical capital.
Furthermore, a simultaneous increase of domestic tax rate and institutional quality/governance improves growth rate (See Figure 3.4). Thus, foreigners invest more in the constrained economy (more negative b) which enhances national savings and investment in domestic physical capital.

Unconstraint case

We analyze the impact of positive shock to productivity when the economy is unconstrained at $t = 0$.

Referring to Figure 3.5 and Figure 3.6, a positive shock to productivity increases wage, production and growth rate. Due to higher wage, the overall consumption, savings and the resources devoted to child's education e increase. Here, investors invest more abroad, thus NFA is positive and increases after higher productivity. These positive macroeconomic performances promote the investment in physical and human capital.
When the economy is unconstrained with high productivity, lower preference for the present increases savings which promotes investment abroad (See Figure 3.7). Furthermore, higher domestic tax rate increases tax revenues. This improves net foreign assets and long run growth (See Figure 3.8).
To conclude, in an unconstrained economy, better domestic productivity and higher tax revenues, enhances net foreign assets and long run growth rate.

3.3.2 Model with non-tradable goods

Figure 3.9 to Figure 3.16 plot the impulse responses to orthogonalized innovations in stochastic disturbances for a set of selected variables.

Calibration

Parameter	Description	Value	Sources
n	Population growth rate	0.6	[100]
α_T	tradable sector private capital Share in production	0.37	[129]
α_N	non-tradable sector private capital Share in production	0.29	[130]
$\bar{R}$	Return to bonds (quarterly)	0.011	[99]
β	Discount rate	0.9891	[99]
γ	Altruism factor	0.2	Set
ϕ	quality of training parameter	1	[117]
ρ_{eta}	Persistency parameter of η	0.95	Set
ρ_{A_T}	Persistency parameter for tradable sector	0.46	[131]
ρ_{A_N}	Persistency parameter for non-tradable sector	0.2	[131]
A_T	Long run aggregate tradable sector productivity	1	Set
A_N	Long run aggregate non-tradable sector productivity	1	Set
τ_T	Tradable sector tax rate	0.6	Set
τ_N	Non-tradable sector tax rate	0	Set
η	Parameter of institutional quality:		
	Constraint case	0.1	[117]
	Unconstraint case	0.2	
RER	Long run Real exchange rate	0.5898	[117]
μ	Proportion of non-tradable in total consumption	0.269	[132]

Constrained case with non-tradable goods

We analyze the impact of positive shock to tradable sector productivity when the economy is constrained at $t = 0$.

Referring to Figure 3.9 and Figure 3.10, when the tradable sector is capital intensive, in a constrained economy with high preference for the present, a posi-

tive shock to the tradable sector productivity (A_T) increases domestic savings and encourages capital inflows. It also appreciates the real exchange rate but does not improve long run growth.
Higher tradable sector productivity increases the tradable sector production at the expense of the non-tradable sector production. The rise of the tradable sector productivity also enhances wage and the domestic return on physical capital. Higher wage allows agents to save and consume more. The latter generally increase their consumption in both types of goods.
Moreover, the competitive behavior of firms leads them to equalize the real wage to the marginal productivity of labor. Therefore, the relative price of the non-tradable good must increase so that the production of non-tradable goods also rises. Higher spending on non-tradable goods tends to put some pressure on the prices of these goods which induces an appreciation of the real exchange rate.

Besides, we find that higher capital inflows do not necessary promote long run growth. For instance, [133] use a pooled data of ten countries for the period 1960-1973, to show that labor inputs, foreign capital inflows and capital formation from domestic savings were positively related to output growth. However, [134], [135] and [136] highlight a negative effect of foreign capital inflows on growth. Indeed, they argue that if a country's economy is immature, the capital liberalization may induce more instability in the financial market. For [137], because of the lack of investment opportunities, capital accumulation of low income countries is insufficient. Thus, more capital inflows appreciates foreign exchange rates and reduces the international competitiveness; which decreases return on investment and undermines economic growth.

In addition, we find that in a constrained economy with high tradable sector productivity, lower preference for the present, enhances growth rate (See Figure 3.11). This induces lower capital inflows and a depreciation of real exchange rate; which decreases the investment in domestic physical capital.
A rise in the tradable sector tax rate and better quality of institutions/governance (See Figure 3.12) improve the capital inflows (more negative b) and lead to real exchange rate appreciation. However, the long run growth is not improved.
To conclude, when the economy is constrained, a positive shock to the tradable

sector productivity, better institutional quality/governance and higher tradable sector tax rate appreciate the real exchange rate, enhance capital inflows without growth improvement.

Unconstraint case with non-tradable goods

We analyze the impact of a positive shock to tradable sector productivity when the economy is constrained at $t = 0$.

Referring to Figure 3.13 and Figure 3.14, when the economy is unconstrained, a positive shock to tradable sector productivity increases national saving, foreign investment and domestic investment. This leads to an appreciation of the real exchange rate and an improvement in growth which is in line with the "Balassa-Samuelson effect". Indeed, higher tradable sector productivity heightens tradable sector production. It also enhances wage which increases savings and the consumption of both types of goods. Thus, production in both sectors raises and appreciates the real exchange rate. This enhances long run growth rate, capital investment and investment abroad.
In an unconstrained economy with high tradable sector productivity, lower preference for the present leads to real exchange rate appreciation and lower capital outflows (See Figure 3.15). Finally, higher tradable sector tax rate appreciates the real exchange rate and promotes long run growth (See Figure 3.16).

3.4 Conclusion

The purpose of this paper is to investigate how borrowing constraint in the international capital markets can affect capital inflows and long run growth. To do this, we extend the [1]' overlapping generation model of a constrained economy, by introducing the fact that debt constraint increases with the quality of institutions/governance and the ability to collect tax revenue. After simulating the model, we obtain two main results.

In a constrained economy with high tradable sector productivity, better ability to collect taxes and quality of institutions/governance appreciate the real exchange rate and enhances capital inflows. However, higher capital inflows do not improve growth in the long run. When the economy is unconstrained, a positive shock to tradable sector productivity and higher tradable sector tax rate increases investment abroad, appreciates the real exchange rate and promotes growth. Therefore, in this framework, results are favorable to the "Balassa-Samuelson effect" only when the economy is unconstrained.

For further research, we plan to investigate what happens when agents are not fully rational. From a theoretical point of view, we would consider such agents by using the adaptive learning hypothesis. More precisely, it would be interesting to investigate how a misperception of the institutional quality would affect capital inflows. The idea is the following: at the beginning, agents have wrong beliefs concerning the institutional quality. This leads them to make mistakes while forming their expectations, which affect the capital inflows in the short run. Given that under adaptive learning, agents learn from their past errors, they will know the true model in the long run. Thus, the economy will converge to the rational expectations equilibrium.

3.5 Graphs of Simulations

3.5.1 Constraint case without non-tradable goods

Figure 3.1: Dynamic responses to shock to productivity A_H (1)

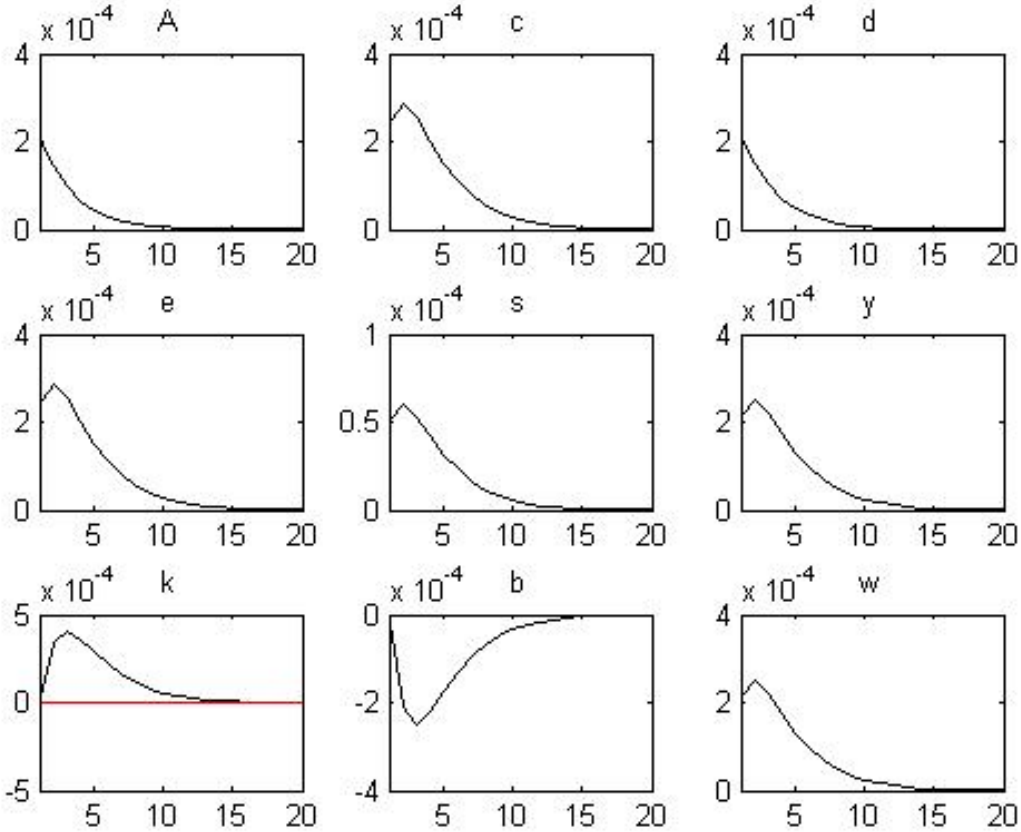


Figure 3.2: Dynamic responses to shock to productivity A_H (2)

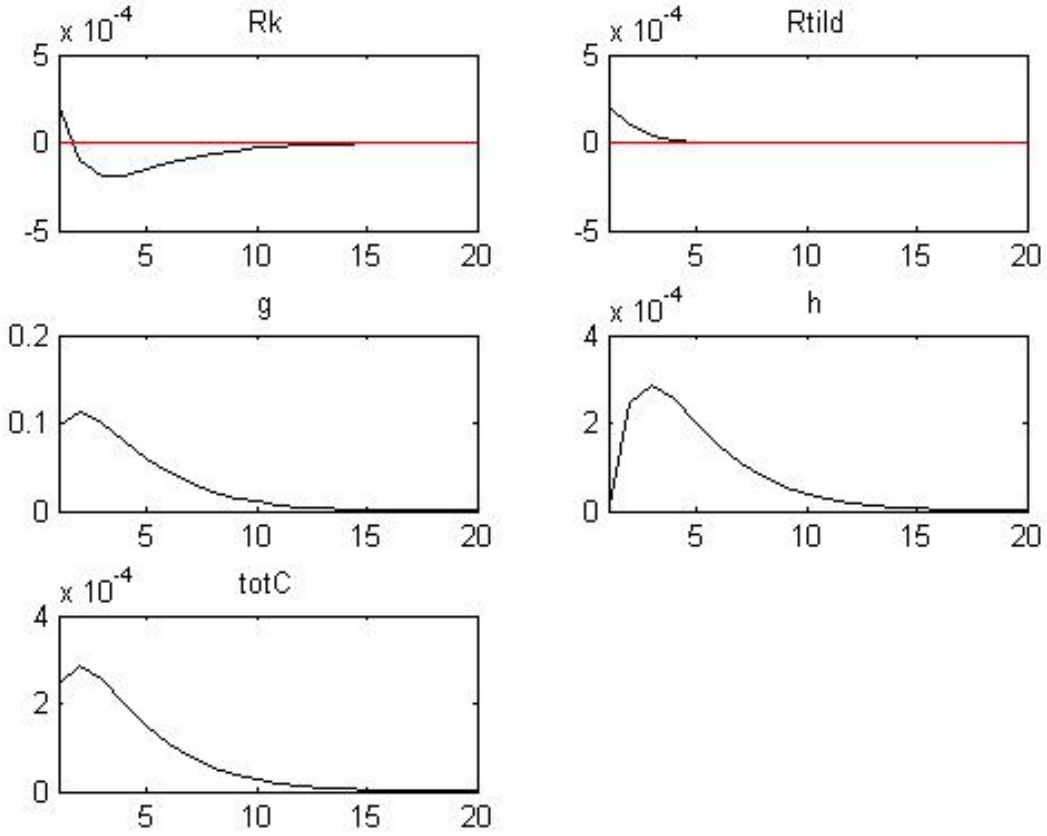


Figure 3.3: Dynamic responses to shock to productivity A_H with different values of the preference for the present β

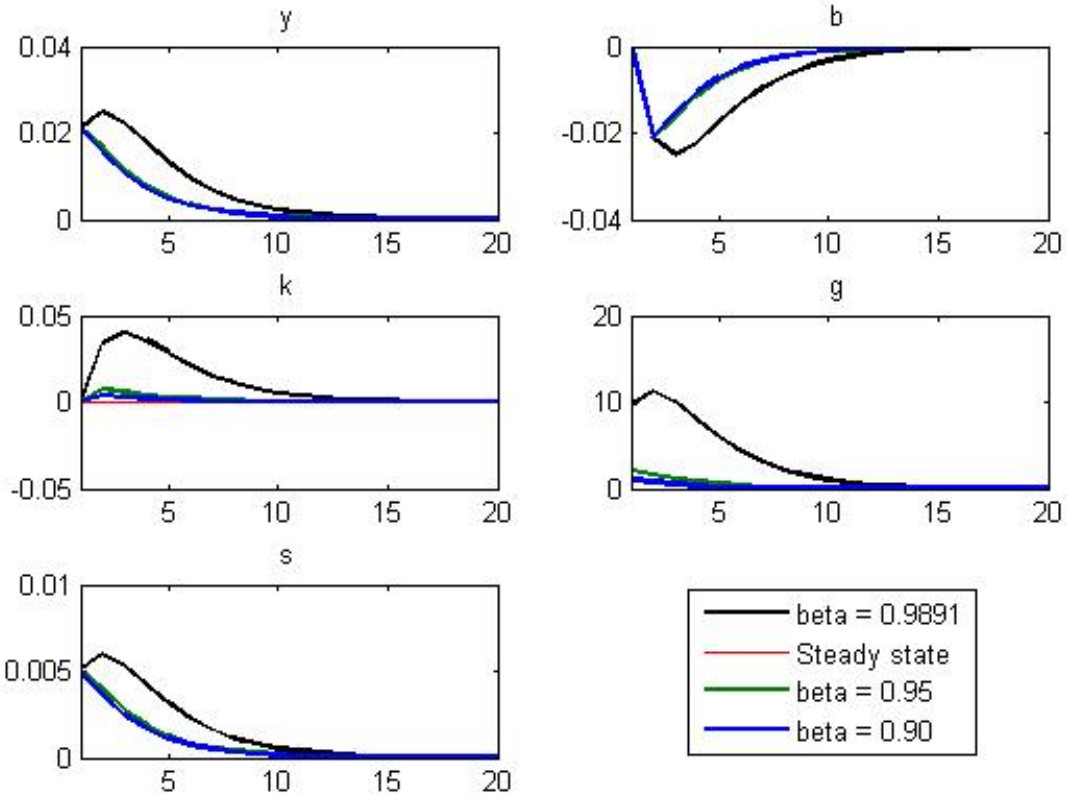
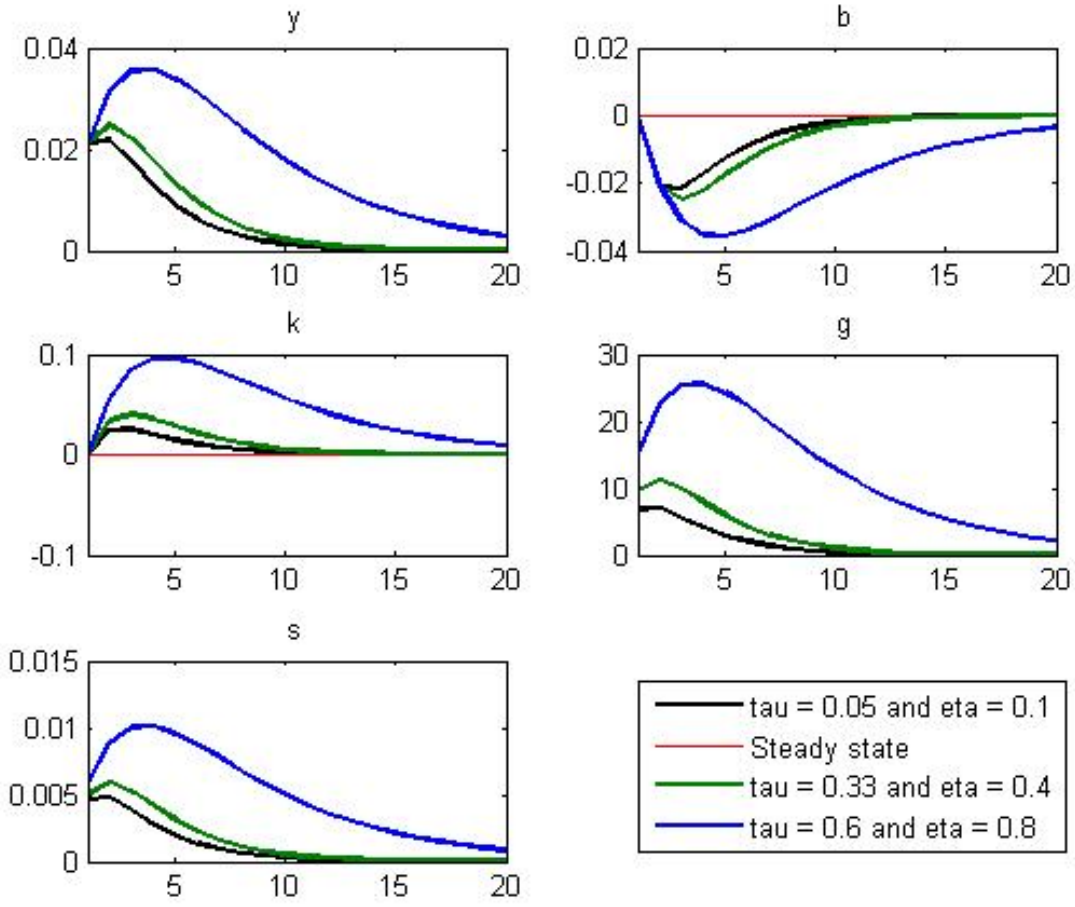


Figure 3.4: Dynamic responses to shock to productivity A_H with different values of tax rate τ_T and institutional quality/governance parameter η



3.5.2 Unconstraint case without non-tradable goods

Figure 3.5: Dynamic responses to shock to productivity A_H (1)

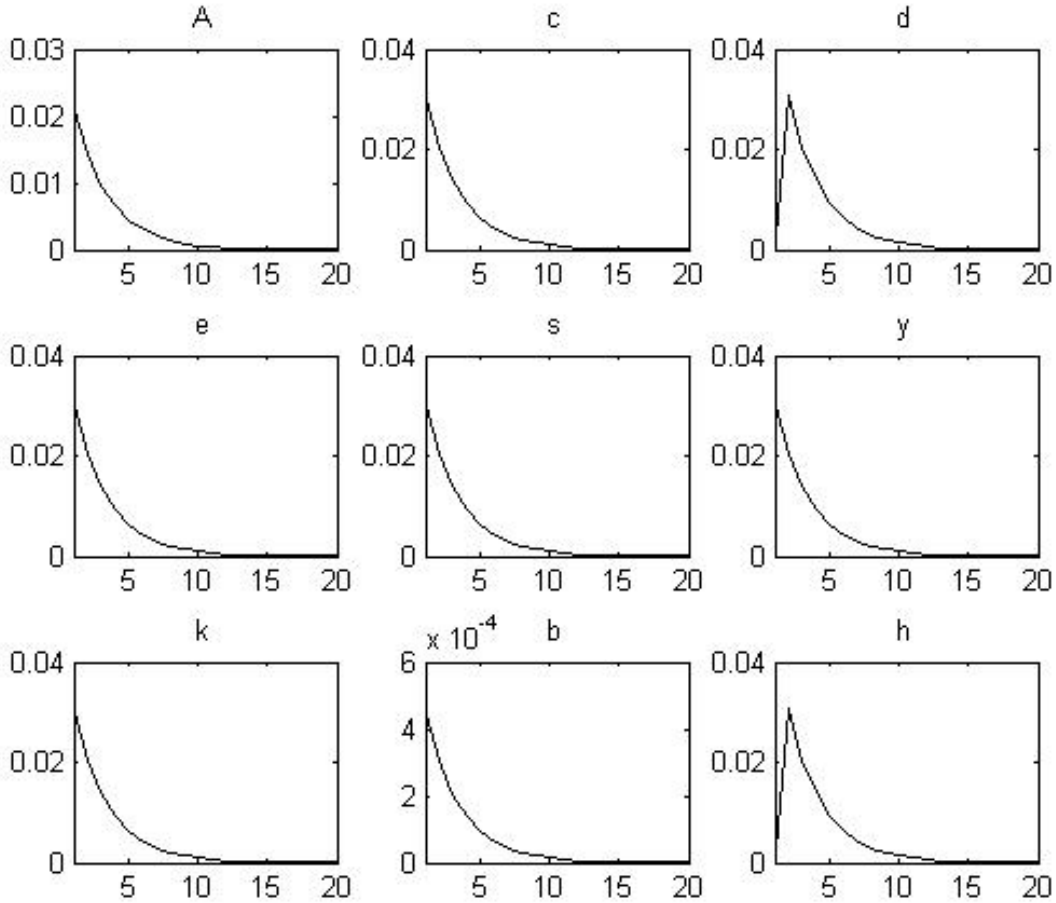


Figure 3.6: Dynamic responses to shock to productivity A_H (2)

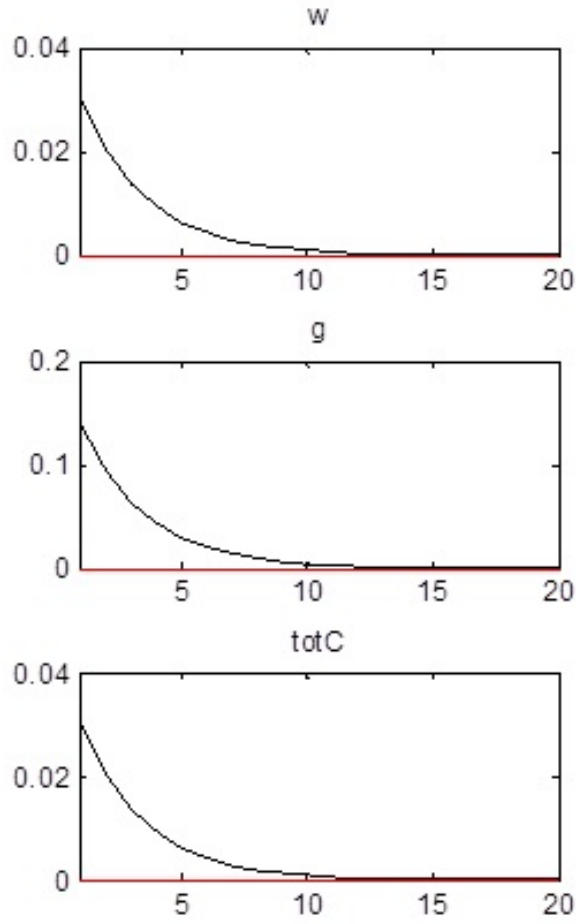


Figure 3.7: Dynamic responses to shock to productivity A_H with different values of the preference for the present β

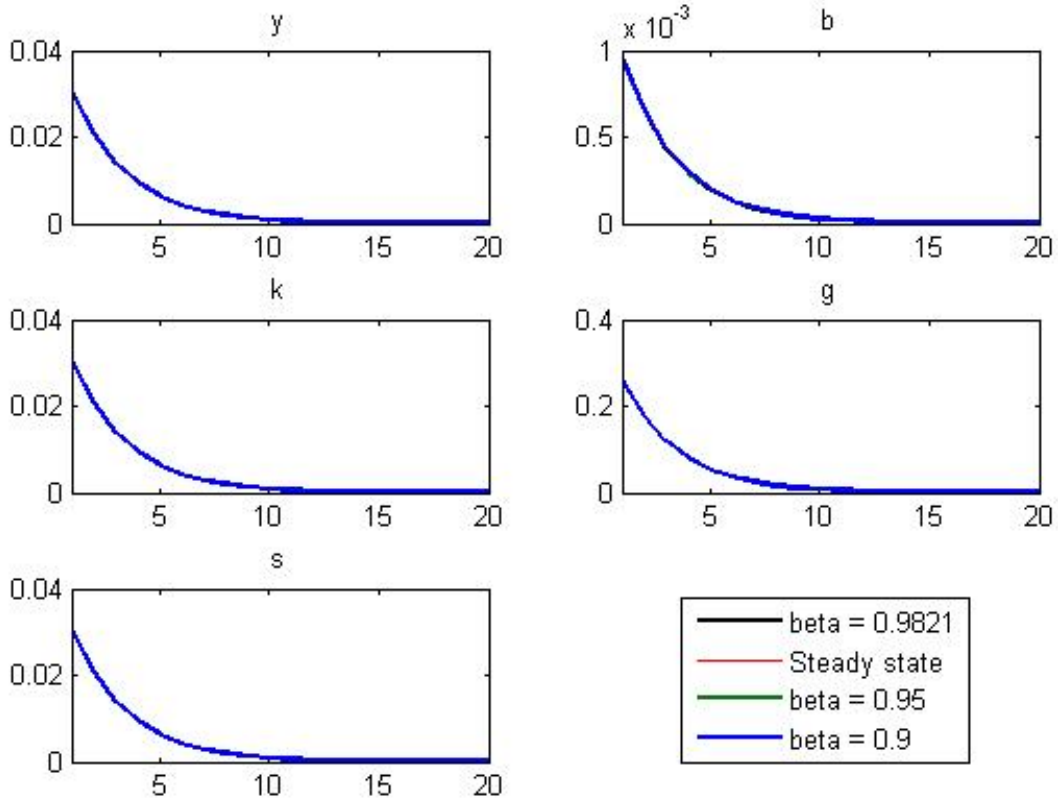
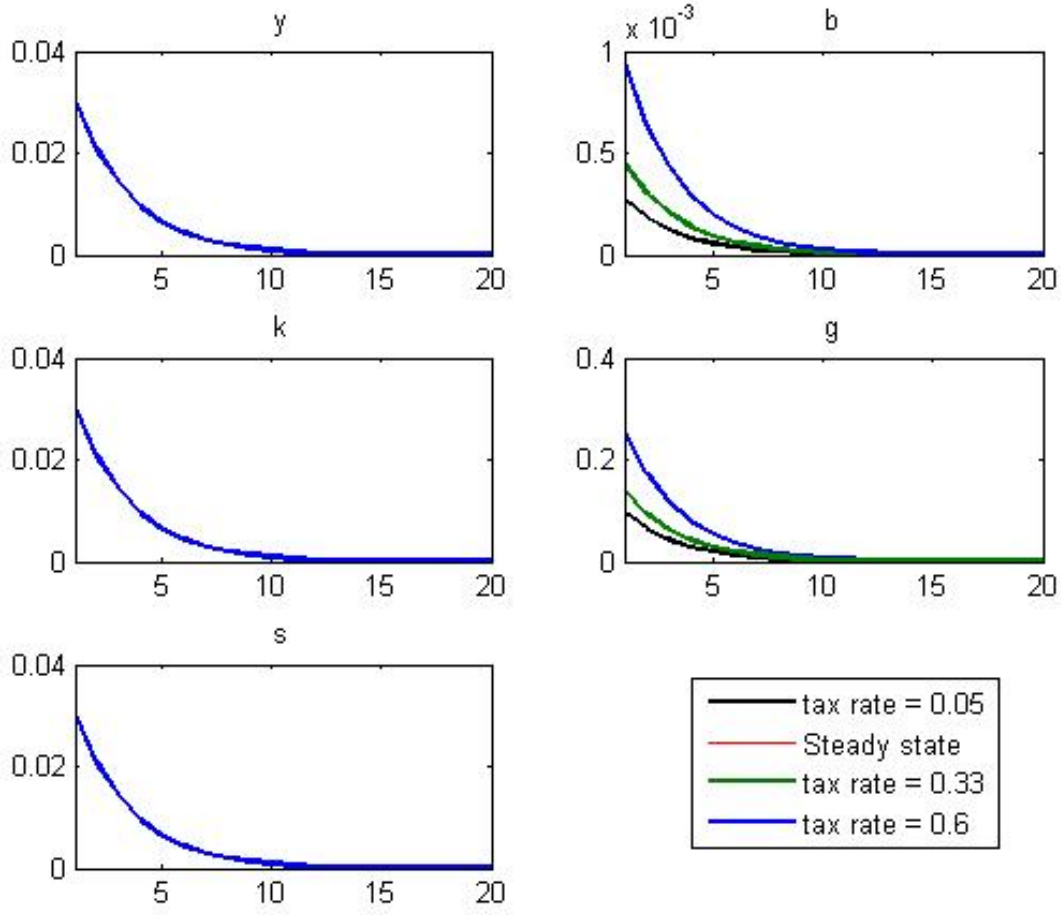


Figure 3.8: Dynamic responses to shock to productivity A_H with different values of tax rate τ_T



3.5.3 Constraint case with non-tradable goods

Figure 3.9: Dynamic responses to shock to tradable sector productivity A_T (1)

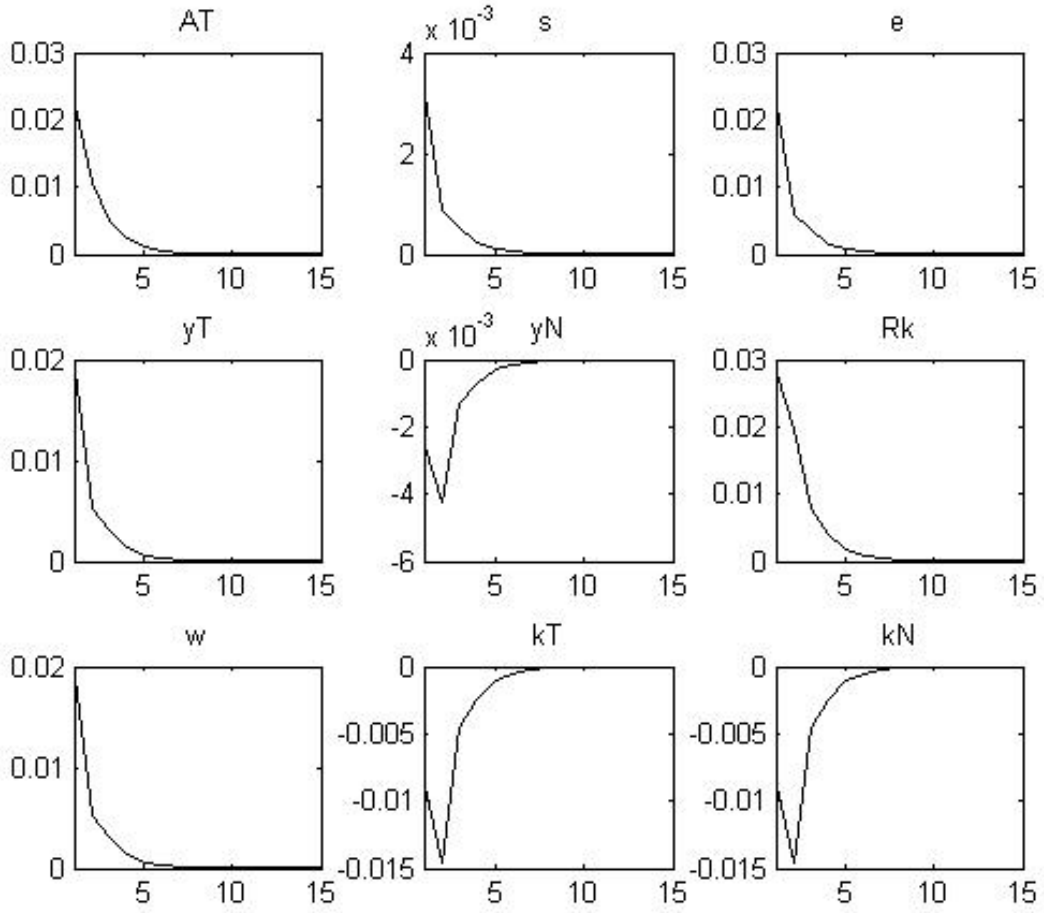


Figure 3.10: Dynamic responses to shock to tradable sector productivity A_T (2)

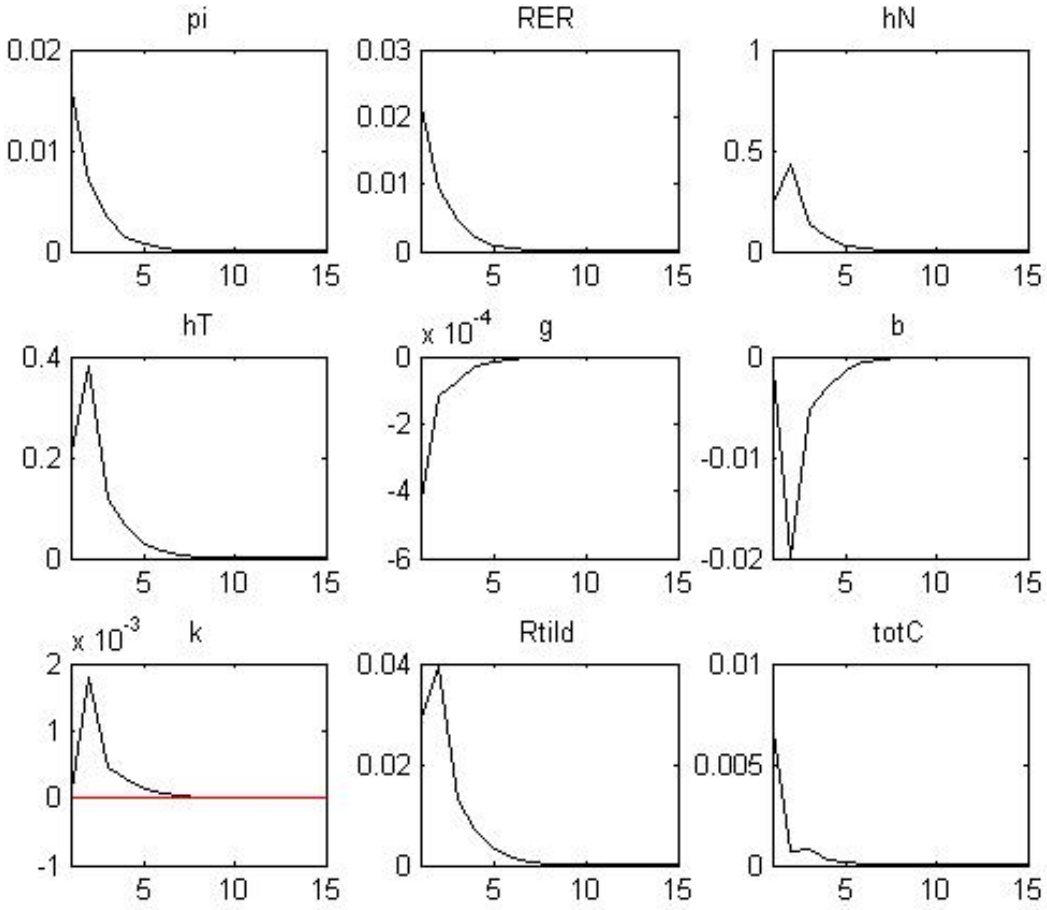


Figure 3.11: Dynamic responses to shock to tradable sector productivity A_T with different values of the preference for the present β

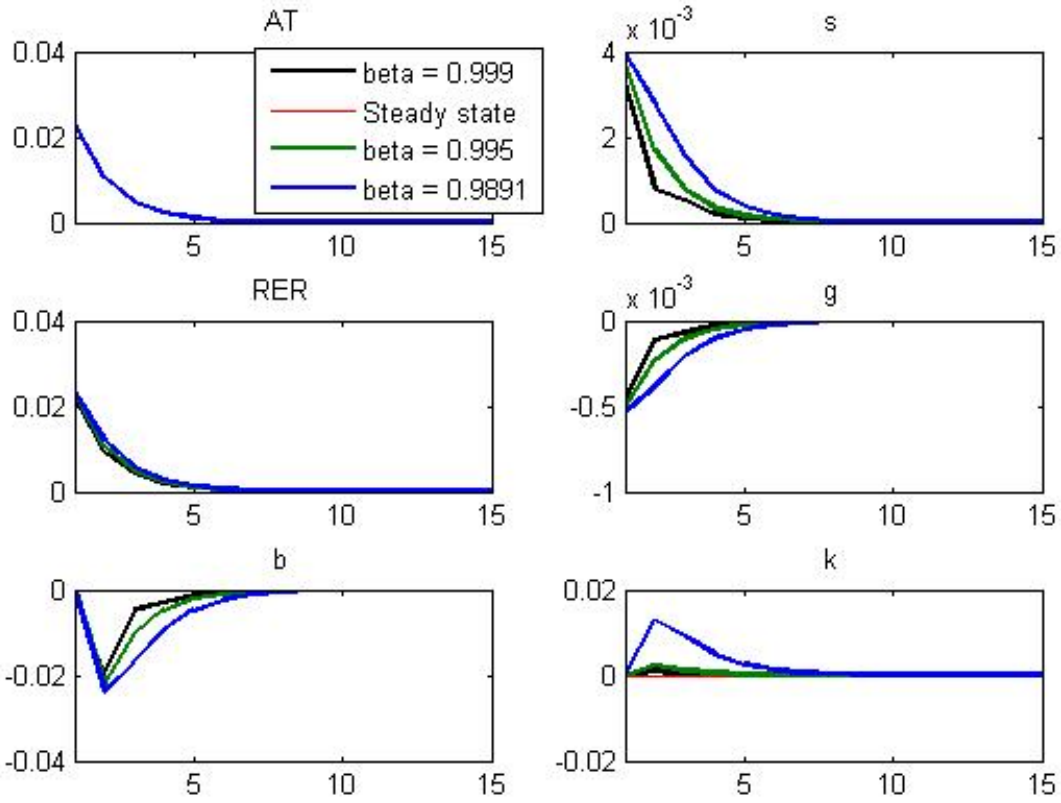
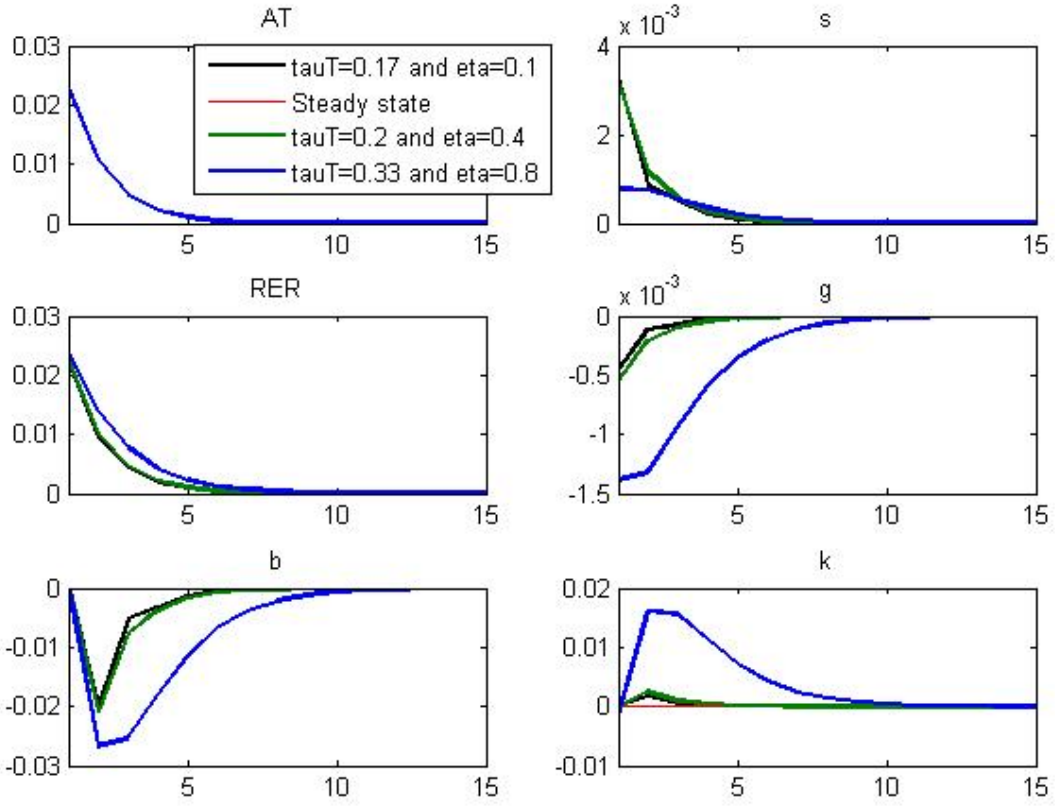


Figure 3.12: Dynamic responses to shock to tradable sector productivity A_T with different values of tax rate τ_T and institutional quality/governance parameter η



3.5.4 Unconstraint case with non-tradable goods

Figure 3.13: Dynamic responses to shock to tradable sector productivity A_T (1)

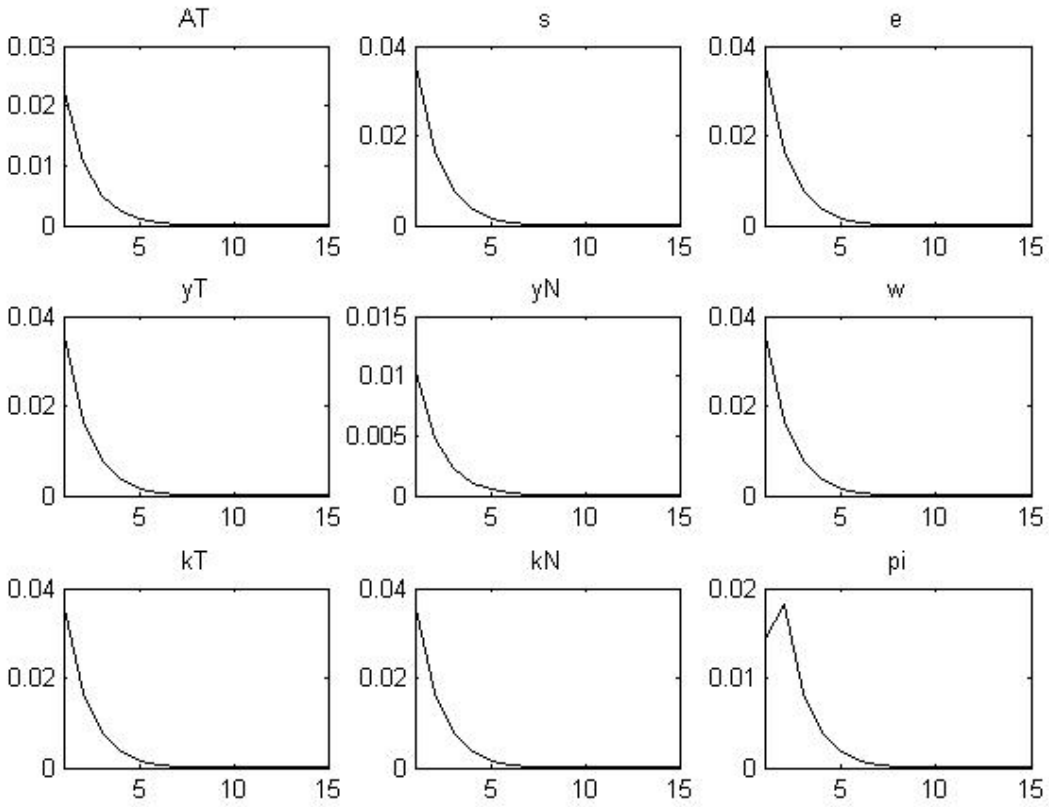


Figure 3.14: Dynamic responses to shock to tradable sector productivity A_T (2)

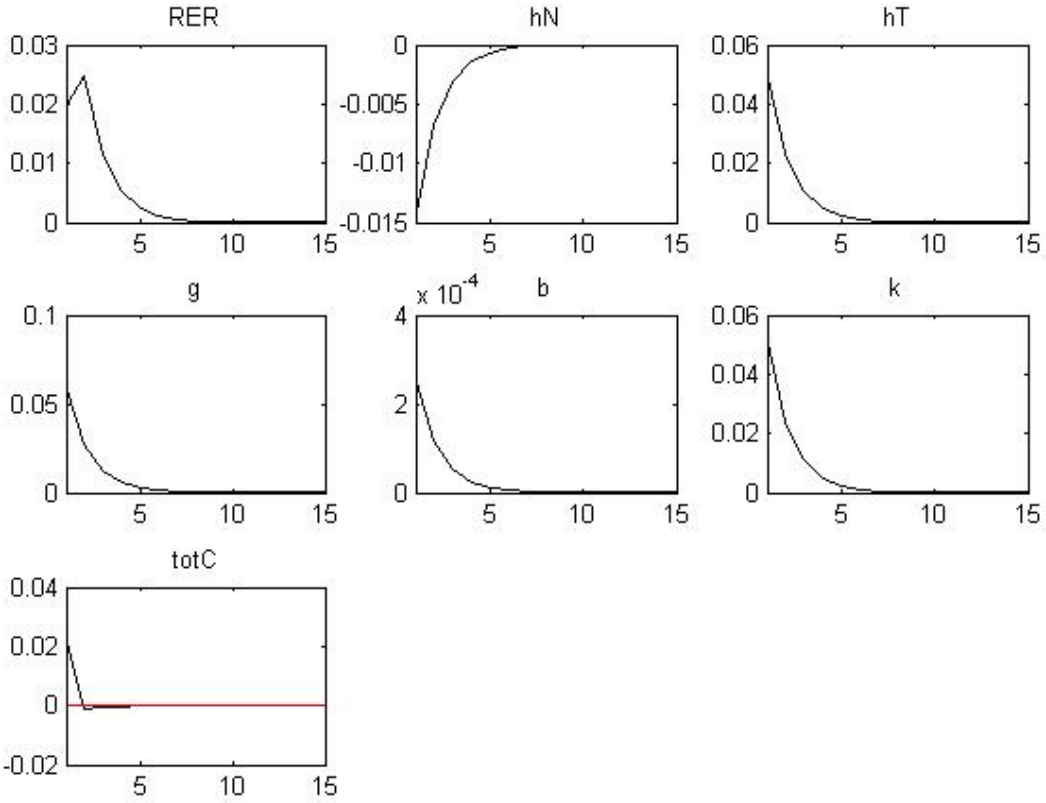


Figure 3.15: Dynamic responses to shock to tradable sector productivity A_T with different values of the preference for the present β

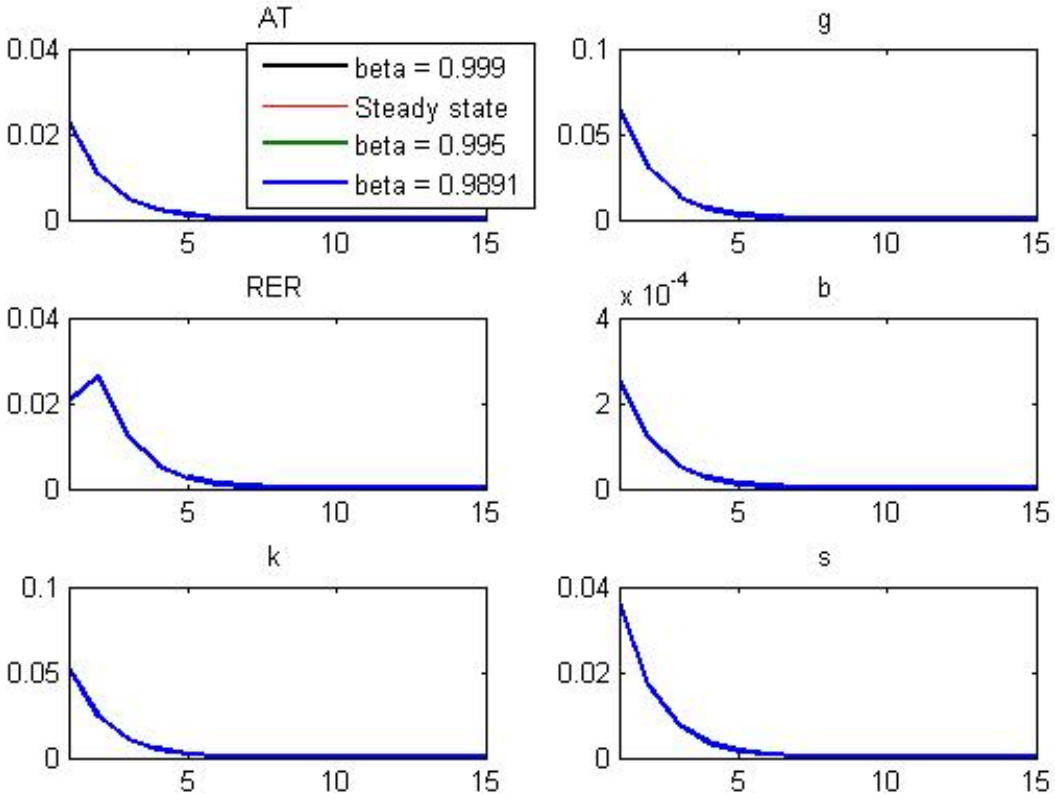
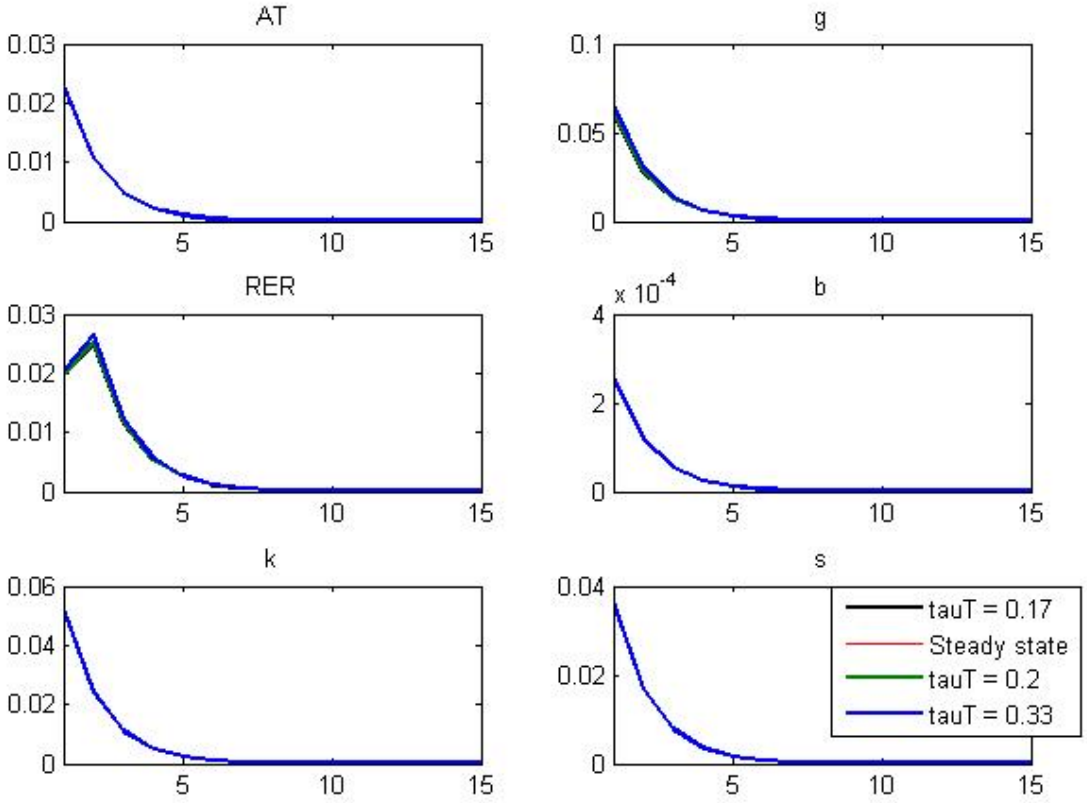


Figure 3.16: Dynamic responses to shock to tradable sector productivity A_T with different values of tax rate τ_T



Conclusion Générale

La plus grande crise financière et économique mondiale depuis les années 1930, a fortement ébranlé les pays membres de la zone euro. En effet, elle a provoqué une détérioration massive des finances publiques et de la confiance des marchés en la solvabilité de certains pays de la zone euro. Par ailleurs, cette crise a révélé entre autres les limites de la coordination des politiques économiques des États membres, la nécessité d'une meilleure surveillance des déséquilibres macroéconomiques et de la mise en place d'un mécanisme permanent de gestion de crise.

Cette thèse s'intéresse aux liens qui existent entre les déséquilibres (macroéconomique, financier et institutionnel) et les crises ; liens dont une meilleure prise en compte peut aider à une gestion plus efficace des crises dans les pays de la zone euro. Notre contribution à la littérature économique revêt trois aspects. Premièrement, nos résultats montrent la nécessité de mieux intégrer les vulnérabilités financières dans la procédure de déséquilibres macroéconomiques (PDM) pour une meilleure anticipation des épisodes de vulnérabilité financières des pays de la zone Euro. Deuxièmement, nos résultats confirment l'effet stabilisateur que peut jouer une meilleure garantie des dépôts bancaires, dans le secteur financier. Ils montrent également l'effet rassurant que peut avoir une meilleure régulation du système financier. Toutefois, ces outils peuvent miner les profits des banques et/ou la production des firmes. Troisièmement, nos résultats soulignent l'importance de la qualité des institutions/ gouvernance et de la bonne gestion des finances publiques (à travers la capacité à collecter les taxes) pour une amélioration de la croissance à long terme.

Les deux premiers chapitres de cette thèse, ont mis l'accent sur l'importance de la confiance des marchés dans l'analyse du lien entre déséquilibres macroé-

conomiques et crises.

Malgré l'imprévisibilité des crises en raison du caractère euphorique et myope des marchés financiers avant les crises, le premier chapitre cherche à savoir si les épisodes de stress budgétaires -avant le déclenchement de la crise de la dette de 2012- dans les pays de zone euro auraient pu être détectés ? Quels indicateurs de déséquilibres macroéconomiques et financiers pourraient servir d'indicateurs d'alerte précoce ? Pour répondre à ces questions, nous avons dans un premier temps choisi de définir les épisodes de stress budgétaires comme étant les épisodes de durcissement des conditions de refinancement des Etats sur le marché de la dette souveraine. La littérature en général, définit le stress budgétaire en termes de soutenabilité budgétaire. Notre approche quant à elle tire les leçons des crises récentes et tient compte de la perception que les marchés ont du risque de défaut souverain. Ensuite, nous avons considéré comme indicateurs d'alerte précoce, les indicateurs de la Procédure de Déséquilibres Macroéconomiques (PDM) et les indicateurs composant l'Indice de Stress Financier (ISF). Notre analyse s'est basée sur l'approche des signaux et les modèles Probit/Logit sur données de panel.

Les résultats de l'approche des signaux suggèreraient que les marchés sont très sensibles à l'évolution des déséquilibres macro-financiers en période de vulnérabilité budgétaire. Par ailleurs, les différentes valeurs de seuil obtenues pour les variables d'alerte précoce, mettent en évidence le caractère plutôt euphorique et myope des marchés. En effet, il semblerait qu'ils soient attentifs aux "petits" déséquilibres macroéconomiques et financiers. Tout ceci souligne, l'importance de la prise en compte de la perception que les marchés ont du risque de défaut souverain pour définir les épisodes de stress budgétaires.

L'analyse empirique par les modèles Probit/Logit sur données de panel confirme que les indicateurs définis dans le PDM et par des variables de vulnérabilité financière (ISF) auraient pu être efficace pour détecter les épisodes de stress budgétaires dans les pays de la zone euro avant la crise de la dette de 2012. En effet, en plus des déséquilibres macroéconomiques de la PDM, la détresse bancaire, le risque des obligations des sociétés, les risques de liquidité sur le marché interbancaire ou la volatilité du prix des actions semblent être des indicateurs d'alerte

précoce statistiquement significatifs. Ces résultats encouragent donc d'élargir la boîte à outils de la PDM afin d'y intégrer des variables supplémentaires tels que les indicateurs de vulnérabilités financières. Enfin, les résultats suggèrent que la correction des déséquilibres macro-financiers n'est pas systématique en cas de doutes à propos de la vulnérabilité budgétaire, ce qui explique qu'un épisode budgétaire de stress ne dépende pas forcément de l'état précédent.

Plusieurs extensions de ce travail sont possibles. La première pourrait consister à analyser d'autres aspects des liens qui existent entre des indicateurs d'alerte précoce et des variables de vulnérabilité budgétaire à travers des modèles non paramétriques (non linéaires et variables dans le temps). Ce type de modèle permettrait de détecter l'instabilité structurelle dans les relations entre les variables endogènes et explicatives. La seconde extension possible pourrait considérer d'autres mesures de vulnérabilité financière telle que la réaction des investisseurs aux communications et aux initiatives politiques. À cet égard, une étude intéressante pourrait consister à tester l'approche proposée par [73] en couvrant les années précédant la crise de la dette européenne.

Le deuxième chapitre cherche à mieux comprendre et anticiper l'impact que peut avoir la confiance des marchés sur le comportement des épargnants et sur l'économie. La confiance des marchés est capturée ici par la présence d'une prime de risque sur le rendement des dépôts bancaires. Dans un contexte où les épargnants tiennent compte du risque de défaut souverain, dans quelle mesure la garantie des dépôts bancaires peut aider à freiner les fuites de dépôts des pays à risque vers les pays plus sûrs ? Pour répondre à cette question, nous avons modélisé et simulé un DSGE à deux pays avec une probabilité de défaut souverain qui permet de tenir compte de la perception des marchés. Nous avons principalement supposer que le rendement sur les dépôts bancaires croît avec une prime de risque qui à son tour augmente avec la probabilité de défaut souverain d'une part, et diminue avec une garantie sur les dépôts d'autre part. Ensuite, pour tenir compte des exigences minimales de fonds propres réglementaires, nous avons également modélisé des banques contraintes, qui cherchent à maximiser une utilité.

Nos résultats confirment le rôle stabilisateur de la garantie sur les dépôts dan-

s le secteur bancaire. En effet, elle permettrait de réduire les retraits de dépôts bancaires après un choc positif sur la probabilité de défaut souverain. En outre, nos résultats soulignent qu'une garantie des dépôts plus élevée pourrait miner les profits des banques tout en améliorant la production; ce en raison de la réallocation des ressources effectuée par les investisseurs. Par ailleurs, lorsque les banques sont contraintes et cherchent à maximiser leur utilité, nous constatons qu'une plus grande régulation du système bancaire pourrait rassurer les investisseurs, contribuer à réduire les retraits de dépôts et améliorer la production. Il semblerait donc qu'une plus grande régulation du système bancaire et une meilleure garantie des dépôts bancaires peuvent avoir des effets négatifs sur le secteur bancaire et/ou sur la production.

Plusieurs extensions de ce travail sont possibles. En effet, dans notre modèle, les banques domestiques détiennent des obligations du gouvernement domestique et étranger. Il pourrait être interessant d'approfondir cette hypothèse d'un marché de la dette non intégré entre les deux pays, en introduisant un paramètre de préférence pour les actifs locaux. Ensuite, nous pourrions modéliser de manière plus complète le comportement des gouvernements en tant de crise. En effet, notre modèle ne tient pas compte du rôle de sauvetage du système bancaire national que pourrait jouer l'Etat. Enfin, une autre extension possible serait d'intégrer dans le modèle le comportement de la BCE. En effet, la BCE est amenée à injecter de la liquidité pour remédier à la fragilité du système bancaire.

Dans le troisième chapitre, nous adoptons une perspective de plus long terme pour analyser les effets de la confiance des marchés sur la dynamique de la croissance. Dans ce chapitre, la confiance des marchés est reflétée par l'accès de l'économie au marché international des capitaux. Nous supposons principalement que cette confiance des marchés augmente avec un paramètre de qualité institutionnelle/gouvernance et la production d'un bien public qui est financée par la collecte d'impôts. La capacité à collecter les taxes reflète aussi du point de vue des marchés, une bonne gouvernance/qualité institutionnelle. L'intuition sous-jacente est qu'une amélioration de la qualité des institutions et de la capacité à collecter les taxes, permettraient d'améliorer la croissance à long terme. Nous avons considéré un modèle de Petite Economie Ouverte (PEO) avec des générations imbriquées

proposé par [1] dans lequel nous avons introduit un paramètre de qualité institutionnelle et des taxes. Nous avons aussi introduit du capital humain pour aborder la question de la croissance de long terme. Enfin, nous avons introduit des biens non échangeables pour intégrer les liens entre les avoirs extérieurs nets, le taux de change réel et la croissance.

Nos simulations montrent principalement que dans une économie contrainte ayant une productivité du secteur échangeable élevée, une meilleure capacité à percevoir les impôts et de meilleurs institutions/gouvernance apprécient le taux de change réel et augmentent les entrées de capitaux. Toutefois, l'augmentation des entrées de capitaux n'améliore pas la croissance à long terme. Lorsque l'économie est non contrainte, un choc positif sur la productivité du secteur échangeable et - une hausse du taux d'imposition dans le secteur échangeable augmentent l'investissement étranger, apprécient le taux de change réel et favorisent la croissance à long terme. Enfin, les résultats confirment l'effet Balassa-Samuelson, seulement lorsque l'économie n'est pas contrainte.

Une extension possible de ce travail consisterait à tenir compte du fait que les investisseurs ne sont pas purement rationnels. En effet, les agents apprendraient de leurs erreurs de sorte que la qualité institutionnelle pourrait varier dans le temps. D'un point de vue théorique, il pourrait être intéressant d'introduire dans le modèle l'" adaptive learning " qui permettra d'analyser les effets d'une perception erronée de la qualité institutionnelle sur les flux de capitaux et sur la croissance à long terme.

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