UNIVERSITÉ DU QUÉBEC À MONTRÉAL

LE RÔLE DU DÉVELOPPEMENT FINANCIER SUR LE LIEN ENTRE LES FLUX DE CAPITAUX ET LA CROISSANCE ÉCONOMIQUE

THÈSE

PRÉSENTÉE

COMME EXIGENCE PARTIELLE

DU DOCTORAT EN ÉCONOMIQUE

PAR

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OCTOBRE 2020

UNIVERSITÉ DU QUÉBEC À MONTRÉAL

THE ROLE OF FINANCIAL DEVELOPMENT ON THE NEXUS BETWEEN CAPITAL FLOWS AND ECONOMIC GROWTH

THESIS

PRESENTED

AS PARTIAL REQUIREMENT

OF DOCTORAL OF PHILOSOPHY IN ECONOMICS

BY

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OCTOBER 2020

REMERCIEMENTS

La réalisation de cette thèse a été un voyage passionnant d'apprentissage et de découverte. Son accomplissement a été rendu possible grâce à un beau monde qui m'a toujours soutenu et encouragé. Ces quelques lignes sont très peu pour leur exprimer toute ma gratitude et ma reconnaissance pour leur soutien tout au long de ce merveilleux parcours.

Avant tout, mes remerciements vont à Wilfried Koch. Il a été pour moi le directeur de thèse dont rêverait tout étudiant de doctorat en quête de savoir, et qui a besoin de la meilleure supervision pour explorer ses propres idées de recherche. Très vite, il m'a fait confiance et m'a octroyé inconditionnellement tout le soutien, que ce soit intellectuel, financier et psychologique dont j'avais besoin pour mener à bien cette thèse. Sa rigueur de travail, sa disponibilité, sa patience et son excellent encadrement m'ont permis d'être un meilleur chercheur et de gagner en maturité sur le plan humain, scientifique et professionnel. Merci, Wilfried, d'être un mentor, un aîné et une inspiration pour moi.

Mes remerciements vont également aux membres de mon jury de thèse qui ont accepté évaluer cette thèse, et dont les commentaires ont permis l'amélioration des articles en vue de futures publications. En plus d'évaluer ma thèse, Alain Paquet et Alessandro Barattieri, professeurs au département des sciences économiques de l'UQAM m'ont toujours prodigué des conseils et m'ont beaucoup soutenu tout au long de mon parcours. Toujours à l'écoute, ils ont contribué significativement à l'aboutissement de cette thèse. Pour tout ce que vous avez fait, je vous réitère toute ma gratitude et ma reconnaissance. Je saurai toujours compter sur votre bienveillance. À Jean-François Rouillard, professeur au département des sciences économiques de l'université de Sherbrooke, je dis également merci pour sa disponibilité, ses commentaires et ses conseils. J'adresse mes sincères remerciements au corps professoral du département des sciences économiques de l'UQAM pour le savoir, les encouragements et les discussions constructives. En particulier, merci à Julien Frédéric Martin pour les conseils, ainsi que les commentaires apportés à mes articles. Merci également au personnel administratif du département, Martine Boisselle, Lorraine Brisson, Karine Fréchette et Julie Hudon. J'ai bénéficié, durant mon parcours de soutien financier de la part de l'École Supérieure de Gestion et du département de sciences économiques de l'UQAM, de la fondation de l'UQAM et d'HYDRO-QUÉBEC. Merci à ces structures pour l'accompagnement.

À mes collègues de l'UQAM et d'autres universités, merci pour les échanges et pour le soutien mutuel : Théophile Bougna, Yorou, Boubacar, Koffi, Jean-Blaise, Oualid, William, Adil, Mélanie, Jean-Paul, Manassé, Hervé Zeida, Ada, Daouda, Benoît. À mes ami-e-s qui m'ont toujours soutenu et qui ont contribué à cet accomplissement, je vous dis un grand merci : Abraham, Kader, Gilchrist, Féliciano, Fabrice, Kadidiatou, Cirielle, Marlène, Benjamine, Inès, Serge, Neil, Abdoul, Michelle, Thièrry et tous ceux qui se reconnaîtrons en ces lignes.

À ma famille pour leur soutien inconditionnel, je dis merci. J'en profite pour rendre un hommage particulier à ma mère, Ramata Tiendrebeogo. Sans ses sacrifices, son amour inconditionnel, sa bienveillance, rien de tout cela n'aurait été possible. Cette thèse est une infime partie de la fierté que le Seigneur te permettra d'avoir de tes enfants. Je t'aime maman. Également à son époux Mr Yaméogo, je dis énormément merci pour le soutien. À mon père, François qui m'a inspiré et initié aux sciences économiques, je dis merci. Je sais que de là-haut tu es très fier de ce travail. À mes frères, Théophile, Dr Arsène et Isaac, merci pour tous les encouragements, le soutien. À mes beaux-parents, le Colonel-Major Ousmane Traoré et son épouse Esther, je dis également merci pour votre accompagnement. Merci à mes cousins, cousines, tantes et mes oncles, en particulier Adama Tiendrebéogo pour tout son amour et son soutien sans égal.

Pour terminer, j'adresse ma gratitude à mon épouse Faridah. Ton amour, ta patience, ton soutien et ta confiance m'ont toujours permis de tenir bon et de me relever pour continuer l'aventure. À mes enfants, Mael et Jade, merci pour votre amour. Vous avez été ma motivation pour l'achèvement de ce projet. Vous pouvez être très fier de vous. Daddy vous aime très fort.

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RÉSUMÉ

Cette thèse explore le rôle du développement financier domestique sur la relation entre les flux de capitaux extérieurs et la croissance économique. Pour étudier cette relation, cette recherche est constituée de trois articles scientifiques.

Dans le premier article intitulé “*Financial Development and Capital Flows : Appraisal of the « Allocation Puzzle » by Schumpeterian Growth*" (co-écrit avec Wilfried Koch) nous explorons le rôle du développement financier pour expliquer la corrélation négative entre les entrées de capitaux et le rattrapage de la productivité. Comme observé dans les données, les pays à taux de croissance de la productivité plus élevés exportent des capitaux tandis que les pays à taux de croissance de la productivité plus faibles reçoivent des entrées de capitaux positives. Ceci est en contradiction avec les prédictions du modèle de croissance néoclassique standard. Gourinchas and Jeanne (2013) ont appelé ce paradoxe le «puzzle d'allocation». Sous l'hypothèse d'un marché du crédit parfait, notre modèle de croissance schumpétérien calibré prévoit également une corrélation positive entre les entrées de capitaux et le rattrapage de la productivité par rapport à la frontière technologique. Nous montrons que le «puzzle d'allocation» est plus large qu'on ne le pensait auparavant. Il peut en fait être généralisé à un échantillon plus large qui couvre plus de pays et une période plus longue. Nous introduisons ensuite des contraintes de crédit dans un modèle de croissance schumpétérien calibré pour répondre à ce paradoxe. Notre principal résultat indique que, lorsque le niveau de développement financier empêche les pays de rattraper leur retard par rapport à la frontière technologique mondiale, les pays importent des capitaux pour compenser leur niveau insuffisant d'épargne intérieure.

Le second article “*External Capital and Economic Growth in Developing Countries : The Threshold Effect of Financial Development*" fournit des preuves empiriques sur l'effet non linéaire du capital extérieur sur la croissance économique. Il analyse les flux agrégés, ainsi que les flux privés et publics séparément. À l'aide de deux méthodes économétriques, je montre qu'il existe un niveau de développement financier au-delà duquel le capital agrégé commence à favoriser la croissance économique. Sinon, les flux de capitaux agrégés nuisent à la croissance économique. La distinction entre les types de flux montre que les flux publics sont nuisibles, tandis que les flux privés stimulent en général la croissance lorsque le développement du marché financier n'atteint pas le seuil. Une analyse plus approfondie des flux privés montre qu'un pays avec un marché financier qui fonctionne bien bénéficie des flux d'IDE et des flux de dette privée.

Concernant les flux de portefeuille d'actions, ils favorisent la croissance économique en dessous du seuil estimé et ralentissent la croissance sinon. Le développement des marchés financiers domestiques est essentiel pour que les pays profitent des flux d'IDE et de la dette privée, mais aussi pour éviter les effets négatifs des flux publics.

Le dernier article intitulé "*Bilateral Cross-border Banking Flows : The Role of the Financial Development of Host and Source Countries*", analyse le rôle du développement financier des pays d'origine et d'accueil sur les flux bancaires transfrontaliers. L'effet du développement financier sur les flux de capitaux, en particulier sur les flux bancaires transfrontaliers, reste sous-exploré dans la littérature. Cet article tente de combler cette lacune en fournissant des preuves empiriques. En utilisant les données sur les flux bancaires bilatéraux de la Bank for International Settlements (BIS), j'évalue la réactivité des transactions des banques transfrontalières à une différence entre les marchés financiers domestiques et étrangers. L'étude utilise des variables instrumentales pour répondre aux problèmes d'endogénéité ainsi que des effets fixes appropriés pour mieux identifier le rôle du développement financier. Les données concernent les activités transfrontalières bilatérales entre banques dans 24 pays vers des banques et des non-banques dans 165 pays entre 1990 et 2015. Le principal résultat suggère que les flux bancaires vont des marchés financiers fonctionnant bien aux marchés financiers sous-développés, uniquement lorsque l'opération est financée par un titre de créance. Sinon, c'est-à-dire lorsque l'instrument de financement est le prêt et le dépôt, je montre que les banques des pays disposant d'un marché financier développé prêtent davantage aux non-banques des pays disposant également de marchés financiers qui fonctionnent bien. Les résultats concilient l'ambiguïté sur la relation entre les conditions financières domestiques et les flux de capitaux dans la littérature en montrant que la relation peut être positive ou négative, selon l'instrument de financement et le secteur emprunteur. Je trouve également que les marchés financiers étrangers et nationaux se complètent pour les flux bancaires transfrontaliers.

Mots-clé : Croissance schumpétérienne, flux de capitaux, contrainte de crédit, développement financier, productivité, croissance économique, effets de seuil, panel dynamique à effet de seuil, flux de capitaux bilatéraux, flux bancaires transfrontaliers.

ABSTRACT

This dissertation explores the role of domestic financial development on the relationship between external capital flows and economic growth. To study this relationship, this research proceeds along with three scientific papers.

In the first paper entitled "*Financial Development and Capital Flows: Appraisal of the "allocation Puzzle" by Schumpeterian Growth*" (joint with Wilfried Koch), we explore the role of financial development to explain the negative correlation between capital inflows and productivity catch-up. As observed in the data, countries with higher productivity growth rates export capital while countries with lower productivity growth rates receive positive capital inflows. This is contradictory to the predictions of the standard neoclassical growth model. Gourinchas and Jeanne (2013) called this paradox the "Allocation Puzzle". Under perfect credit market, our calibrated Schumpeterian growth model also predicts a positive correlation between capital inflows and productivity catch-up. We show that the "Allocation Puzzle" is more prevalent than previously thought. It can be actually generalized to a larger sample by covering more countries and a longer time period. We then introduce credit constraints in a calibrated Schumpeterian growth model to address this paradox. Our main result indicates that, when the level of financial development prevents countries from catching up relative to the world technological frontier, countries import capital to compensate for their insufficient level of domestic savings.

The second paper entitled "*External Capital and Economic Growth in Developing Countries: The Threshold Effect of Financial Development*" provides evidence supporting the non-linear effect of external capital on economic growth. It analyzes aggregate flows as well as private and public flows separately. Using two econometric methods, there appears to be threshold of level of financial development beyond which aggregate capital begins to promote economic growth. Otherwise, total capital flows harm economic growth. Distinguishing between the types of flows shows that public flows may be growth detrimental,, while private flows are growth-enhancing when the financial market does not reach the threshold. A more in-depth analysis of private flows shows that a well-functioning financial market benefits from FDI and private debt flows. Regarding portfolio equity flows, they promote growth below the estimated threshold and reduce growth otherwise. Hence, this suggests that developing the domestic financial markets may be critical for countries in order to take advantage of FDI and private debt flows, but also to reverse the sign of the correlation linked with public flows.

The last paper entitled "*Bilateral Cross-border Banking Flows: The Role of the Financial Development of Host and Source Countries*" analyzes the role of the financial development in both source and host countries on cross-border banking flows. It attempts to fill the gap on the underexplored effect of financial development on capital flows, especially on cross-border banking flows, by providing empirical evidence. Using the Bank for International Settlements (BIS) dyadic banking flows data, I assess the responsiveness of cross-border banks' transactions to differences between the home country's and the foreign's financial markets. The study uses instrumental variables to address endogeneity concerns and suitable fixed effects to identify appropriately the role of financial development. The data are made up of bilateral cross-border transactions between banks located in 24 reporter countries and all sectors (banks and non-banks) located in 165 counterparty countries. The main finding suggests that bank flows go from well-functioning financial markets to underdeveloped financial markets, only when the transaction is financed by debt security. Otherwise, i.e. when the financing instrument is loan, I show evidence that banks in countries with a developed financial market lend more to non-banks in countries with also well-functioning financial markets. The findings conciliate the ambiguity on the relationship between domestic financial conditions and capital flows in the literature by showing that the relationship may be positive or negative, according to the financing instrument and the borrowing sector. I also find that foreign and domestic financial markets complement each other for cross-border banking flows.

Keywords: Schumpeterian growth, Capital flows, Credit constraint, Financial Development, Productivity, Economic growth, Threshold effects, Dynamic panel threshold, Bilateral capital flows, Cross-border banking flows.

INTRODUCTION

Il est généralement admis qu'une libre circulation des capitaux entre les pays permet une allocation efficiente des ressources. Les capitaux étrangers devraient affluer vers les pays avec les investissements les plus productifs. C'est ce que prédit effectivement le modèle de croissance néoclassique standard. Cependant, les données observées sont en contradiction avec ces prédictions théoriques. Lucas (1990) montre empiriquement que le volume de capitaux affluant des pays riches vers les pays pauvres est très faible. Gourinchas and Jeanne (2013) pour leur part montrent empiriquement que les capitaux vont des pays à fort taux de croissance de la productivité vers les pays à faible taux de croissance de la productivité. Ces deux contradictions empiriques avec les prédictions théoriques sont connues dans la littérature comme étant respectivement le «Lucas puzzle» et l'«allocation puzzle». Outre le phénomène des flux des capitaux en contre sens, les flux de capitaux internationaux ont connu une rapide expansion depuis les années 80. Cela a relancé les débats au sein de la communauté académique et des décideurs politiques sur le contrôle des flux de capitaux. En effet, les implications des flux de capitaux extérieurs peuvent autant être bénéfiques que néfastes pour les économies, surtout dans les pays en développement. En plus d'être une source supplémentaire de financement des projets domestiques, les capitaux étrangers viennent généralement avec de nouvelles technologies ainsi que des compétences managériales. En ce sens, les capitaux étrangers sont sources de croissance économique. À l'opposé, ces capitaux viennent aussi avec des risques d'inflation et de surévaluation de la monnaie pour le pays de destination, et donc avoir des effets néfastes pour la croissance économique. Ces effets dépendront certainement des capacités du pays à absorber ces flux extérieurs, mais également de la nature de ces capitaux extérieurs. Dans cette optique, cette thèse vise à analyser la relation entre la croissance économique et divers types de flux de capitaux extérieurs, en tenant compte de la capacité des marchés financiers domestiques à rediriger ces capitaux vers les investissements les plus productifs.

Les flux agrégés de capitaux extérieurs, mesurés par le négatif du solde de la balance du compte courant, sont en général négativement corrélés avec la croissance économique comme le montrent Aguiar and Amador (2011); Alfaro et al. (2014); Gourinchas and Jeanne (2013); Prasad et al. (2007). Néanmoins, Alfaro et al. (2014) affirment que cette corrélation est attribuable au fait que les échantillons utilisés sont généralement de petite taille et majoritairement dominés par des pays asiatiques et africains. Ils montrent alors que la corrélation pourrait être nulle ou faiblement positive avec un échantillon plus large, similairement aux résultats de Prasad et al. (2006). L'origine de cette différence dans les corrélations résiderait dans la composition des flux agrégés. En effet, les capitaux privés sont positivement corrélés avec la croissance économique tandis que les capitaux publics sont négativement corrélés avec la croissance économique (Alfaro et al., 2014; Gourinchas and Jeanne, 2013). Ainsi, la corrélation des flux agrégés avec la croissance économique tend à être négative quand l'échantillon étudié est dominé par des pays qui reçoivent beaucoup plus d'aide publique ou qui accumulent beaucoup de réserves, en l'occurrence les pays africains et asiatiques respectivement. Outre cette distinction des types de capitaux étrangers, la prise en compte des conditions économiques domestiques des pays hôtes est un élément clé pour mieux comprendre la relation entre capitaux étrangers et croissance économique. En particulier, on trouve dans la littérature des modèles théoriques qui, une fois bonifiés par l'introduction de frictions sur les marchés financiers domestiques, arrivent à prédire la corrélation négative entre capitaux extérieurs et croissance économique observée dans les données. Entre autres, nous retrouvons ces résultats dans les travaux de Buera and Shin (2017); Sandri (2014). Quelques articles empiriques corroborent ces résultats (par exemple, Alfaro et al. (2010); Prasad et al. (2007)). Cette thèse s'inscrit dans ce contexte de recherche et vise à prendre en compte le niveau de développement financier domestique pour mieux comprendre et expliquer les différentes relations qui existent entre la croissance économique et les divers types de capitaux étrangers. Le premier chapitre présente un modèle théorique qui montre que la prise en compte des frictions sur le marché financier domestique peut aider à expliquer la relation négative entre les flux de capitaux et la croissance économique. Le deuxième chapitre présente des évidences empiriques des effets des différents types de capitaux sur la croissance en utilisant le développement financier comme variable seuil. Le troisième chapitre est consacré à l'analyse empirique des effets du développement financier des pays hôtes et des pays sources sur les flux bancaires transfrontaliers bilatéraux.

Nous commençons par développer un modèle de croissance schumpétérien dans le premier chapitre, que nous calibrons pour évaluer la relation flux de capitaux-croissance de la productivité. Un des avantages de ce type de modèle est qu'il permet d'endogénéiser le progrès technologique et de tenir aussi compte de l'obsolence des biens intermédiaires plus anciens, d'où le concept de «destruction-créatrice». Nous nous intéressons plus particulièrement à l'«allocation puzzle» dans ce chapitre. Dans un premier temps, nous supposons dans le modèle un marché de crédit parfait ; ainsi, les entrepreneurs ont un accès illimité au crédit domestique pour financer des projets innovateurs. Avec une probabilité d'innovation plus importante, le niveau de la productivité de l'économie convergera vers celui de la frontière technologique. À leur tour, les agents économiques, en anticipant des revenus futurs plus importants, vont augmenter leur consommation présente (et diminuer leur épargne par conséquence). Étant donné que leurs revenus actuels sont inchangés et qu'ils ont accès au marché financier international, ils emprunteront à l'étranger pour financier cette augmentation de leur consommation. Le modèle sans contrainte de crédit prédit alors que les flux entrants nets de capitaux seront positivement corrélés avec la croissance de la productivité. À l'aide des données de Lane and Milesi-Ferretti (2007) sur les flux de capitaux, nous construisons ensuite un échantillon de 109 pays entre 1980 et 2010 que nous utilisons pour analyser empiriquement la relation entre les capitaux étrangers et la croissance de la productivité. À la différence de l'analyse de Gourinchas and Jeanne (2013) qui se focalisent sur les pays en développement, notre échantillon inclut en plus des pays développés. Nous trouvons également que la corrélation est négative entre les flux entrants nets de capitaux et la croissance de la productivité. Ce résultat empirique est également en contradiction avec les prédictions de notre modèle sans contrainte crédit. Pour apporter une solution à cette contradiction, nous introduisons dans le modèle une imperfection dans le marché de crédit à la Aghion et al. (2005). Ce type de friction dans un modèle de croissance est capable de générer la convergence ou la divergence des économies, en fonction d'un niveau seuil de développement financier. Notre modèle est alors capable de prédire la corrélation négative observée dans les données entre les flux entrants de capitaux étrangers et la croissance de la productivité pour les pays avec un marché financier moins développé. C'est aussi ce qui les empêche de converger vers la frontière technologique. Cette corrélation négative est générée par la composante épargne des flux nets de capitaux du modèle. Par construction, les flux entrants de capitaux dans le modèle peuvent être décomposés en composante épargne et composante investissement. Il est alors possible d'identifier la contribution de chacune des composantes aux flux nets de capitaux.

Le second chapitre de la thèse est une évaluation empirique du rôle du développement financier dans la relation flux de capitaux et croissance économique. En particulier, j'utilise deux approches économétriques et des données de panel de 60 pays en développement entre 1980 et 2015 pour analyser les effets de divers capitaux étrangers sur la croissance économique, en considérant le niveau de développement financier comme variable seuil. Les études antérieures dans le même registre utilisent des estimations avec des variables d'interaction ou séparent les échantillons en utilisant la valeur médiane ou la moyenne du développement financier comme seuil. Ces techniques assument à priori une relation monotone et symétrique entre les capitaux étrangers et la croissance économique. Cependant, la magnitude des effets pourrait être différente selon que le développement financier du pays est en dessous ou au-dessus du seuil. Ces techniques ne permettent pas non plus de déterminer la valeur seuil de développement financier. Pour pallier ces limites, j'utilise une stratégie économétrique novatrice développée par Seo and Shin (2016), à savoir une estimation de panel dynamique à effet de seuil. Cette technique est une extension du modèle original de Hansen (1999), amélioré pour pouvoir prendre en compte l'endogénéité des régresseurs ainsi que celle de la variable de seuil. Dans un premier temps, j'estime l'effet des capitaux étrangers sur la croissance économique en utilisant la technique de panel dynamique. Les résultats révèlent un effet négatif et significatif des flux agrégés sur la croissance du PIB. Une analyse plus approfondie montre que l'effet est négatif et significatif pour les flux publics, tandis que l'effet des flux privés est positif mais non significatif. Le même type d'estimation avec une interaction entre le développement financier et les flux de capitaux montre que les flux agrégés et les flux publics commencent à influencer positivement la croissance au-delà d'un certain niveau de développement financier. En regardant les différents types de flux privé (Investissement Direct Étranger, portefeuilles d'action et dette privée), je trouve également que les IDE et la dette privée affectent positivement la croissance économique seulement quand le marché financier domestique atteint un certain niveau de développement. Ces résultats corroborent les résultats d'études antérieures concernant les flux agrégés, les flux publics, les flux privés, [1] ainsi que les différents types de flux privé (Alfaro et al., 2004, 2009, 2010; Aizenman et al., 2013; Azman-Saini et al., 2010; Baharumshah et al., 2017; Durham, 2004). La seconde technique d'estimation que j'utilise à savoir le panel dynamique à effet de seuil confirme ces résultats et permet en plus d'estimer les valeurs optimales au-delà desquelles chaque type de flux commence à avoir un effet positif sur la croissance économique. Les résultats montrent que les flux agrégés ont un effet positif sur la croissance seulement quand le ratio de crédit privé au PIB domestique excède 45%. Concernant les flux privés, ils ont un effet positif seulement quand le ratio est inférieur à 53% ; au-delà, l'effet est nul. Les flux publics quant à eux sont nocifs pour la croissance économique seulement quand le ratio est inférieur à 16% et nul au-delà.

Dans le troisième chapitre, j'analyse empiriquement les effets du développement financier sur les flux bancaires transfrontaliers bilatéraux. En particulier, j'analyse les réponses de ces flux à une différence entre le marché financier du pays préteur et celui du pays emprunteur. L'étude porte sur les flux bruts (entrants et sortants) ainsi que sur les flux nets (entrants moins sortants). Ce type de flux est sous exploré dans la littérature et les quelques articles qui s'y consacrent font abstraction des conditions financières domestiques et étrangères. Pour cette analyse, j'utilise les données bilatérales sur les flux bancaires du Locational Banking Statistics (LBS) du BIS (Bank of International Settlements) de banques localisées dans 24 pays (pour la plupart développés ou émergeants) vers des banques localisées dans 165 pays (incluant des pays en développement). J'utilise alors une estimation de données de panel à effets fixes. Afin de bien identifier les effets du développement financier sur les flux bancaires, j'ai recours aux effets fixes-temps pour contrôler les facteurs globaux (croissance de la production mondiale, taux d'intérêt mondial et aversion mondiale pour le risque) et effets fixes par paires de pays pour contrôler les facteurs bilatéraux non observés (dis-

1. Voir Alfaro et al. (2014); Gourinchas and Jeanne (2013); Prasad et al. (2007)

tance, langage commun, origines juridiques communes et relation coloniale commune). Pour surmonter les problèmes de causalité inverse et répondre aux préoccupations de biais des variables omises, j'utilise le retard d'une période des variables d'intérêt et des variables de contrôle dans les régressions. Je présente également une estimation où j'utilise le niveau de développement financier des pays géographiquement contigus pour instrumenter le niveau de développement financier. Cette variable s'est révélée être un bon instrument pour le niveau de développement financier dans la littérature. Par exemple, Donaubauer et al. (2019) l'utilise pour analyser l'effet du développement financier sur les IDE. Les résultats montrent que, en général, les banques et institutions non bancaires des pays disposant d'un marché financier mieux développé prêtent davantage à l'étranger, tandis que les banques et institutions non bancaires des pays avec un marché financier moins développé empruntent davantage à l'étranger. Par ailleurs, la croissance économique stimule les flux transfrontaliers pour les pays avec un niveau de développement financier au-dessus d'un seuil minimum. Ce résultat est robuste à la prise en compte de plusieurs facteurs pouvant affecter les flux bancaires et également corroboré par l'estimation avec variable instrumentale. Étant donné que le niveau de risque diffère d'un instrument à l'autre et que le motif d'emprunt et de prêt est différent d'un secteur à l'autre, je désagrège les flux bancaires en tenant compte des secteurs emprunteurs (banque ou non-banque) et aussi de l'instrument de financement de l'emprunt (titre de créance ou prêts et dépôts). Les résultats montrent que les banques étrangères sont prêtes à prêter aux secteurs non bancaires uniquement dans les pays où le marché financier assure une forte probabilité de remboursement, c'est-à-dire les marchés financiers développés. Par contre, quand le prêt est financé par l'émission d'un titre de créance, les banques étrangères sont plus portées à prêter aux banques et non bancaires domestiques parce que cet instrument garantit que le prêt sera entièrement remboursé, et aussi parce que ce type de dette est hautement négociable. Les résultats suggèrent également que les marchés financiers domestiques et étrangers se complètent dans le cas des flux bancaires bilatéraux. À l'opposé, Donaubauer et al. (2019) trouve que ces marchés sont des substituts pour les flux bilatéraux d'IDE. Un marché financier qui fonctionne bien permet de mobiliser l'épargne et l'investissement direct vers des projets plus productifs. Cependant, les investisseurs devraient également investir à l'étranger pour diversifier leurs risques, et ils le feront dans les pays où le rendement attendu est élevé. Dans le même temps, les pays dont le marché financier est moins développé peuvent avoir un potentiel de croissance élevé, mais le marché financier est incapable de mobiliser l'épargne vers les secteurs les plus productifs. Par conséquent, le marché financier étranger semble être une source alternative pour compléter le manque de fonds dans le pays hôte.

CHAPTER I

FINANCIAL DEVELOPMENT AND CAPITAL FLOWS: APPRAISAL OF THE "ALLOCATION PUZZLE" SCHUMPETERIAN GROWTH

joint with Wilfried Koch.

Abstract

We explore the role of financial development to explain the negative correlation between capital inflows and productivity catch-up. As observed in the data, countries with higher productivity growth rates export capital while countries with lower productivity growth rates receive positive capital inflows. This is contradictory to the predictions of the standard neoclassical growth model. Gourinchas and Jeanne (2013) called this paradox the "Allocation Puzzle". Under perfect credit market, our calibrated Schumpeterian growth model also predicts a positive correlation between capital inflows and productivity catch-up. We show that the "Allocation Puzzle" is more prevalent than previously thought. It can be actually generalized to a larger sample by covering more countries and a longer time period. We then introduce credit constraints in a calibrated Schumpeterian growth model to address this paradox. Our main result indicates that, when the level of financial development prevents countries from catching up relative to the world technological frontier, countries import capital to compensate for their insufficient level of domestic savings.

KEYWORDS: Capital flows, Financial development, Productivity, Schumpeterian growth

JEL: F43, O40, O16

1.1 Introduction

According to the neoclassical growth theory, capital must flow into countries where the marginal product is higher, in contrast to what we observe with data. [1] Starting with Lucas (1990), who showed that capital flows from rich to poor countries in small amounts, some articles emphasized the role of financial frictions to explain the discrepancy between theoretical predictions and observed data. By using a calibrated neoclassical growth model, Gourinchas and Jeanne (2013) showed that the "Allocation Puzzle" may be explained by a wedge affecting savings decisions; the "Allocation Puzzle" is related to the downstream capital flows from high-growth to low-growth countries while the "Lucas Puzzle" is related to the downstream capital flows from high-income to low-income countries.

In this paper, we introduce an endogenous imperfect creditor protection *à la* Aghion et al. (2005) in a calibrated Schumpeterian growth model to address the "allocation Puzzle". Our model shows that countries above some threshold level of financial development will catch-up relative to the world technological frontier while the others will fall behind. Then, following Gourinchas and Jeanne (2013), we decompose theoretical net capital inflows and focus on the contributions of investment and savings on the motion of external debt. We find an interesting prediction for countries which fall below the world technological frontier because of their level of financial development: predicted net capital inflows going toward domestic saving is strongly and negatively correlated with productivity catch-up. Because entrepreneurs have a limited access to credit in countries with low level of financial development, they have to self-finance new projects with a greater fraction of their own wealth. Therefore, the credit constraint tends to reduce capital income in these countries and increases current consumption relative to future consumption. The representative domestic consumer borrows from abroad to finance this increase of consumption. On the other hand, a country with a low level of financial development fails to innovate because investments in new projects are insufficient to reach the productivity level of the world technological

1. Prasad et al. (2007) showed that capital tends to flow from high-growth to low-growth non-industrialized countries.

frontier. Thus, a country with a low level of financial development falls below the technological frontier and also has a positive capital inflows because of the limited access to credit in the domestic financial market. Our model is able to replicate the direction of capital inflows observed in the data, for groups of countries with low levels of financial development. Our choice of a domestic credit constraint rather than a friction in the international credit market is primarily motivated by two reasons. First, as mentioned by Gourinchas and Jeanne (2013), international financial frictions can just mute capital flows by increasing the cost of external finance relative to domestic finance, but these frictions cannot reverse the direction of the capital flows. Therefore, most of the articles using a financial constraint to address the "allocation Puzzle" are more focused on domestic distortions. According to Gertler and Rogoff (1990), domestic financial frictions, determined endogenously and depending on the country's wealth, can mute and possibly reverse capital flow direction from rich countries to poor ones. A country's level of financial development determines the capacity of borrowing to private agents who would like to invest in a risky project. Second, as we show in this paper [2], financial development measured by the size of credit to the private sector provided by domestic financial institutions is positively correlated with productivity catch-up [3], as suggested by Gourinchas and Jeanne (2013), yet also negatively correlated with capital inflows. The more a country is financially developed, the more likely it is to catch up relative to the technological frontier and import less capital, than less financially developed countries.

We show in this paper that the "allocation Puzzle" can also be generalized to worldwide economies no matter their level of development, and also that the Schumpeterian growth model predicts a positive relationship between capital inflows and productivity catch-up when entrepreneurs have unlimited access to credit. With an extended sample including OECD and non-OECD countries, we show that observed net capital inflows are negatively correlated with productivity growth as in most of the works in the literature that used primarily samples of developing countries (Prasad et al., 2007; Aguiar

2. See Figures A.1, A.2, A.3 and A.4.

3. See Aghion et al. (2005) for theoretical support and empirical evidence.

and Amador, 2011). As we do not perform a decomposition between public and private debts in observed net capital inflows, as in most of empirical works, we broaden our sample to developed countries [4]. We are only interested in the general pattern of total net capital inflows, in other words, the negative correlation of observed capital flows and productivity growth, which we use to assess the prediction of our model. Alfaro et al. (2014) argued that the sign of correlation between net capital flows and productivity changes depend on the selected sample; with a sample dominated by Asian and African countries, they find a robust negative correlation, while this correlation is weakly positive with a larger sample. Gourinchas and Jeanne (2013) used a sample of developing countries and found that total net capital inflows are negatively correlated with productivity growth. We generalize their results to the entire world. Our results can withstand changes resulting from limiting the sample to developing countries, and only using data from the period of 1980 to 2000 instead of 1980 to 2010. We also use two different measures for total net capital inflows, but the sign of the correlation between capital flows and productivity growth remains the same.

Intuitively, we can interpret the predictions of our model as follows. When agents have unlimited access to credit, the country will catch-up relative to the world technological frontier since they anticipate higher future income, will then increase their consumption. Given that their current income is unchanged and that they have access to international financial market, they will borrow from abroad. When agents have limited access to credit and the level of financial development is sufficient, the same pattern is observed, but the predicted capital inflows going toward saving is higher. This is attributable to credit constraints, which reduce capital income and increases current consumption relative to future consumption. In contrast, a financially underdeveloped country will likely fall below the world technological frontier. Agents will borrow on the international financial market to finance the increase of their consumption and their debt will also increase due to the reduction of their wealth created by the expenditure on new projects.

4. The World Bank data do not report details on foreign debt for countries classified as “developed". Therefore, empirical articles that perform decomposition of net debt can only focus on developing countries.

This article is related to several strands in the literature. First, this article is linked to the wide literature documenting the negative correlation between capital flows and growth. Our analysis is close to that of Gourinchas and Jeanne (2013). We show that the Schumpeterian growth model under perfect financial markets (Aghion et al., 1998; Aghion and Howitt, 1998; Howitt, 2000) also yields the same predictions as the standard neoclassical growth model. In addition to Gourinchas and Jeanne (2013), our model endogenizes the productivity catch-up. We also show that this negative correlation holds for developing countries and is strong when extended to the rest of the world.

Second, this paper is related to the literature on the determinants of capital flows. Many commentators have focused on determinants of the relationship between savings, investment, and growth to explain why the standard neoclassical growth model fails to predict the negative correlation between productivity growth and net capital inflows. It is well known in the literature that saving is strongly positively correlated with growth across countries (Carroll and Weil, 1994; Carroll et al., 2000; Modigliani, 1970), as well as with investment (Attanasio et al., 2000; Feldstein and Horioka, 1979). Among determinants affecting these relationships, friction on the domestic financial market seems to be a potential candidate. A financial friction can reduce the agents' ability to borrow against future income (Caballero et al., 2008). Morever with a lack of social insurance, this could also increase precautionary savings (Carroll and Jeanne, 2009; Mendoza et al., 2009). Aghion et al. (2016) showed that distortions in the domestic financial market prevent domestic savings from substituting perfectly for foreign savings. Therefore, agents in poor countries have to increase their saving to be able to invest in a new project, while saving matters for growth in these countries. Some articles in the literature are also focused on distortions affecting investment in physical capital to explain the puzzle (Buera and Shin, 2017; Caselli and Feyrer, 2007). We propose a model with an endogenous credit constraint that affects the consumption-saving behavior of agents. We show that the credit constraint measured by the level of financial development tends to reduce the total wealth of agents. These effects are more severe in countries that are likely to fall below the technological frontier and, in particular, will have to rely more on external debt.

Third, this paper is linked to the literature on financial development and economic growth. Since Raymond (1969), the literature in development economics has established evidence of the strong positive relationship between financial development and economic growth. We show in this paper that, depending on their level of financial development, the productivity of countries grows at a higher or lower rate than the technological frontier productivity growth rate. Our findings corroborate the conclusions reached by Aghion et al. (2005) who show that countries converge at the technological frontier growth rate only if their level of financial development is above a critical level.

The rest of the paper is organized as follows. In Section 2 we present the Schumpeterian growth model under perfect financial markets and we propose the theoretical ratio of cumulated net capital inflows to initial output. In section 3, we introduce imperfect creditor protection in our model and we derive its implications. In section 4, we discuss the data and calibration, and we compare the model's predictions with the observed data. Section 5 concludes the article.

1.2 The Schumpeterian Growth Framework

We use the Schumpeterian growth model including physical capital accumulation developed by Aghion et al. (1998); Aghion and Howitt (1998); Howitt (2000). Time is discrete and there is a continuum of individuals in each country. There are J small open countries, indexed by $j = 1,...,J$, which exchange goods and factors, and are technologically interdependent in the sense that they use technological ideas developed elsewhere in the world. Each country can borrow and lend at an exogenously given world real interest rate $r^\star$.

1.2.1 Household

The economy consists of a set of identical households (whose size is normalized to 1), but where the number of infinite lifetime individuals in each household grows at the exogenous rate n, so that $L_j(t) = (1+n_j)^t L_j(0)$. Each individual supplies inelastically one unit of labor. The representative household maximizes the following constant relative risk aversion (CRRA) utility function:

$$\max_{\{c_j(t)\}_{t=0,1,\ldots}} U_j(0) = L_j(0) \sum_{t=0}^{\infty} \beta^t \frac{c_j(t)^{1-\gamma} - 1}{1-\gamma}, \tag{1.1}$$

where $c_j(t) = C_j(t)/L_j(t)$ is the per-worker consumption in country j at date t, $\beta \equiv \frac{1+n_j}{1+\rho}$ is the effective discount rate and ρ is the subjective discount rate, with $\rho > n_j$, and $\gamma > 0$ is the inverse of the elasticity of intertemporal substitution. Denoting $\mathscr{A}_j(t)$ as the asset holding of the representative household at time t, the law of motion of total assets is given by:

$$\mathscr{A}_j(t+1) = w_j(t)L_j(t) + (1+r^\star)\mathscr{A}_j(t) - C_j(t), \tag{1.2}$$

and we assume that the following no-Ponzi condition holds:

$$\lim_{t\to\infty} \left(\frac{1}{1+r^\star}\right)^t \mathscr{A}_j(t+1) \geq 0. \tag{1.3}$$

The Euler condition for this small open economy is given by:

$$c_j(t)^{-\gamma} = \beta(1+r^\star)c_j(t+1)^{-\gamma}, \tag{1.4}$$

so that, we follow Gourinchas and Jeanne (2013) in assuming that the world interest rate is:

$$1 + r^\star = \frac{(1+g)^\gamma}{\beta}, \tag{1.5}$$

where we implicitly assume that the rest of the world is composed of advanced countries at their steady state level, and sharing the same preference parameters of the J small countries under consideration here.

1.2.2 Production

Production of final good. Let us assume each country produces a single good. The final good is produced under perfect competition by labor and a continuum of intermediate products, according to the production function:

$$Y_j(t) = \left(\frac{L_j(t)}{Q_j(t)}\right)^{1-\alpha} \int_0^{Q_j(t)} A_j(\nu,t)^{1-\alpha} x_j(\nu,t)^{\alpha} d\nu. \tag{1.6}$$

where $Y_j(t)$ is country's j gross output at date t, $L_j(t)$ is the flow of raw labor used in production, $Q_j(t)$ measures the number of different intermediate products produced and used in the country j at date t, $x_j(\nu,t)$ is the flow output of intermediate product $\nu \in [0, Q_j(t)]$ used at date t, and $A_j(\nu,t)$ is a productivity parameter attached to the latest version of intermediate product ν.

We assume that labor supply and population size are identical. They both grow exogenously at the fixed proportional rate n_j. The form of the production function, that is, the presence of the term $Q_j(t)$ dividing the labor, ensures that growth in product variety does not affect aggregate productivity. Therefore, we suppose, as in Aghion et al. (1998); Howitt (2000), that the number of products grows as a result of serendipitous imitation, not deliberate innovation. Imitation is limited to domestic intermediate products; thus, each new product will have the same productivity parameter as a randomly chosen existing product within the country. Each agent has the same propensity to imitate $\xi > 0$, which we assume to be identical for each country j. Moreover, we assume that the exogenous fraction ψ of existing intermediate products disappears each period. Thus, the aggregate flow of new products is: $Q_j(t+1) - Q_j(t) = \xi L_j(t) - \psi Q_j(t)$, so that the number of workers per product $l_j(t) \equiv L_j(t)/Q_j(t)$ converges monotonically to the constant:

$$l = \psi/\xi. \tag{1.7}$$

Assuming that this convergence has already occurred, so that: $L_j(t) = lQ_j(t)$ for all t. The form of the production function (1.6) ensures that growth in product variety does not affect aggregate productivity. This and the fact that population growth induces product proliferation guarantees that the model does not exhibit the sort of scale effect that Jones (1995) argues is contradicted by postwar trends in research and development (R&D) spending and productivity. Without loss of generality, we set l=1 in the rest of the paper.

The final good is used for consumption, as an input into entrepreneurial innovation or invested to create new units of physical capital. Producers of the final good act as perfect competitors in all markets, so that the inverse demands for intermediate goods and labor are given by:

$$\text{(FOC)} \quad \begin{cases} p_j(\nu,t) = \alpha \left(\dfrac{A_j(\nu,t)L_j(t)}{Q_j(t)} \right)^{1-\alpha} x_j(\nu,t)^{\alpha-1} \quad \text{for all sectors } \nu \in [0, Q_j(t)], \\ w_j(t) = (1-\alpha)\dfrac{Y_j(t)}{L_j(t)}. \end{cases} \tag{1.8}$$

Production of intermediate goods. Each intermediate good is produced with physical capital using a one-to-one technology such as:

$$x_j(\nu,t) = K_j(\nu,t).$$

where $K_j(\nu,t)$ is the physical capital used in sector ν at date t in country j to produce $x_j(\nu,t)$ units of intermediate goods. For each intermediate good ν, there is an innovator who enjoys a monopoly power in the production of this intermediate good and maximizes profits according to:

$$\begin{aligned} \max_{\{x_j(\nu,t)\}} \pi_j(\nu,t) &= p_j(\nu,t)x_j(\nu,t) - (r^\star + \delta)x_j(\nu,t), \\ &= \alpha \left(\frac{A_j(\nu,t)L_j(t)}{Q_j(t)} \right)^{1-\alpha} x_j(\nu,t)^{\alpha} - (r^\star + \delta)x_j(\nu,t), \end{aligned}$$

where δ is the depreciation rate of physical capital. The equilibrium quantity of intermediate good ν is given by:

$$x_j(\nu,t) = \alpha^{\frac{2}{1-\alpha}}(r^\star + \delta)^{-\frac{1}{1-\alpha}} \frac{A_j(\nu,t)L_j(t)}{Q_j(t)}.$$

Replacing in the inverse demand, we obtain the equilibrium price as: $p_j(\nu,t) = \alpha^{-1}(r^\star + \delta)$.

Aggregate stock of capital. The aggregate stock of physical capital demanded is:

$$K_j(t) = \int_0^{Q_j(t)} K_j(\nu,t)d\nu = \int_0^{Q_j(t)} x_j(\nu,t)d\nu = \alpha^{\frac{2}{1-\alpha}}(r^\star+\delta)^{-\frac{1}{1-\alpha}}A_j(t)L_j(t),$$

where $A_j(t) \equiv \frac{1}{Q_j(t)}\int_0^{Q_j(t)} A_j(\nu,t)d\nu$ is the productivity average in country j, so that the capital stock per-efficient unit of labor, denoted by $\widehat{k}$, is constant and given by:

$$\widehat{k} = \left(\frac{\alpha^2}{r^\star+\delta}\right)^{\frac{1}{1-\alpha}}.$$

Aggregate profits. Substituting the equilibrium quantity of intermediate good and the equilibrium price leads to the equilibrium profit of the monopoly in the sector ν of country j at date t, as:

$$\pi_j(\nu,t) = \frac{1-\alpha}{\alpha}(r^\star+\delta)x_j(\nu,t) = (1-\alpha)\alpha^{\frac{1+\alpha}{1-\alpha}}(r^\star+\delta)^{-\frac{\alpha}{1-\alpha}}\frac{A_j(\nu,t)L_j(t)}{Q_j(t)},$$

which we can rewrite in function of the per-efficient unit of labor physical capital, $\widehat{k}$, as: $\pi(\hat{k})\frac{A_j(\nu,t)L_j(t)}{Q_j(t)}$ where $\pi(\widehat{k}) \equiv \alpha(1-\alpha)\widehat{k}^\alpha$. The aggregate profits are therefore given by:

$$\Pi_j(t) = \int_0^{Q_j(t)} \pi_j(\nu,t)d\nu = \pi(\widehat{k})A_j(t)L_j(t).$$

Equilibrium wage and output. Introducing equilibrium quantity of intermediate product in each sector ν in the production function of final good sector leads to the equilibrium quantity of per-worker final good: $y_j(t) = A_j(t)\widehat{k}^\alpha$, where $y_j(t) \equiv Y_j(t)/L_j(t)$ is the per-worker GDP. The equilibrium wages are $w_j(t) = (1-\alpha)A_j(t)\widehat{k}^\alpha = \omega(\widehat{k})A_j(t)$ where $\omega(\widehat{k}) \equiv (1-\alpha)\widehat{k}^\alpha$.

Per worker GDP is given by the sum of incomes (wages, profits of monopolists and rent of capital) in the economy as $y_j(t) = \pi(\widehat{k})A_j(t) + \omega(\widehat{k})A_j(t) + (r^\star+\delta)\widehat{k}A_j(t) = A_j(t)\widehat{k}^\alpha$ so that the growth rate of the economy is therefore given by the growth rate of the average productivity. [5]

1.2.3 Innovation and dynamics of aggregate productivity

Assume that each period and in each sector ν, there exists a large number of innovators who invest $Z_j(\nu,t)$ units of final goods in R&D. When successful with a probability $\mu_j(\nu,t)$, an innovator replaces the incumbent monopolist next period and reach the worldwide technological frontier denoted by $\overline{A}(t)$, and when there is no innovation in sector ν, the level of productivity remains at its previous level of $A_j(\nu,t)$. Therefore, the law of motion of productivity in each sector ν is given by:

$$A_j(\nu,t+1) = \begin{cases} \overline{A}(t+1) & \text{with probability} \quad \mu_j(\nu,t), \\ A_j(\nu,t) & \text{with probability} \quad (1-\mu_j(\nu,t)). \end{cases} \tag{1.9}$$

The probability of innovation is linear and given by:

$$\mu_j(\nu,t) = \lambda \frac{Z_j(\nu,t)}{\overline{A}(t)},$$

where $\lambda > 0$ is the productivity of R&D, and where we deflate R&D expenditures in each sector by $\overline{A}(t)$ in order to recognize the force of increasing complexity; as technology advances, the resource cost of further advances increases proportionally. The leading-edge technological is the worldwide technology frontier denoted as $\overline{A}(t)$ and its growth rate is g, so that $\overline{A}(t) = (1+g)^t \overline{A}(0)$.

Moreover, an incumbent monopolists that innovated at date t and are still producing at date $t+1$, with a probability of $(1-\mu_j(\nu,t))$, have the following firm value written in recursive form:

$$V_j(\nu,t) = \frac{1}{1+r^\star}\left(\pi_j(\nu,t) + (1-\mu_j(\nu,t))V_j(\nu,t+1)\right), \tag{1.10}$$

5. $y_j(t)$ is indeed the per-worker GDP of the country j, since the sum of value added in all sectors is given by: $\left(y_j(t) - \int_0^{Q_j(t)} p_j(\nu,t)x_j(\nu,t)\right) + \left(\int_0^{Q_j(t)} p_j(\nu,t)x_j(\nu,t) - 0\right) = y_j(t)$.

so that the problem of the innovator is given by:

$$\max_{\{Z_j(\nu,t)\}} \mu_j(\nu,t)V_j(\nu,t+1) - Z_j(\nu,t). \tag{1.11}$$

Therefore, the innovator invests $Z_j(\nu,t)$ units of final good in R&D and obtains the value $V_j(\nu,t+1)$ with a probability $\mu_j(\nu,t)$. The FOC of the innovator's problem gives the Schumpeterian non-arbitrage condition, which is: $\lambda v_j(\nu,t+1) = \frac{1}{1+g}$, where $v_j(\nu,t+1) \equiv \dfrac{V_j(\nu,t+1)}{\overline{A}(t+1)}$ is the value of a firm in sector ν in efficient units, so that the equilibrium probability to innovate is given by:

$$\mu_j^\star = \lambda\pi(\widehat{k}) - \frac{r^\star - g}{1+g}. \tag{1.12}$$

Finally, total R&D expenditures are given by:

$$Z_j(t) = \int_0^{Q_j(t)} Z_j(\nu,t)d\nu = \int_0^{Q_j(t)} \left[\frac{\overline{A}(t)}{\lambda}\mu_j^\star\right] d\nu = \frac{\overline{A}(t)}{\lambda}\mu_j^\star Q_j(t) = z(\widehat{k})\overline{A}(t)L_j(t),$$

where $z(\widehat{k}) = \left(\pi(\widehat{k}) - \dfrac{r^\star - g}{\lambda(1+g)}\right)$.

Denoting the proximity to the technological frontier by $a_j(t) = A_j(t)/\overline{A}(t)$, using equation (1.9), it evolves according to:

$$a_j(t+1) = \mu_j^\star + \frac{1-\mu_j^\star}{1+g}a_j(t) \equiv F_1(a_j(t)), \tag{1.13}$$

and the steady-state equilibrium of the proximity to the frontier is given by:

$$a_j^\star = \frac{1+g}{g+\mu_j^\star}\mu_j^\star,$$

where $\mu_j^\star$ is given by equation (1.12).

1.2.4 Net Capital Inflows

In our Schumpeterian growth model, net capital inflows can be decomposed, as in Gourinchas and Jeanne (2013), in terms of convergence, trend, investment and saving. We therefore write the volume of capital inflows in terms of the exogenous parameters of the model to be able to compare the prediction of the model to the observed data.

Market clearing implies that the assets must be equal to: $\mathscr{A}_j(t) = K_j(t) - D_j(t) + V_j(t)$, where $K_j(t)$ is the stock of physical capital of country j, $D_j(t)$ is the country's j external debt, and $V_j(t) = \int_0^{Q_j(t)} V_j(\nu,t)d\nu$ is the total value of corporate assets. Therefore, the resources constraint can be rewritten as:

$$C_j(t)+K_j(t+1)-D_j(t+1) = w_j(t)L_j(t)+(1+r^\star)(K_j(t)-D_j(t))+(r^\star V_j(t)-\Delta V_j(t)).$$

Given the recursive form of the value of firms and the free entry condition in the R&D sector $\mu_j(\nu,t)V_j(\nu,t+1) = Z_j(\nu,t)$, we have:

$$\begin{aligned}\int_0^{Q_j(t)} \left(r^\star V_j(\nu,t) - \Delta V_j(\nu,t)\right) d\nu &= \int_0^{Q_j(t)} \left(\pi_j(\nu,t) - Z_j(\nu,t)\right) d\nu, \\ &= \Pi_j(t) - Z_j(t),\end{aligned}$$

where $\Pi_j(t) = \int_0^{Q_j(t)} \pi_j(\nu,t)d\nu$ is the aggregate profits and $Z_j(t) = \int_0^{Q_j(t)} Z_j(\nu,t)d\nu$ is the aggregate R&D expenditures. Therefore, the representative household's budget constraint in country j at date t is written as:

$$C_j(t)+K_j(t+1)-D_j(t+1) = w_j(t)L_j(t)+(1+r^\star)(K_j(t)-D_j(t))+\Pi_j(t)-Z_j(t).$$

We can now rewrite the budget constraint in terms of per-efficient worker variables as:

$$\begin{aligned}\widehat{c}_j(t)+(1+g_j(t+1))(1+n_j)\left(\widehat{k}_j(t+1)-\widehat{d}_j(t+1)\right) &= (1+r^\star)\left(\widehat{k}_j(t)-\widehat{d}_j(t)\right) \\ &\quad +\omega(\widehat{k})+\pi(\widehat{k})-\frac{z(\widehat{k})}{a_j(t)},\end{aligned}$$

where, $\widehat{x} = x/A$ denotes the per-worker variables in efficiency units and $g_j(t+1)$ is the growth rate of average productivity, i.e., $g_j(t+1) \equiv \dfrac{A_j(t+1)-A_j(t)}{A_j(t)}$.

As in Gourinchas and Jeanne (2013) state, we assume that the economy reaches its steady-state at a finite date $T < \infty$. The economy steady growth path is $g_j(t+1) = g$, $a_j(T) = a_j^\star$, $\widehat{k}_j(t+1) = \widehat{k}_j(t) = \widehat{k}$ and $\widehat{d}_j(t+1) = \widehat{d}_j(t) = \widehat{d}_j(T)$, so that the steady-state debt value is given by:

$$\widehat{d}_j(T) = \widehat{k} + \frac{\omega(\widehat{k}) + \pi(\widehat{k}) - \frac{z(\widehat{k})}{a_j(T)} - \widehat{c}_j(T)}{r^\star - G_j}, \tag{1.14}$$

where $1 + G_j \equiv (1+g)(1+n_j)$. Steady-state consumption in terms of the proximity to the technological frontier is given as:

$$\widehat{c}_j(T) = \frac{\widehat{c}_j(0)}{a_j(T)/a_j(0)}, \tag{1.15}$$

and the initial consumption per-efficient worker is given by:

$$\begin{aligned} \widehat{c}_j(0) &= \frac{r^\star - G_j}{a_j(0)(1+r^\star)} \sum_{t=0}^{\infty} \left(\frac{1+G_j}{1+r^\star} \right)^t \left(\omega(\widehat{k}) + \pi(\widehat{k}) \right) a_j(t) - \frac{z(\widehat{k})}{a_j(0)} \\ &\quad + (r^\star - G_j) \left(\widehat{k}_j(0) - \widehat{d}_j(0) \right). \end{aligned} \tag{1.16}$$

Finally, we follow Gourinchas and Jeanne (2013) and use the change in external debt between dates 0 and T normalized by initial GDP as the measure of capital inflows:

$$\frac{\Delta D_j}{Y_j(0)} = \frac{D_j(T) - D_j(0)}{Y_j(0)}. \tag{1.17}$$

Given equations (1.14), (1.15), (1.16) and (1.17), we obtain the volume of capital inflows in terms of the exogenous parameters of the model as follows: [6]

$$\frac{\Delta D_j}{Y_j(0)} = \overbrace{\frac{\widehat{k}-\widehat{k}_j(0)}{\widehat{y}_j(0)}(1+G_j)^T}^{\Delta D^c/Y_0} + \overbrace{\frac{\widehat{d}_j(0)}{\widehat{y}_j(0)}((1+G_j)^T-1)}^{\Delta D^t/Y_0} + \overbrace{\left(\frac{a_j(T)}{a_j(0)}-1\right)\frac{\widehat{k}}{\widehat{y}_j(0)}(1+G_j)^T}^{\Delta D^i/Y_0}$$
$$+ \underbrace{\left(\frac{a_j(T)}{a_j(0)}-1\right)\left(\frac{\omega(\widehat{k})+\pi(\widehat{k})}{\widehat{y}_j(0)(1+r^\star)}\right)(1+G_j)^T\left[\sum_{t=0}^{T-1}\left(\frac{1+G_j}{1+r^\star}\right)^t(1-f(t))\right]}_{\Delta D^s/Y_0}, \quad (1.18)$$

where $f(t) \leq 1$ and $f(t) = 1$ for $t \geq T$.

The decomposition of the capital inflows in equation (1.18) leads to the following terms, similar to Gourinchas and Jeanne (2013): the convergence term ($\Delta D^c/Y_0$), which represents the initial level of capital scarcity, the trend term ($\Delta D^t/Y_0$), which is the impact of initial debt on capital inflows, the investment term ($\Delta D^i/Y_0$), and the saving term ($\Delta D^s/Y_0$), which both represent the effect of the productivity catch up. The investment term reflects the amount of external debt dedicated to domestic investment while the saving term is the impact of domestic saving on external debt.

It is worth noting that the Schumpeterian framework developed in our paper allows us to endogenize the productivity catch-up parameter which depends on the proximity to the technological frontier, unlike the one used by Gourinchas and Jeanne (2013). Because the evolution of the proximity to the technological frontier, $a_j(T)$ is endogenous according to equation (1.13), we obtain an endogenous productivity catch-up and also a function $f(t)$, which is given by: $f(t) = 1 - \left(\frac{1-\mu^\star}{1+g}\right)^t$ and therefore depends explicitly on probability to innovate given by equation (1.12).

1.3 The Imperfect Credit Market Model

With perfect credit markets, as it was implicitly assumed in the previous section, innovators have unlimited access to credit and all countries converge on the technological

6. See Appendix A.

frontier growth rate. We now introduce a asymmetric information as in Aghion et al. (2005). This constraint will affect the total amount potential innovators could invest in R&D, the equilibrium probability to innovate and the evolution of the proximity to the technological frontier. As we will show, countries fall in three different groups depending on their own level of financial development: the non-credit constrained group, the credit constrained with convergence group and the credit-constrained divergence group. Each group leads to different predicted net capital inflow.

1.3.1 Innovation Under Credit Constraints

Each period, a potential innovator with current total wealth $\mathscr{A}_j(t)$ decides to invest $Z_j(\nu,t)$ units of final goods in R&D in each sector ν. Assuming she invests the amount $\mathscr{A}_j(\nu,t)$, defined by some constant and exogenous fraction of her total wealth, in each sector, she needs to borrow the amount $Z_j(\nu,t) - \mathscr{A}_j(\nu,t)$ for each project. We also assume as in Aghion et al. (2005); Bemanke and Gertler (1989) that she can pay a cost $H_j Z_j(\nu,t)$ to hide her successful result and defraud her creditor. To ensure she pays back the loan, we assume that the cost of defraud is greater than the repayment of the loan. As shown in appendix B, the innovator could only invest up to a finite multiple of her total wealth in equilibrium:

$$Z_j(\nu,t) \leq \phi_j \mathscr{A}_j(\nu,t), \tag{1.19}$$

where $\phi_j = \frac{1+r^\star}{1+r^\star - H_j}$, $\phi_j \in [1,\infty)$ is the credit multiplier and H_j is the parameter of the hiding cost.

The innovator now chooses $Z_j(\nu,t)$ to maximize her expected net profit of being an incumbent in date t+1 with probability $\mu_j(\nu,t) = \lambda \frac{Z_j(\nu,t)}{\bar{A}(t)}$, namely:

$$\begin{aligned} \max_{\{Z_j(\nu,t)\}} \quad & \lambda \frac{Z_j(\nu,t)}{\bar{A}(t)} V_j(\nu,t+1) - Z_j(\nu,t) \\ \text{subject to} \quad & Z_j(\nu,t) \leq \phi_j \mathscr{A}_j(\nu,t). \end{aligned} \tag{1.20}$$

The first order conditions of (1.20) give the Schumpeterian non-arbitrage condition and the expenditure in R&D for each sector ν:

$$\lambda V_j(\nu,t+1) = (1+\Gamma_j(\nu,t))\overline{A}(\nu,t) \quad \text{and} \quad Z_j(\nu,t) = \phi_j \mathscr{A}_j(\nu,t),$$

where $\Gamma_j(\nu,t) > 0$ is the Lagrange multiplier associated with the credit constraint [7]. Since the probability of innovation is the same in all sectors at the equilibrium, the potential innovator will self-finance the same amount $\mathscr{A}_j(\nu,t)$ in each sector and the total expenditure in R&D in the economy is given therefore by $Z_j(t) = \int_0^{Q_j(t)} Z_j(\nu,t)d\nu = \phi_j q_j(t)\mathscr{A}_j(t)$, , where $q_j(t) < 1$ represents the fraction of the households' total wealth devoted to R&D. The entrepreneur will now innovate with probability $\mu(a_j(t)) < \mu^\star$ given by:

$$\mu(a_j(t)) = \lambda\phi\hat{\mathscr{F}}_j(t)a_j(t), \tag{1.21}$$

where $\hat{\mathscr{F}}_j(t) \equiv q(t)\hat{\mathscr{A}}_j(t)$ is self-financing per-efficient worker. The evolution of the proximity to the technological frontier is now given by:

$$a_j(t+1) = \mu(a_j(t)) + \frac{1-\mu(a_j(t))}{1+g}a_j(t) \equiv F_2(a_j(t)), \tag{1.22}$$

which is an increasing concave function and $F_2(0) = 0$.

When a country is credit constrained but has sufficient level of financial development ($\phi_j > g/((1+g)\lambda\hat{\mathscr{F}}_j)$ and $F_2'(0) > 1$), function $F_2(a_j(t))$ has a slope greater than one and converges to the limit proximity $\widehat{a}_j$. This proximity is lower than the one without credit constraint ($\widehat{a}_j < a^\star$). Hence, the higher is the level of financial development, the higher is the size of investment in R&D and the higher is the probability to innovate and reach the productivity growth rate of the world technological frontier at the equilibrium. Otherwise $\phi_j < g/((1+g)\lambda\hat{\mathscr{F}}_j)$ and $F_2'(0) < 1$), the slope of $F_2(a_j(t))$ is lower than one and and it converges to 0. The economy fails to innovate and grows at a lower rate.

7. $\Gamma_j(\nu,t) = 0$ corresponds to the case where the entrepreneur is not financially constrained. We do not consider the case where $\Gamma_j(\nu,t) = 0$ and $Z_j(\nu,t) = \phi\mathscr{A}_j(\nu,t)$).

1.3.2 Household

From the evolution of the representative household's assets and the evolution of the value of the firms in equilibrium, given by $r^{\star}V_j(t) - \Delta V_j(t) = \Pi_j(t) - (1+\Gamma_j(t))\phi_j \mathscr{F}_j(t)$, we can write the new budget constraint as:

$$\begin{aligned} C_j(t) + K_j(t+1) - D_j(t+1) &= w_j(t)L_j(t) + (1+r^{\star})(1-\tau_j(t))(K_j(t) - D_j(t)) \\ &\quad + \Pi_j(t) - (1+\Gamma_j(t))q_j(t)\phi_j V_j(t), \end{aligned} \tag{1.23}$$

where $\tau_j(t) = \frac{(1+\Gamma_j(t))q_j(t)}{1+r^{\star}-H_j}$ is the saving wedge. This wedge will act as a "tax" on household saving and will be spent in R&D. Saving wedge increases with the level of financial development H_j.

In countries where the financial institutions are developed, to defraud creditors is expensive. Lenders are more induce to pay back their loans than to defraud. Hence, the higher is the hiding cost that will have to be paid by the investor who defaults on his creditor, the more the impact of asymmetric information will be reduced. Thus, the size of credit granted by financial institutions to the investor may be higher and the probability to innovate may increase.

The representative household will now maximize the utility function given by equation (1.1), subject to budget constraints (1.23). The Euler condition for the small open economy is now given by:

$$c_j(t)^{-\gamma} = \beta(1+r^{\star})(1-\tau_j(t))c_j(t+1)^{-\gamma}, \tag{1.24}$$

and finally

$$c_j(t) = c_j(0)(1+g)^t \Phi_j(t)^{min(t,T)}. \tag{1.25}$$

The saving wedge will affect consumption growth. Indeed, consumption will now grow by the factor $(1+g)\Phi_j(t)$ in every period $t < T$ and by the factor $(1+g)$ afterwards, with $\Phi_j(t) = (1-\tau_j(t))^{1/\gamma}$.

1.3.3 Net Capital Inflows Under Credit Constraint

Once again, we need to write the volume of capital inflows in terms of the exogenous parameters. From the country's aggregate resource constraint, we write the steady-state debt in terms of efficiency units as:

$$\widehat{d}_j(T) = \widehat{k} + \frac{\omega(\widehat{k}) + \pi(\widehat{k}) - (1+\Gamma_j)\phi_j \hat{\mathscr{F}}_j(T) - \widehat{c}_j(T)}{r^\star - G_j}. \tag{1.26}$$

Because of the Euler equation presented in (1.24), steady-state consumption in terms of the proximity to the technological frontier becomes:

$$\widehat{c}_j(T) = \frac{\widehat{c}_j(0)\Phi_j^T}{a_j(T)/a_j(0)}, \tag{1.27}$$

and the initial consumption per-efficiency worker will be:

$$\begin{aligned}\widehat{c}_j(0) = (r^\star - g)\Theta\left(\frac{1}{a_j(0)(1+r^\star)}\textstyle\sum_{t=0}^{\infty}\left(\frac{1+G}{1+r^\star}\right)^t\left(\omega(\widehat{k}) + \pi(\widehat{k}) - (1+\Gamma_j)\phi_j\widehat{\mathscr{F}}_j(T)\right)a_j(t)\right)\\ +(r^\star - g)\Theta\left(\widehat{k}_j(0) - \widehat{d}_j(0)\right),\end{aligned} \tag{1.28}$$

where $\Theta_j = \dfrac{(1+r^\star)-(1+G_j)\Phi_j}{r^\star - G_j + \left(\dfrac{1+G_j}{1+r^\star}\right)^T \Phi_j^T(1+G_j)(1-\Phi_j)}$.

Finally, using equations (1.26), (1.27), (1.28) and the definition of the change in external debt given by (1.17), we can write the volume of net capital inflows under credit constraint as:

$$\begin{aligned}\frac{\Delta D_j}{Y_j(0)} = \overbrace{\left(\frac{\widehat{k} - \Theta_j\Phi_j^T\widehat{k}_j(0)}{\widehat{y}_j(0)}\right)(1+G_j)^T}^{\Delta D^c/Y_0} + \overbrace{\frac{\widehat{d}_j(0)}{\widehat{y}_j(0)}((1+G_j)^T\Theta_j\Phi_j^T - 1)}^{\Delta D^t/Y_0} + \overbrace{\left(\frac{a_j(T)}{a_j(0)} - 1\right)\frac{\widehat{k}}{\widehat{y}_j(0)}(1+G_j)^T}^{\Delta D^i/Y_0}\\ \underbrace{+\left(\frac{a_j(T)}{a_j(0)} - 1\right)\left(\frac{\omega(\widehat{k}) + \pi(\widehat{k}) - (1+\Gamma_j)\phi_j\hat{\mathscr{F}}_j}{\widehat{y}_j(0)(1+r^\star)}\right)(1+G_j)^T\Theta_j\Phi_j^T\left[\sum_{t=0}^{T-1}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(\frac{a_j(T)\Phi_j^{(t-T)} - a_j(t)}{a_j(T) - a_j(0)}\right)\right]}_{\Delta D^s/Y_0}.\end{aligned} \tag{1.29}$$

Our model with credit constraint leads to equation (1.29), which gives a general form of the volume and direction of the capital inflows. We can thus identify again the four terms as above: the convergence term $\Delta D^c/Y_0$, representing the part of the international borrowing going toward investment to reach the steady state, the trend term $\Delta D^t/Y_0$, representing the part of the initial debt on capital inflows, the investment term $\Delta D^i/Y_0$ and the saving term $\Delta D^s/Y_0$, representing the effect of productivity growth on capital inflows. Imperfection in the domestic financial market will affect all the terms except the investment term; capital scarcity is higher in the case of credit constraint, $\left(\widehat{k}-\Theta_j\Phi_j^T\widehat{k}_j(0)\right) > \left(\widehat{k}-\widehat{k}_j(0)\right) \forall\ \Theta_j\Phi_j^T > 1$ because a fraction of the initial capital is used in R&D; the gap of capital needed to be financed by external debt is therefore higher. The impact of initial debt on external debt is reduced because a fraction of the initial debt goes toward R&D. The trend term will therefore be lower in an imperfect financial market. The investment term does not change as shown in equation (1.29) because the domestic friction only affects saving. The country could always borrow on the international financial market to finance domestic investment as its productivity grows.

In the next section, we discuss on the particular forms of equation (1.29) according to the level of financial development.

1.3.4 Theoretical predictions

From the above, we can separate economies into three different groups according to the level of financial development, and predict the direction and the volume of capital inflows with respect to the productivity evolution between 0 and T.

Capital Inflows in an Perfect Credit Market

Looking at the condition $\phi_j \in [1,\infty)$ where $\phi_j = \infty$ corresponds to the case without financial friction, in which that entrepreneurs have unlimited access to credit, it follows that countries with a high financial development level, $H_j \geq (1+r^\star)$, are assumed to be financially unconstrained. Therefore, one shows that $\Phi_j = \Theta_j = 1$, $q_j = 0$, and thus equation (1.29) become similar to equation (1.18). The proximity of the country to the technological frontier will evolve according to $F_1(a_j(t))$ and will converge to:

$$a_j^\star = \frac{1+g}{g+\mu_j^\star}\mu^\star.$$

The growth rate of productivity will be the same as the technological frontier productivity growth rate $g = \left(\frac{1+r^\star}{\beta}\right)^{1/\gamma} - 1$ for $t \geq T$. For this group of countries, the model predictions are similar to Gourinchas and Jeanne (2013) as follows:

Proposition 1. Without capital scarcity and initial debt, a country will have a positive net capital inflow only if it converges.

$$\Delta D_j/Y_j(0) > 0 \quad \text{only if} \quad a_j(T) > a_j(0).$$

Proposition 2. For two identical countries i and j, except for their productivity catch-up, country j will receive more capital inflows than i only if j catches up relative to the technological frontier faster than i.

$$\Delta D_j/Y_j(0) > \Delta D_i/Y_i(0) \quad \text{if and only if} \quad \left(\frac{a_j(T)}{a_j(0)} - 1\right) > \left(\frac{a_i(T)}{a_i(0)} - 1\right).$$

Interpretation: The positive slope of $\Delta D_j/Y_j(0)$ indicates that countries that catch-up relative to the technological frontier will import capital. As the country catches up and reaches the frontier, productivity grows at a higher rate and households, who anticipate higher future incomes, increase their consumption. Saving decreases and external debt has to increase since current income $(\omega(\widehat{k}) + \pi(\widehat{k}))$ does not change. Also, external debt has to increase with the productivity catch-up to finance domestic investment. Both effects of the productivity catch-up on saving and investment lead to the positive link between net capital inflows and productivity catch-up.

Capital inflows under imperfect credit market with convergence

In countries where the level of financial development is low ($H_j < (1+r^\star)$), entrepreneurs have limited access to credit and thus cannot invest more than some percentage of their total wealth in R&D. They will innovate with probability $\mu(a_j(t)) < \mu^\star$ and the proximity of the country to the technological frontier will evolve according to $F_2(a_j(t))$, that is an increasing concave function. With a sufficient level of financial development so that $\phi_j > g/((1+g)\lambda\hat{\mathscr{F}}_j)$ and $F_2'(0) > 1$, the economy will converge to a limit $\widehat{a}_j < a^\star$ given by: [8]

$$\widehat{a}_j = (1+g) - \frac{g}{\lambda\phi_j\hat{\mathscr{F}}_j}.$$

The volume and direction of capital inflows between 0 and T (equation (1.29)) depend on the exogenous parameters of the model and is therefore given by:

$$\begin{aligned}\frac{\Delta D_j}{Y_j(0)} = {} & \overbrace{\left(\frac{\widehat{k} - \Theta_j\Phi_j^T\widehat{k}_j(0)}{\widehat{y}_j(0)}\right)(1+G_j)^T}^{\Delta D^c/Y_0} + \overbrace{\frac{\widehat{d}_j(0)}{\widehat{y}_j(0)}((1+G_j)^T\Theta_j\Phi_j^T - 1)}^{\Delta D^t/Y_0} + \overbrace{\left(\frac{a_j(T)}{a_j(0)} - 1\right)\frac{\widehat{k}}{\widehat{y}_j(0)}(1+G_j)^T}^{\Delta D^i/Y_0} \\ & \underbrace{+\left(\frac{a_j(T)}{a_j(0)} - 1\right)\left(\frac{\omega(\widehat{k}) + \pi(\widehat{k}) - (1+\Gamma_j)\phi_j\hat{\mathscr{F}}_j}{\widehat{y}_j(0)(1+r^\star)}\right)((1+G_j)^T\Theta_j\Phi_j^T)\left[\sum_{t=0}^{T-1}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(\frac{\widehat{a}_j\Phi_j^{(t-T)} - a_j(0)\left(\frac{1+g_j}{1+g}\right)^t}{\widehat{a}_j - a_j(0)}\right)\right]}_{\Delta D^s/Y_0}.\end{aligned}$$

where $g_j = (1+g)\lambda\phi_j\hat{\mathscr{F}}_j$ and $g_j > g$ is the average growth rate of productivity, specific to the economy j for $t < T$, $g_j = g$ for $t \geq T$, and $a_j(0)$ is its initial proximity to the technological frontier. As the economy converges to $\widehat{a}_j > a_j(t) > a_j(0)$ and $\Phi_j < 1$, we can easily show the positive relationship between $\Delta D_j/Y_j(0)$ and $(a_j(T)/a_j(0) - 1)$.

For this group, the model also predicts a similar net capital inflows: without capital scarcity and initial debt, one observes positive capital inflows only if the country converges. Considering two identical countries except for their productivity catch-up, a

8. We have $F_2(0) = 0$ and $F_2'(0) = \lambda\phi_j\hat{\mathscr{F}}_j + \frac{1}{1+g}$, so that countries with $\phi_j > g/((1+g)\lambda\hat{\mathscr{F}}_j)$ converge to a positive proximity to the technological frontier, whereas others with $\phi_j < g/((1+g)\lambda\hat{\mathscr{F}}_j)$ diverge and belong to the third group presented below.

country will receive more capital inflows than another one only if it catches up the technological frontier faster.

Interpretation. The behaviour of the investment term is the same as that of the group of countries with perfect financial markets: external debt has to increase to finance domestic investment for the country to feature positive productivity growth. On the other hand, we observe two effects on the direction and the volume of the saving component when the economy experiences some imperfection on the domestic financial market, but has a sufficient level of financial development to catch-up to the world technological frontier.

The first effect is driven by the expenditure in R&D. Indeed, a positive fraction of wealth is used to self-finance part of a new project because of the credit constraint while it decreases the household's current income. The second effect is due to the permanent income hypothesis. As the country invests in R&D and expects a higher growth rate in its productivity, households anticipate higher future income, thus increasing their consumption and decreasing saving. The country will borrow on the international financial market to finance this increase of the consumption. Because of the decrease in current income induced by the first effect, the volume of external debt going toward domestic saving is amplified.

Theoretically, both effects in combination with the effect of the investment component imply a positive relationship between capital inflows and productivity catch-up, as well as a higher volume of capital inflow compared to the group of countries with a perfect domestic credit market. To sum up, countries in this group catch-up relative to the technological frontier because of their level of financial development, and have positive net capital inflows. We observe a positive correlation between net capital inflows predicted by the saving component and productivity catch-up. A sufficient level of financial development amplifies the volume of the saving component, compared to an economy with a perfect credit market.

Capital inflows under imperfect credit market with divergence

This group is also characterized by countries with limited access to credit; the proximity to the technological frontier will evolve according to $F_2(a_j(t))$. Opposite to the previous group, countries in this group have an insufficient level of financial development so that $\phi_j < g/((1+g)\lambda\hat{\mathscr{F}}_j)$ and $F_2'(0) < 1$. The proximity of the country to the technological frontier will therefore converge to 0 at a lower growth rate, $g_j \in (0,g)$. By the l'Hôpital's rule, one shows that the productivity growth rate $g_j(t)$ will approach:

$$\lim_{t\to\infty} g_j(t) = (1+g)\lim_{t\to\infty}\left(\frac{a_j(t+1)}{a_j(t)}\right) - 1 = (1+g)\lim_{a\to 0} F_2'(a) = (1+g)\lambda\phi_j l\hat{\mathscr{F}}_j.$$

Equation (1.29), representing the volume and the direction of capital inflows between 0 and T, with respect to the exogenous parameters of the model, can be written as:

$$\frac{\Delta D_j}{Y_j(0)} = \overbrace{\left(\frac{\widehat{k} - \Theta_j\Phi_j^T\widehat{k}_j(0)}{\widehat{y}_j(0)}\right)(1+G_j)^T}^{\Delta D^c/Y_0} + \overbrace{\frac{\widehat{d}_j(0)}{\widehat{y}_j(0)}((1+G_j)^T\Theta_j\Phi_j^T - 1)}^{\Delta D^r/Y_0} + \overbrace{\left(\frac{a_j(T)}{a_j(0)} - 1\right)\frac{\widehat{k}}{\widehat{y}_j(0)}(1+G_j)^T}^{\Delta D^i/Y_0}$$
$$\underbrace{+\left(\frac{a_j(T)}{a_j(0)} - 1\right)\left(\frac{\omega(\widehat{k}) + \pi(\widehat{k}) - (1+\Gamma_j)\phi_j\hat{\mathscr{F}}_j}{\widehat{y}_j(0)(1+r^\star)}\right)((1+G_j)^T\Theta_j\Phi_j^T)\left[\sum_{t=0}^{T-1}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(\frac{\left(\frac{1+g_j}{1+g}\right)^T\Phi_j^{(t-T)} - \left(\frac{1+g_j}{1+g}\right)^t}{\left(\frac{1+g_j}{1+g}\right)^T - 1}\right)\right]}_{\Delta D^s/Y_0}.$$

Given that the economy converges to $0 < a_j(t) < a_j(0)$ at a lower growth rate than the growth rate of the technological frontier and that $\Phi_j < 1$, we find a negative relationship between net capital inflows predicted by saving term and productivity catch-up[9]. The prediction is therefore different for this group of countries. Without capital scarcity and initial debt, we can observe the following directions and volume of capital inflows with respect to productivity catch-up:

Proposition 3. As a country diverges, the saving component of net capital inflows is

9. For $g_j < g$ and $\Phi_j < 1$, we can show that $\sum_{t=0}^{T-1}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(\frac{\left(\frac{1+g_j}{1+g}\right)^T\Phi_j^{(t-T)} - \left(\frac{1+g_j}{1+g}\right)^t}{\left(\frac{1+g_j}{1+g}\right)^T - 1}\right) < 0.$

positive and investment component of net capital inflows is negative:

$$\Delta D^s_j/Y_j(0) > 0 \quad \text{only if} \quad a_j(T) < a_j(0),$$

and

$$\Delta D^i_j/Y_j(0) < 0 \quad \text{only if} \quad a_j(T) < a_j(0).$$

Proposition 4. Consider two identical countries with insufficient level of financial development, except for their productivity catch-up, country i will have a higher saving component and a lower investment component of net capital inflows than j only if i falls behind the technological frontier faster than j.

$$\Delta D^s_j/Y_j(0) < \Delta D^s_i/Y_i(0) \quad \text{if and only if} \quad \left(\frac{a_j(T)}{a_j(0)} - 1\right) > \left(\frac{a_i(T)}{a_i(0)} - 1\right),$$

and

$$\Delta D^i_j/Y_j(0) > \Delta D^i_i/Y_i(0) \quad \text{if and only if} \quad \left(\frac{a_j(T)}{a_j(0)} - 1\right) > \left(\frac{a_i(T)}{a_i(0)} - 1\right).$$

Interpretation. As the credit constraint does not affect the share of international borrowing going toward domestic investment, we can observe the same pattern of the investment term as for the two groups above. As for the previous credit-constrained group, countries with an insufficient level of financial development experience the same effects from productivity growth and R&D expenditures on the direction and volume of the saving component of net capital inflows.

The total effect will be positive net capital inflows, denoting that the volume of net capital inflows will also be amplified by the extra external debt due to the decrease in current income. In contrast, countries in this group fail to innovate and will fall behind the technological frontier. Also, the more a country is financially underdeveloped, the more its wealth decreases because of the wedge, and it likely falls below the technological frontier. We therefore observe a negative correlation between net capital inflows predicted by the saving component and productivity catch-up; as shown previously, the credit constraint implies a higher volume of capital inflows predicted by the saving component than in an economy with a perfect credit market.

We have shown that the Schumpeterian growth model allows us to have several predictions for the relationship between productivity growth and net capital inflows, depending on the level of financial development. In the next section, we assess our model predictions with the observed data.

1.4 Empirical Assessment of the Model

1.4.1 Data

We follow the standard calibration adopted in the development accounting literature proposed by Caselli (2005). The depreciation rate of physical capital is set to δ=0.06 and the capital share to α=0.3. We set the annual discount factor to β=0.96 and we assume log preference (γ = 1) as in Gourinchas and Jeanne (2013). The growth rate of the world technological frontier is set to (1+g) = 1.017, which corresponds to the observed average growth rate of the USA's total factor productivity between 1980 and 2010. Therefore, the gross world interest rate is in accordance with equation (1.5) given by $1+r^{\star} = 1.04$.

Regarding the measure of productivity, we use data from Version 9.0 of the Penn World Tables [10] (Feenstra et al., 2015), and from the World Bank's World Development Indicators for national accounts [11], population, GDP, price levels, income classification and investment. Productivity is obtained by using $A_j(t) = \left(y_j(t)/k_j(t)^{\alpha}\right)^{1/1-\alpha}$ and the level of capital stock per-efficient unit of labor $\widehat{k}_j(t)$ as $k_j(t)/A_j(t)$, where $y_j(t)$ and $k_j(t)$ are respectively the per-capita output and capital stock. Using the trend component of the productivity $A_j(t)^{hp}$ obtained with the Hodrick-Prescott filter, we then construct the proximity of each country to the technological frontier (that is defined as that of the

10. http://www.aeaweb.org/articles?id=10.1257/aer.20130954

11. https://data.worldbank.org/indicator/NY.GDP.MKTP.CD

U.S), as $a_j(t) = \left(A_j(t)^{hp}/\overline{A}(t)^{hp}\right)$.

We use the External Wealth of Nations Mark II database (EWN) of Lane and Milesi-Ferretti (2007) to calculate net capital inflows as the opposite of the ratio of the change in net foreign assets to initial GDP between 1980 and 2010. We normalize the series by GDP to control for the relative size of countries. We also use data on current accounts from the IMF's International Financial Statistics as an alternative measure of the net capital inflows. Since EWN and IFS data are in current US dollars, we use the PPP-adjustment method in Hsieh and Klenow (2007) to convert NFA from current US dollars to constant international dollars [12]. Since PWT 9.0 reports data on the price of investment $P_j(t)$, we use it as the price index. The PPP-adjustor is therefore computed as $\tilde{P}_j(t) = P_j(t)\left(\frac{CGDPO_j(t)}{RGDPO_j(t)}\right)$ where $CGDPO(RGDPO)$ is GDP at current (constant) US dollars (international dollars). As in Gourinchas and Jeanne (2013), the volume of capital inflows normalized by initial GDP between 1980 and 2010 for each country is constructed using:

$$\frac{\Delta D_j}{Y_j(0)} = \frac{D_j(2010) - D_j(1980)}{Y_j(1980)}. \tag{1.30}$$

As we do not have a direct measure of the level of financial development, we follow what is standard in the literature by using the ratio of private credit to GDP as a proxy of the parameter H. Data on private credit come from Beck et al. (2000) and represent the ratio of credit granted by financial intermediaries to the private sector, to GDP. [13]

The parameters regarding R&D for the countries with perfect credit markets are calibrated to match observed data in the United States; the probability of innovation $\mu^\star$ is set to 3.6%, which corresponds to the steady-state rate of creative destruction of firms in

12. According to Gourinchas and Jeanne (2013), this adjustment method does not affect the results and allows us to compare the capital flows measure to the capital accumulation or the output measures used in the development accounting literature.

13. We also use data on private credit by deposit money banks and other financial institutions to GDP, and, alternatively data on private credit by deposit money banks to GDP, although this did not affect qualitatively our results.

Table 1.1: Parameter calibration

	Perfect credit market	Imperfect credit market	
		Convergence	Divergence
Probability of innovation	$\mu^{\star}$=3.6%	$\mu(\widehat{a})$= 1.3%	$\mu(\widehat{a})$= 0%
Lagrange multiplier	$\Gamma = 0$	$\Gamma_{conv} = 0.13$	$\Gamma_{div} = 0.86$
Credit multiplier	$\phi^{\star} = \infty$	$\phi_{conv} = 3.99$	$\phi_{div} = 1.28$
Productivity growth rate	g=0.017	$g_{conv} = 0.028$	$g_{div} = 0.0091$

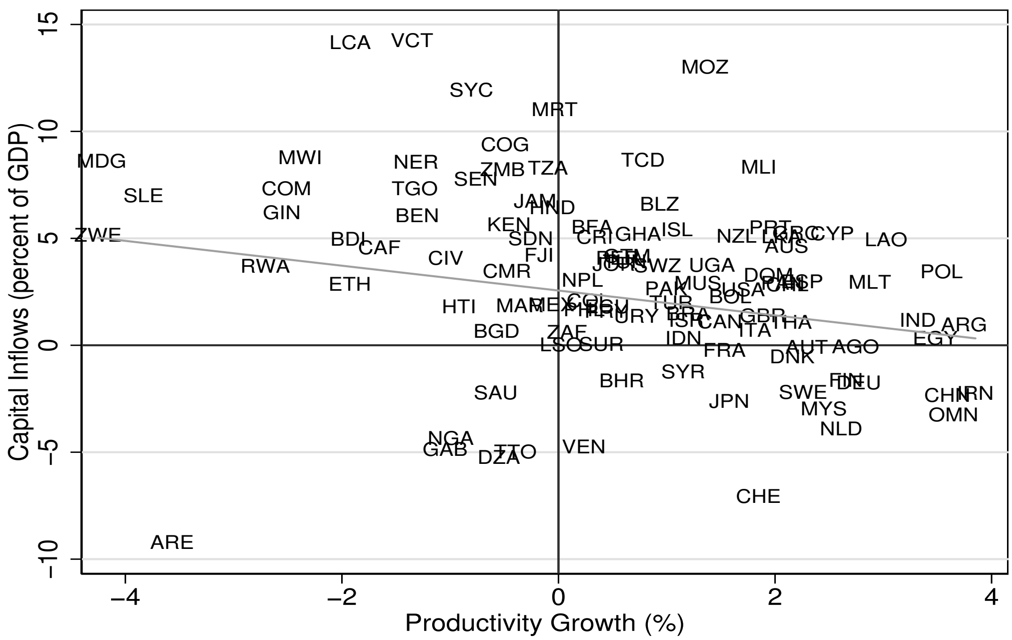
the U.S economy [14] and the productivity of R&D λ parameter is set by using equation (1.12). Table 1.1 summarizes the main parameters for the three groups of countries. ϕ_{conv} and ϕ_{div} are the average credit multipliers for each group. The average productivity growth rate is computed using $g_{conv} = (1+g)\lambda\phi_{conv}\hat{\mathscr{F}}_j$ and $g_{div} = (1+g)\lambda\phi_{div}\hat{\mathscr{F}}_j$. We use the World Bank data on R&D expenditure and data on countries' total wealth to set q = 0.025 identical to each country with credit constraints, assuming that 2.5% of the total wealth in the economy is dedicated to R&D self-financing. After excluding outlier countries, the final sample consists of 109 countries, including 90 non-OECD and 19 OECD countries. The start of the period is 1980 except for some countries (Angola, Burundi and Brunei based in 1985, Belize and Laos in 1984 and China in 1982), and the end of the period is 2010.

1.4.2 The "Allocation Puzzle": Evidence and Predictions

Figure 1.1 shows a quick illustration of the negative relationship between the average growth rate of total factor productivity (TFP) and the average ratio of net capital inflows measured by the negative of the ratio of the average current account to GDP for the whole sample over the period 1980-2010. In our sample, we include developed countries but the pattern of the capital inflows remains similar to the one illustrated by Gourinchas and Jeanne (2013): several countries with a negative average growth rate of TFP received positive capital inflows while others with a positive average growth rate of TFP exported capital. Also, one can observe that capital inflows decrease with productivity

14. See Caballero and Jaffe (1993).

Figure 1.1: Productivity growth and average capital inflows (-CA/GDP),1980-2010



growth as shown by the regression line; the slope is negative (-0.91) and statistically significant at 1% with a standard error of (0.20). In Figure 1.1, we also observe that the volume of capital flows varies between -5% of GDP for countries exporting capital, and up to 15% of GDP for countries importing capital. This reveals the high volume of capital movement across countries. The standard neoclassical growth model predicts a lower capital should flow from rich to poor countries, but that also a positive correlation is expected between productivity growth and capital inflows. Figure 1.1 highlights that is observed both in the data, the opposite of the neoclassical growth model predictions. Therefore, the "allocation Puzzle" (Gourinchas and Jeanne, 2013) and the "Lucas Puzzle" (Lucas, 1990) are depicted in the same figure. To explore further the relationship between net capital inflows and productivity catch-up, Table 1.2 groups countries according to their level of financial development. In group 1 we find countries with a high level of financial development, hence not financially constrained ($H_j \geq (1+r^\star)$). In group 2, we have countries with medium level of financial development ($H_j < (1+r^\star)$ and $\phi_j > g/((1+g)\lambda\hat{\mathscr{F}}_j)$). Finally, countries with a low level of financial development are in group 3 ($H_j < (1+r^\star)$ and $\phi_j \leq g/((1+g)\lambda\hat{\mathscr{F}}_j)$). On average, countries in our sample fall behind the technological frontier ($(a_j(T)/a_j(0)-1) = -0.19$) and receive positive capital inflows (63.80%), as measured by the ratio of change in external debt to initial output over the period 1980-2010. We observe the same pattern, on average, for non-OECD countries (productivity catch-up = -0.25 and net capital inflows = 70.64% of initial output). The finding for developing countries is similar to Gourinchas and Jeanne (2013), who found an average productivity catch up of -0.10 and an average net capital inflow of 31.49% with a sample of 68 developing countries. Compared to Non-OECD countries, on average, OECD countries are more likely to catch-up relative to the technological frontier (0.10) and to receive a positive, but lower, volume of capital inflows (31.41%). Among the three groups mentioned above, we observe a negative relationship between productivity catch-up and capital inflows only with the third group [15]. With a negative productivity catch-up (-0.27 on average), countries in this group borrow about 77.53% of their initial output. The pattern is different for the two other groups. With a positive productivity catch-up, countries with high (0.12) and sufficient (0.005) level of financial development borrow, respectively, on average, 42.02% and 18.08% of their initial output abroad. Our results are, without surprise, in line with the conclusion of Gourinchas and Jeanne (2013). Contrary to the prediction of the neoclassical growth model, net capital inflow are negatively correlated with productivity growth in the data. In Figure 1.2 we assess the predictions of the Schumpeterian growth model with a perfect financial market against the capital inflows observed in the data. Assuming that there is common population growth and no capital scarcity or initial debt, [16], we present only the predicted investment (D^i/Y_0) and saving terms (D^s/Y_0). On one hand, the observed negative relationship sharply appears in the graph: the slope of the regression line is negative and statistically significant (-1.19 significant at 5%). [17] One can observe that most countries that fall below the technological

15. See Table A.1. By grouping countries with a low level of financial development according to their income, one can observe that external debt decreases with productivity catch-up

16. Gourinchas and Jeanne (2013) show with multiple regressions and robustness checks that initial capital scarcity and population growth do not enter significantly in observed capital inflows. They also found that initial debt has a positive and significant coefficient, as predicted by their model.

17. The slope is also negative (-1.12) and significant (5%) when we include only non-OECD countries.

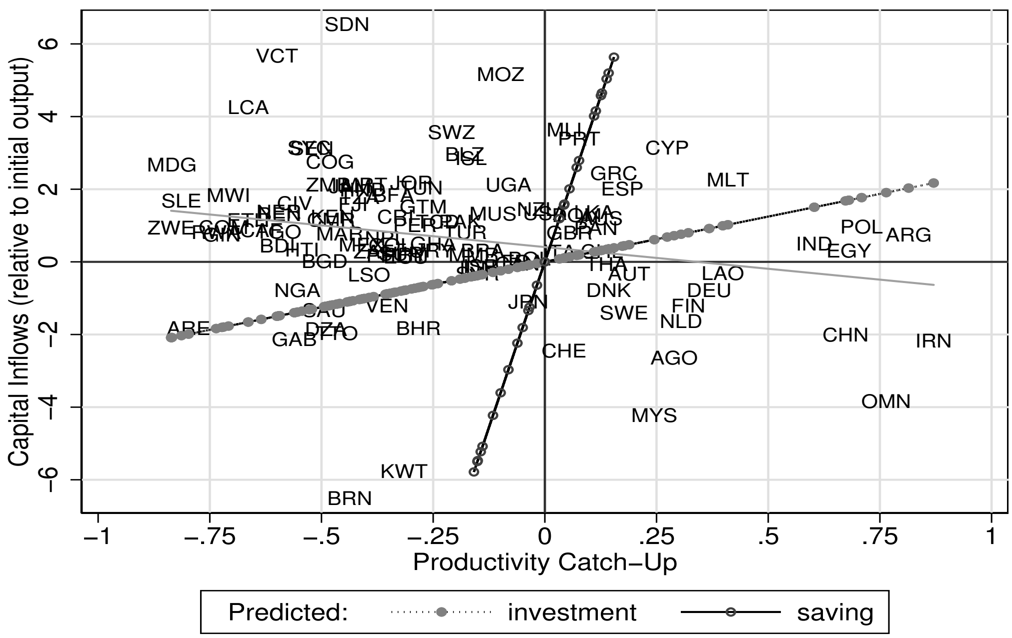
Table 1.2: Productivity catch-up and capital nflows (1980-2010) by level of financial development

	Productivity $\left(\frac{a_j(T)}{a_j(0)}-1\right)$	Fin Dev H_j	Capital flows $\Delta D_j/Y_j(0)$	Obs
Total sample	-0.19	41.56	63.80	109
OECD countries	0.10	94.06	31.41	19
Non-OECD countries	-0.25	30.48	70.64	90
By financial development level:				
High	0.12	135.39	42.02	7
Medium	0.005	79.44	18.08	21
Low	-0.27	23.63	77.53	81

frontier (the countries in the left panel) received positive net capital inflows. According to our threshold of financial development, these are countries that likely diverge because of their low level of financial development. In this panel, we find African and Latin-American countries, which are characterized by lower long-run productivity growth rates and lower levels of financial development. Asian, and some European, countries are characterized by higher productivity growth rates and higher levels of financial development in the right panel. On the other hand, we represent net capital inflows predicted by the Schumpeterian model in a perfect financial market. Under the assumption of absence of capital scarcity and initial debt, total capital inflow is the sum of the investment term and the saving term. We observe in the graph that both these terms have a positive slope for the reasons we invoked above. The volume of capital inflows predicted by the saving term is much greater than for the investment term. The slope of the saving term is 36.42, while that of the investment term is 2.49. [18] This is expected because of the assumption of infinite life of consumers in the model. According to Gourinchas and Jeanne (2013), households can perfectly smooth their consumption, so the saving term is more sensitive to the productivity growth. Gourinchas and Jeanne (2013) have predicted approximately the same magnitude for the investment term but

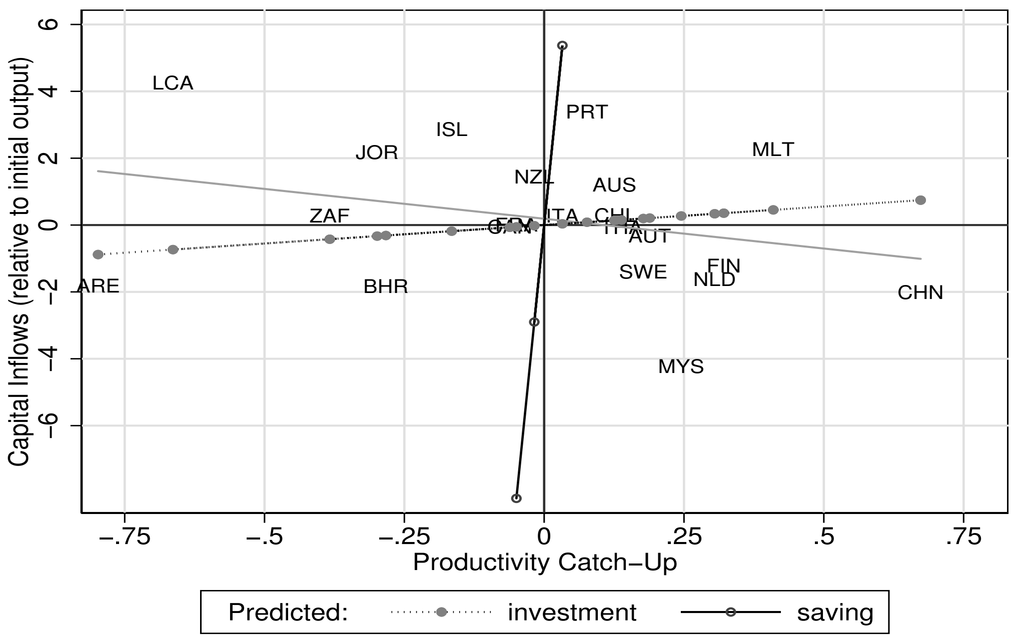
18. Gourinchas and Jeanne (2013) predict a slope of the investment term=2.14 and a slope for the saving term=5.25. The slope of saving is higher in our model because we normalize the saving and investment terms by the initial income (as indicated in equation (1.18)) instead of normalizing by capital, as they did.

Figure 1.2: Productivity catch-up and average capital inflows (NFA), 1980-2010



a lower one for the saving term. Considering the positive correlation predicted by our model in a perfect financial market and the negative correlation observed in the data, we conclude that the Schumpeterian growth model also faces the “allocation Puzzle” as in the neoclassical growth model. We now turn to the prediction of the Schumpeterian growth model with imperfection in the domestic financial market and compare it with the observations. Figures 1.3 and 1.4 show capital flows predicted by the saving and investment components against the observed data for the group of countries which are credit constrained. In Figure 1.3, we group countries with a sufficient level of financial development. As we discussed previously, countries that belonging to this group catch-up with the technological frontier in the long run. As with the model without credit constraint, one can observe that net capital inflows predicted by saving and investment terms have positive slopes; because of the credit constraint, the saving component predicted by the model will be greater as we also explained in the previous section, but the predicted investment component remains unchanged. The saving term has a greater positive slope (164.73%). Regarding the observed data, productivity catch-up seems to

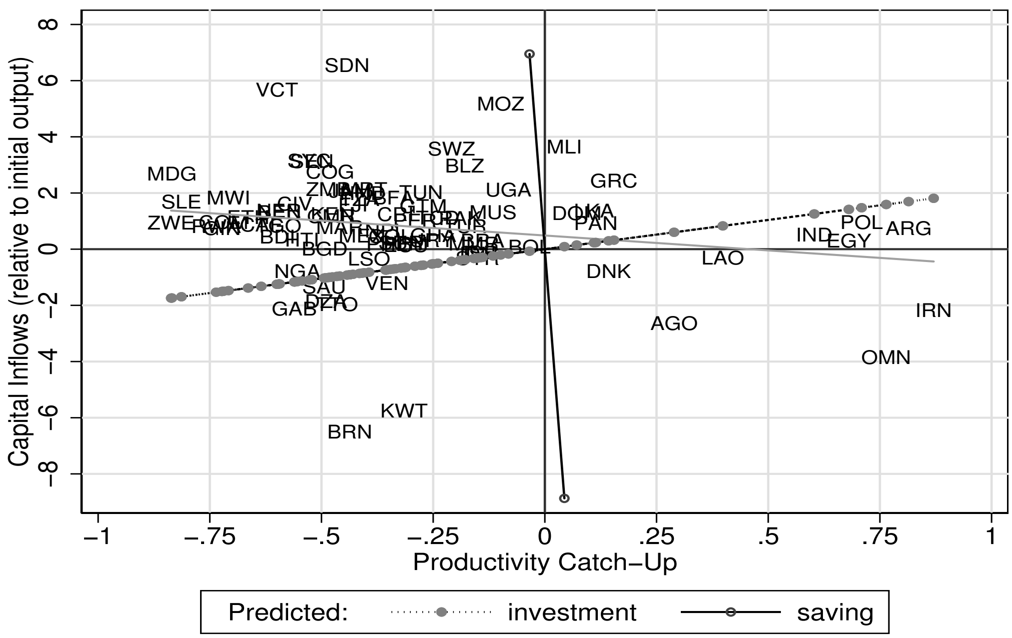
Figure 1.3: Productivity catch-up and average capital inflows 1980-2010, medium level of financial development



have no significant effect on the capital inflows or, at best, a positive effect. [19] As we do not have a wider sample of convergent countries with credit constraint, the correlation between capital flows and productivity catch-up observed in the data is ambiguous. Therefore, we conclude that the "allocation Puzzle" for this group of countries is related to the positive correlation predicted by the model and the positive (at most null) correlation observed in the data. Our main finding is presented in Figure 1.4. Countries in this graph are those which likely diverge because of a low level of financial development. When we look at the observed net external debt and productivity catch-up, most of the countries are located in the left panel. Few of them catch-up to the frontier despite their low level of financial development. The whole pattern is a decrease of net capital inflows with the productivity catch-up. We also draw the saving and investment terms predicted by the model with imperfection in the domestic financial market. The

19. Given that only a few countries belong to this group, we find that the regression of the net capital inflows on productivity catch-up gives is non-significant.

Figure 1.4: Productivity catch-up and average capital inflows 1980-2010, low level of financial development



predicted investment term increases with the productivity catch-up as we argued above. An increase of one percentage point in productivity catch-up implies an increase of capital inflows predicted by investment term by 2.08% of initial output. This is identical to the model without credit constraint as well as for the model with a sufficient level of financial development. That is because the imperfection introduced in the model does not affect investment, but only the saving component of net capital inflows. Our model prediction about the investment component of capital flows are similar to the conclusion of Gourinchas and Jeanne (2013). Concerning the saving component, the low level of financial development, in addition to preventing the countries from catching up to the technological frontier, it also increases, generally, external borrowing going toward saving. The more a country is financially constrained, the more it falls below the technological frontier and the more its net capital inflows predicted by the saving component is higher. This leads to the negative correlation between productivity catch-up and net external debt predicted by the saving term.

For countries which fail to catch-up relative to the technological frontier because of their level of financial development, the direction of net capital flows predicted by the saving component of our model with friction on the domestic financial market fits the observed data. However, our model fails in replicating the volume of net capital inflows. Although the predicted investment component succeeds to replicate the magnitude of net capital inflows in absolute value as with the observed net external debt [20], our predicted saving component decreases by 202.94 % of initial output for an increase of one percentage point in the productivity catch-up for countries with an insufficient level of financial development; the predicted saving component increases by 164.73 % of initial output for an increase of one percentage point in the productivity catch-up for countries with a sufficient level of financial development. To be able to replicate perfectly the volume of observed net capital inflows, Gourinchas and Jeanne (2013) estimate an average saving wedge of about 1% of aggregate saving, which is relatively small. In Gourinchas and Jeanne (2013), the saving wedge τ_s for each country is computed such that the predicted net capital inflows perfectly match the observed net external debt. We propose in our model an endogenous wedge of about 5% of aggregate saving, that itself depends on the level of financial development. We assume that there is no initial debt or capital scarcity and use this wedge to predict separately the saving and the investment components. [21] This is not the case in Gourinchas and Jeanne (2013), who also use an additional wedge for physical capital. The saving wedge is estimated in their model using the whole model (with initial debt and capital scarcity).

The Schumpeterian growth model gives the same prediction as the neoclassical growth model about capital inflows when there is no friction on the domestic financial market. We show that observed net capital inflows are negatively correlated with the average

20. Net capital inflows predicted by the investment component increases by 2.08% and 1.10% of initial output for an increase of one percentage point in the productivity catch-up, respectively, for countries with insufficient and sufficient levels of financial development. According to the data, net capital inflows decrease by 1.19% of initial output for an increase of one per cent of productivity catch-up.

21. In addition to the saving wedge, Gourinchas and Jeanne (2013) also use capital wedge that distorts investments decisions. This last affects directly the gross return to capital. Therefore, the saving wedge is estimated using a model with distortions on investment and saving decisions. In our model, there is no capital wedge as in Gourinchas and Jeanne (2013).

growth rate of productivity whereas the theoretical model predicts a positive correlation. In a perfect financial market, our model also faces the "allocation Puzzle" and fails to explain the negative correlation between productivity growth and net capital inflows. However, by assuming a friction in the domestic financial market that reduces the capacity of entrepreneurs to borrow and invest in a new project, the model is able to replicate the negative relationship between capital flows and productivity growth observed with the data, for countries which likely diverge from the technological frontier.

1.5 Concluding Remarks

We addressed in this paper the "allocation Puzzle" by looking at the movement of capital across countries according to their level of financial development. We introduced a credit constraint in a Schumpeterian growth model and showed that this constraint reduces a country's total wealth. When the level of financial development allows a country to catch-up relative to the world technological frontier, we find that net capital inflows increase with the productivity catch-up. In contrast, we find that the saving component of net capital inflows decreases with productivity catch-up when a country grows at a lower rate than the technological frontier. Since the "allocation Puzzle" is more related to domestic saving (Gourinchas and Jeanne, 2013; Alfaro et al., 2014), our model contributes to explaining the negative correlation between productivity catch-up and capital inflows. We also showed that the "Lucas Puzzle" holds in a Schumpeterian growth framework and, with more recent data, can be generalized to a larger sample that includes developed countries.

However, despite these interesting findings, our model is unable to replicate the volume of the external debt flowing from rich to poor countries (Lucas, 1990), as observed in the data. The shortcoming of our model in replicating the volume of capital flows can be due to the fact that the saving wedge in our model is somewhat high. [22] In addition, our model does not take into account human capital, which is an important determinant of capital flows (Lucas, 1990) and saving (Aghion et al., 2016) in developing countries.

22. Gourinchas and Jeanne (2013) estimated an average wedge of 1% of aggregate saving to replicate perfectly the volume of observed net capital inflows rather than an average wedge of 5% in our model.

We believe that these features can help to improve the predictions of our model. We will propose an approach in this direction in future research.

APPENDIX A

ADDITIONAL TABLES AND FIGURES

Table A.1: Productivity catch-up and capital inflows (1980-2010), low level of financial development

	Productivity $\left(\frac{a_j(T)}{a_j(0)}-1\right)$	Fin Dev H_j	Capital flows $\Delta D_j/Y_j(0)$	Obs
Group of countries with level of financial development	-0.27	23.63	77.53	81
Low income	-0.40	14.40	130.43	39
Lower middle income	-0.19	28.47	103.51	23
Upper middle income	-0.09	30.98	-7.98	14
High income	-0.12	52.83	-215.10	5

Figure A.1: Average private credit and productivity catch-up 1980-2010

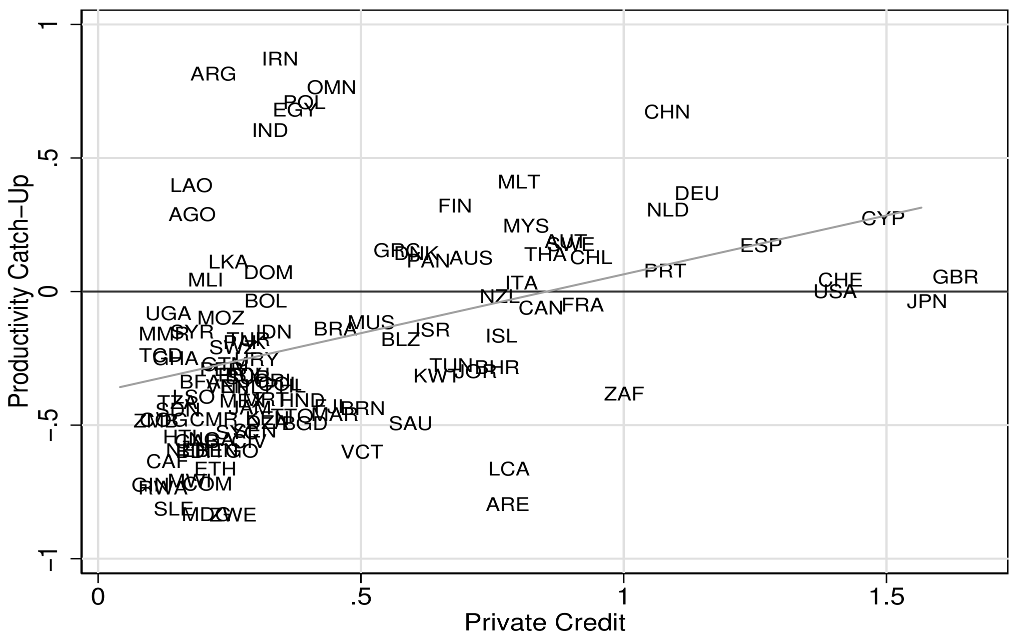


Figure A.2: Average private credit and productivity catch-up 1980-2010, low level of financial development

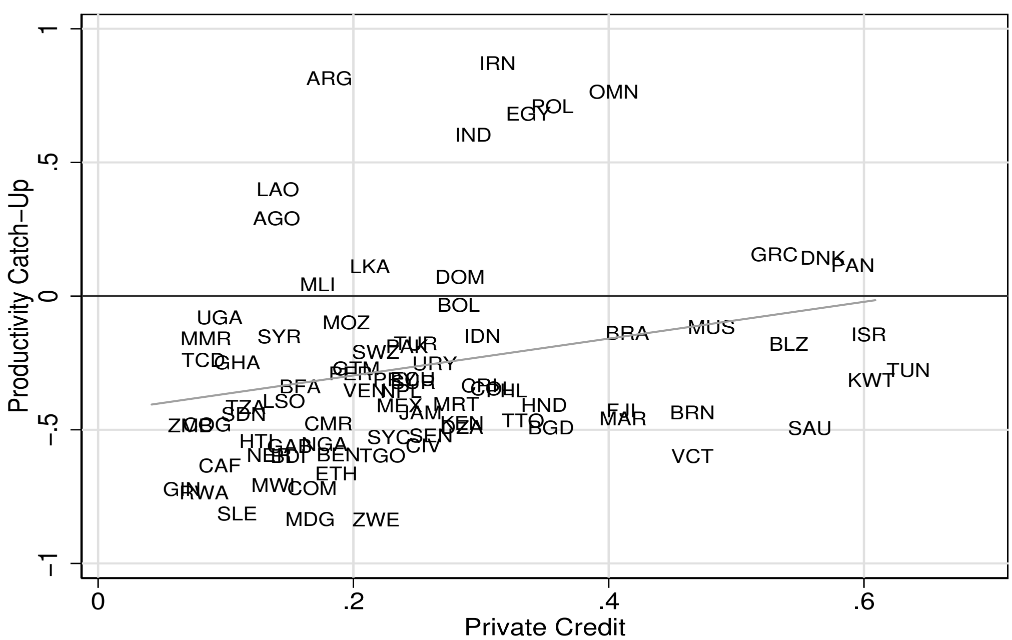


Figure A.3: Average private credit and average capital inflows 1980-2010

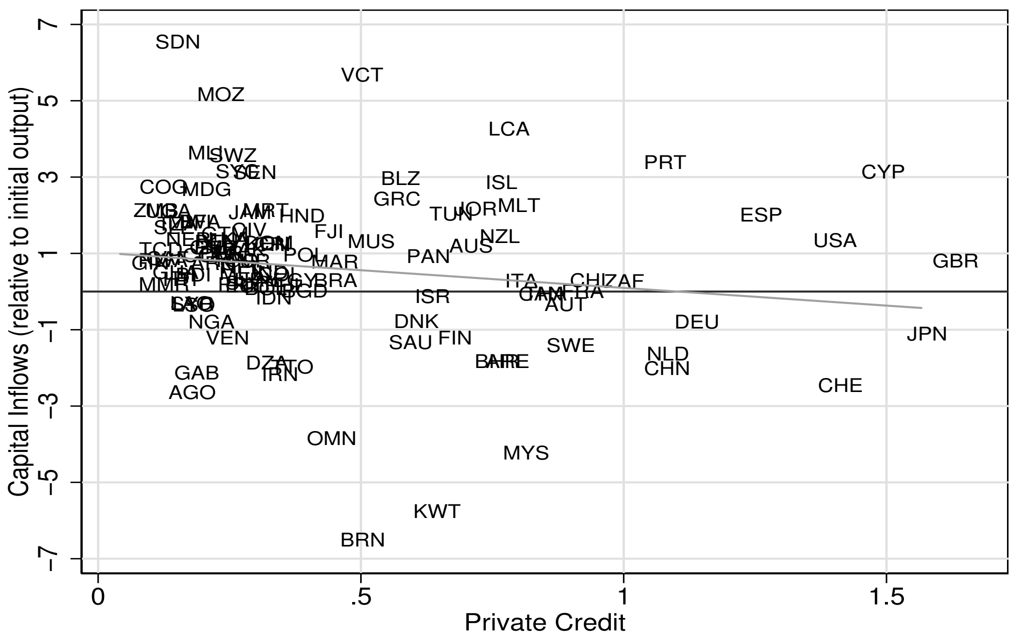
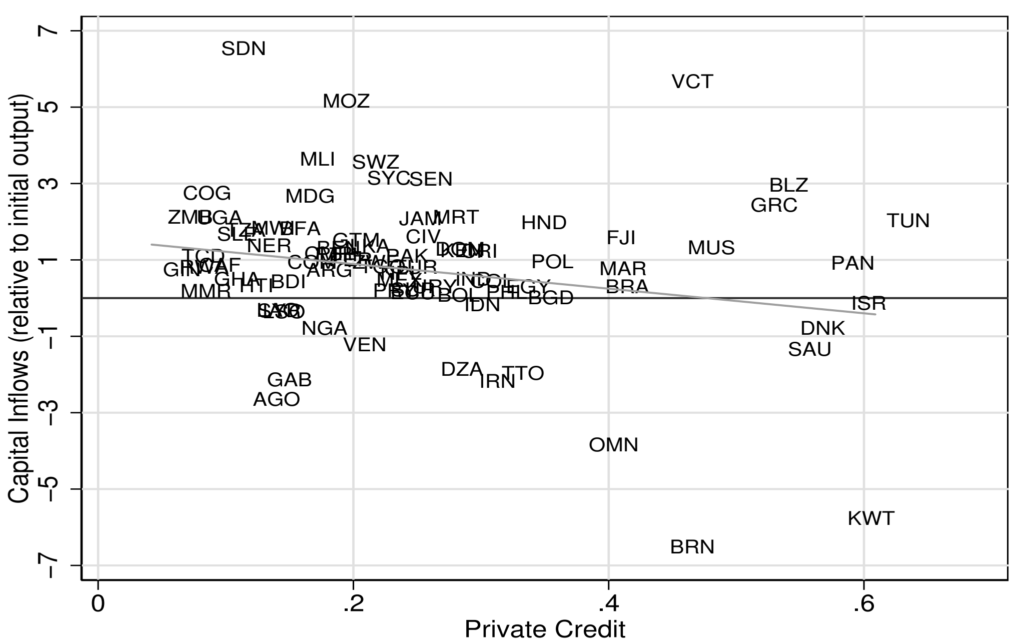


Figure A.4: Average private credit and average capital inflows 1980-2010, low level of financial development



APPENDIX B

B.1 Ratio of cumulated net capital inflows to initial output under perfect financial market

Ratio of the debt to initial GDP. We first write the ratio of the debt to initial GDP by expressing variables per-efficient worker.

$$\frac{\Delta D_j}{Y_j(0)} = \frac{D_j(T) - D_j(0)}{Y_j(0)} = \frac{\widehat{d}_j(T)\dfrac{A_j(T)L_j(T)}{A_j(0)L_j(0)} - \widehat{d}_j(0)}{\widehat{y}_j(0)}$$

where $\widehat{d}_j(t) \equiv \dfrac{D_j(t)}{A_j(t)L_j(t)}$ is the per-efficient worker debt and $\widehat{y}_j(t) \equiv \dfrac{Y_j(t)}{A_j(t)L_j(t)}$ is the per efficient worker GDP, for all $t \geq 0$. Using $a_j(t) \equiv \dfrac{A_j(t)}{\overline{A}(t)}$ the proximity to the frontier, $L_j(T) = L_j(0)(1+n_j)^T$ and $\overline{A}(T) = \overline{A}(0)(1+g)^T$, we can write the debt ratio as:

$$\frac{\Delta D_j}{Y_j(0)} = \frac{\dfrac{a_j(T)}{a_j(0)}\widehat{d}_j(T)(1+G_j)^T - \widehat{d}_j(0)}{\widehat{y}_j(0)} \tag{B.1}$$

where $1+G_j \equiv (1+g)(1+n_j)$ without loss of generality.

Steady-state debt per-efficient worker. The law of motion for total assets is given by:

$$\mathscr{A}_j(t+1) = w_j(t)L_j(t) + (1+r^\star)\mathscr{A}_j(t) - C_j(t)$$

where market clearing implies that assets must be equal to: $\mathscr{A}_j(t) = K_j(t) - D_j(t) + V_j(t)$, where $K_j(t)$ is the stock of physical capital of country j, $D_j(t)$ is country's j external debt, and $V_j(t) = \int_0^{Q_j(t)} V_j(\nu,t)d\nu$ is the total value of corporate assets. We have:

$$C_j(t)+K_j(t+1)-D_j(t+1)=w_j(t)L_j(t)+(1+r^\star)(K_j(t)-D_j(t))+(r^\star V_j(t)-\Delta V_j(t))$$

Given the recursive form of the firm value $V_j(\nu,t) = \frac{1}{1+r^\star}\left(\pi_j(\nu,t)+(1-\mu_j(\nu,t))V_j(\nu,t+1)\right)$ and the free entry condition in the R&D sector $\mu_j(\nu,t)V_j(\nu,t+1) = Z_j(\nu,t)$, we have:

$$\begin{aligned}\int_0^{Q_j(t)}\left(r^\star V_j(\nu,t)-\Delta V_j(\nu,t)\right)d\nu &= \int_0^{Q_j(t)}\left(\pi_j(\nu,t)-Z_j(\nu,t)\right)d\nu \\ &= \Pi_j(t)-Z_j(t)\end{aligned}$$

so that:

$$C_j(t)+K_j(t+1)-D_j(t+1)=w_j(t)L_j(t)+(1+r^\star)(K_j(t)-D_j(t))+\Pi_j(t)-Z_j(t)$$

where $\Pi_j(t) = \int_0^{Q_j(t)} \pi_j(\nu,t)d\nu$ is aggregate profits and $Z_j(t) = \int_0^{Q_j(t)} Z_j(\nu,t)d\nu$ stands for aggregate R&D expenditures.

We can now write the budget constraint in terms of per-efficient worker variables as:

$$\begin{aligned}\widehat{c}_j(t)+(1+g_j(t+1))(1+n_j)\left(\widehat{k}_j(t+1)-\widehat{d}_j(t+1)\right) &= (1+r^\star)\left(\widehat{k}_j(t)-\widehat{d}_j(t)\right) \\ &\quad +\omega(\widehat{k})+\pi(\widehat{k})-\frac{z(\hat{k})}{a_j(t)}\end{aligned}$$

where $z(\hat{k}) = \left(\pi(\hat{k}) - \frac{\xi}{\psi\lambda}\frac{r^\star-g}{1+g}\right)$ and $g_j(t+1)$ is the growth rate of average productivity, i.e., $g_j(t+1) \equiv \dfrac{A_j(t+1)-A_j(t)}{A_j(t)}$.

After time T, the economy steady growth path is $g_j(t+1) = g$, $\widehat{k}_j(t+1) = \widehat{k}_j(t) = \widehat{k}$

and $\widehat{d}_j(t+1) = \widehat{d}_j(t) = \widehat{d}_j(T)$, so that the steady-state debt value is given by:

$$\widehat{d}_j(T) = \widehat{k} + \frac{\omega(\widehat{k}) + \pi(\widehat{k}) - \frac{z(\widehat{k})}{a_j(T)} - \widehat{c}_j(T)}{r^\star - G_j} \tag{B.2}$$

Steady-state consumption per-efficient worker. We now compute steady-state consumption in terms of the proximity to the technological frontier. Steady-state consumption per-effective worker is defined by:

$$\widehat{c}_j(T) = \frac{c_j(T)}{A_j(T)}$$

We can therefore define the average productivity as $A_j(t) = a_j(t)\overline{A}(t) = \overline{A}(0)a_j(t)(1+g)^t$.

Using $c_j(T) = c_j(0)(1+g)^T$ and the definition for average productivity, we can write:

$$\widehat{c}_j(T) = \frac{c_j(0)(1+g)^T}{a_j(T)\overline{A}_j(0)(1+g)^T}$$

that becomes:

$$\widehat{c}_j(T) = \frac{\widehat{c}_j(0)}{a_j(T)/a_j(0)} \tag{B.3}$$

Initial consumption per-efficient worker. The per-worker intertemporal budget constraint is:

$$\begin{aligned}\textstyle\sum_{t=0}^{\infty} \left(\frac{1+n_j}{1+r^\star}\right)^t c_j(t) \quad &= (1+r^\star)(k_j(0) - d_j(0)) \\ &+ \sum_{t=0}^{\infty} \left(\frac{1+n_j}{1+r^\star}\right)^t w_j(t) + \sum_{t=0}^{\infty} \left(\frac{1+n_j}{1+r^\star}\right)^t (\pi_j(t) - z_j(t))\end{aligned}$$

Using $c_j(t) = \widehat{c}_j(0)A_j(0)(1+g)^t$, $w_j(t) = \omega(\widehat{k})a_j(t)\overline{A}_j(0)(1+g)^t$, $\pi_j(t) = \pi(\widehat{k})a_j(t)\overline{A}_j(0)(1+g)^t$ and $z_j(t) = z(\widehat{k})\overline{A}_j(0)(1+g)^t$ we can write:

$$\sum_{t=0}^{\infty}\left(\tfrac{1+n_j}{1+r^\star}\right)^t \widehat{c}_j(0)A_j(0)(1+g)^t = (1+r^\star)(k_j(0)-d_j(0)) + \sum_{t=0}^{\infty}\left(\tfrac{1+n_j}{1+r^\star}\right)^t \omega(\widehat{k})a_j(t)\overline{A}_j(0)(1+g)^t$$
$$+\sum_{t=0}^{\infty}\left(\tfrac{1+n_j}{1+r^\star}\right)^t \left(\pi(\widehat{k})a_j(t)\overline{A}_j(0)(1+g)^t - z(\widehat{k})\overline{A}_j(0)(1+g)^t\right)$$

It follows that:

$$\sum_{t=0}^{\infty}\left(\tfrac{(1+g)(1+n_j)}{1+r^\star}\right)^t \widehat{c}_j(0)A_j(0) = (1+r^\star)(k_j(0)-d_j(0)) + \sum_{t=0}^{\infty}\left(\tfrac{(1+g)(1+n_j)}{1+r^\star}\right)^t \omega(\widehat{k})a_j(t)\overline{A}_j(0)$$
$$+\sum_{t=0}^{\infty}\left(\tfrac{(1+g)(1+n_j)}{1+r^\star}\right)^t \left(\pi(\widehat{k})a_j(t)\overline{A}_j(0) - z(\widehat{k})\overline{A}_j(0)\right)$$

Since $(1+g)(1+n_j) = (1+G_j)$, without loss of generality and dividing both sides by $A_j(0)$, we can write:

$$\begin{aligned}\sum_{t=0}^{\infty}\left(\frac{1+G_j}{1+r^\star}\right)^t \widehat{c}_j(0) &= (1+r^\star)\left(\widehat{k}_j(0)-\widehat{d}_j(0)\right) + \sum_{t=0}^{\infty}\left(\frac{1+G_j}{1+r^\star}\right)^t \frac{a_j(t)}{a_j(0)}\omega(\widehat{k}) \\ &+\sum_{t=0}^{\infty}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(\frac{a_j(t)}{a_j(0)}\pi(\widehat{k}) - \frac{z(\widehat{k})}{a_j(0)}\right)\end{aligned}$$

Since :

$$\sum_{t=0}^{\infty}\left(\frac{1+G_j}{1+r^\star}\right)^t = \frac{1+r^\star}{r^* - G_j}$$

the previous equation implies that:

$$\begin{aligned}\widehat{c}_j(0) &= \frac{r^\star - G_j}{a_j(0)(1+r^\star)}\sum_{t=0}^{\infty}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(\omega(\widehat{k})+\pi(\widehat{k})\right)a_j(t) \\ &-\frac{z(\widehat{k})}{a_j(0)} + (r^\star - G_j)\left(\widehat{k}_j(0)-\widehat{d}_j(0)\right)\end{aligned} \tag{B.4}$$

Ratio of cumulated net capital inflows to initial output between $t = 0$ and $t = T$. Given equations (B.1),(B.2),(B.3) and (B.4), we can finally compute the volume of capital inflows in terms of the exogenous parameters of the model as follow: Using the initial consumption per-efficient worker equation, we can write steady-state consumption per effective worker as:

$$\begin{aligned}\widehat{c}_j(T) &= \frac{r^\star - G_j}{a_j(T)(1+r^\star)} \sum_{t=0}^{\infty} \left(\frac{1+G_j}{1+r^\star}\right)^t \left(\omega(\widehat{k}) + \pi(\widehat{k})\right) a_j(t) \\ &\quad - \frac{z(\widehat{k})}{a_j(T)} + \frac{a_j(0)}{a_j(T)}(r^\star - G_j)\left(\widehat{k}_j(0) - \widehat{d}_j(0)\right)\end{aligned}$$

We then introduce this last term into the steady-state debt per-worker equation. It follows that:

$$\begin{aligned}\widehat{d}_j(T) &= \widehat{k} + \left(\frac{\omega(\widehat{k}) + \pi(\widehat{k})}{r^\star - G_j}\right) - \frac{a_j(0)}{a_j(T)}\left(\widehat{k}_j(0) - \widehat{d}_j(0)\right) \\ &\quad - \frac{1}{a_j(T)(1+r^\star)} \sum_{t=0}^{\infty} \left(\frac{1+G_j}{1+r^\star}\right)^t \left(\omega(\widehat{k}) + \pi(\widehat{k})\right) a_j(t)\end{aligned}$$

Multiplying both side by $\dfrac{a_j(T)}{a_j(0)}(1+G_j)^T$, we have:

$$\begin{aligned}\frac{a_j(T)}{a_j(0)}(1+G_j)^T \widehat{d}_j(T) &= \frac{a_j(T)}{a_j(0)}(1+G_j)^T \left(\tfrac{\omega(\widehat{k})+\pi(\widehat{k})}{r^\star - G_j}\right) - (1+G_j)^T\left(\widehat{k}_j(0) - \widehat{d}_j(0)\right) \\ &\quad + \frac{a_j(T)}{a_j(0)}(1+G_j)^T \widehat{k} - \frac{(1+G_j)^T}{a_j(0)(1+r^\star)} \textstyle\sum_{t=0}^{\infty} \left(\tfrac{1+G_j}{1+r^\star}\right)^t \left(\omega(\widehat{k}) + \pi(\widehat{k})\right) a_j(t)\end{aligned}$$

Introducing this last into equation (B.1), we finally obtain:

$$\begin{aligned}\frac{\Delta D_j}{Y_j(0)} &= \frac{a_j(T)}{a_j(0)}(1+G_j)^T \left(\tfrac{\omega(\widehat{k})+\pi(\widehat{k})}{\widehat{y}_j(0)(r^\star - G_j)}\right) - (1+G_j)^T \left(\frac{\widehat{k}_j(0)}{\widehat{y}_j(0)} - \frac{\widehat{d}_j(0)}{\widehat{y}_j(0)}\right) - \frac{\widehat{d}_j(0)}{\widehat{y}_j(0)} \\ &\quad + \frac{a_j(T)}{a_j(0)}(1+G_j)^T \frac{\widehat{k}}{\widehat{y}_j(0)} - \frac{(1+G_j)^T}{a_j(0)\widehat{y}_j(0)(1+r^\star)} \textstyle\sum_{t=0}^{\infty} \left(\tfrac{1+G_j}{1+r^\star}\right)^t \left(\omega(\widehat{k}) + \pi(\widehat{k})\right) a_j(t)\end{aligned}$$

$$\begin{aligned}\frac{\Delta D_j}{Y_j(0)} &= \frac{\widehat{d}_j(0)}{\widehat{y}_j(0)}((1+G_j)^T - 1) + \frac{\widehat{k}}{\widehat{y}_j(0)}\left(\frac{a_j(T)}{a_j(0)} - 1\right)(1+G_j)^T + \frac{a_j(T)}{a_j(0)}(1+G_j)^T \left(\tfrac{\omega(\widehat{k})+\pi(\widehat{k})}{\widehat{y}_j(0)(r^\star - G_j)}\right) \\ &\quad + \frac{\widehat{k} - \widehat{k}_j(0)}{\widehat{y}_j(0)}(1+G_j)^T - \frac{(1+G_j)^T}{a_j(0)\widehat{y}_j(0)(1+r^\star)} \textstyle\sum_{t=0}^{\infty} \left(\tfrac{1+G_j}{1+r^\star}\right)^t \left(\omega(\widehat{k}) + \pi(\widehat{k})\right) a_j(t)\end{aligned}$$

Let us denote:

$$\begin{aligned}
A &= \frac{(1+G_j)^T}{a_j(0)\widehat{y}_j(0)(1+r^\star)}\left[\sum_{t=0}^{\infty}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(\omega(\widehat{k})+\pi(\widehat{k})\right)a_j(t)\right] \\
&= \frac{(1+G_j)^T}{a_j(0)\widehat{y}_j(0)(1+r^\star)}\left[\sum_{t=0}^{\infty}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(\omega(\widehat{k})+\pi(\widehat{k})\right)\left(a_j(t)-a_j(T)+a_j(T)\right)\right] \\
&= \frac{(1+G_j)^T}{a_j(0)\widehat{y}_j(0)(1+r^\star)}\left[\sum_{t=0}^{\infty}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(\omega(\widehat{k})+\pi(\widehat{k})\right)\left(a_j(t)-a_j(T)\right)\right] \\
&\quad +\frac{(1+G_j)^T}{a_j(0)\widehat{y}_j(0)(1+r^\star)}\left[\sum_{t=0}^{\infty}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(\omega(\widehat{k})+\pi(\widehat{k})\right)a_j(T)\right]
\end{aligned}$$

Using

$$\sum_{t=0}^{\infty}\left(\frac{1+G_j}{1+r^\star}\right)^t = \frac{1+r^\star}{r^* - G_j}$$

we can write:

$$\begin{aligned}
A &= \frac{(1+G_j)^T}{a_j(0)\widehat{y}_j(0)(1+r^\star)}\left[\sum_{t=0}^{\infty}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(\omega(\widehat{k})+\pi(\widehat{k})\right)\left(a_j(t)-a_j(T)\right)\right] \\
&\quad +\frac{a_j(T)}{a_j(0)}(1+G_j)^T\left(\frac{\omega(\widehat{k})+\pi(\widehat{k})}{\widehat{y}_j(0)(r^\star-G_j)}\right) \\
&= \frac{\omega(\widehat{k})+\pi(\widehat{k})}{a_j(0)\widehat{y}_j(0)(1+r^\star)}(1+G_j)^T\left[\sum_{t=0}^{\infty}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(a_j(t)-a_j(T)\right)\right] \\
&\quad +\frac{a_j(T)}{a_j(0)}(1+G_j)^T\left(\frac{\omega(\widehat{k})+\pi(\widehat{k})}{\widehat{y}_j(0)(r^\star-G_j)}\right) \\
&= \frac{\omega(\widehat{k})+\pi(\widehat{k})}{a_j(0)\widehat{y}_j(0)(1+r^\star)}(1+G_j)^T\left[\sum_{t=0}^{T-1}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(a_j(t)-a_j(T)\right)\right] \\
&\quad +\frac{\omega(\widehat{k})+\pi(\widehat{k})}{a_j(0)\widehat{y}_j(0)(1+r^\star)}(1+G_j)^T\left[\sum_{t=T}^{\infty}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(a_j(t)-a_j(T)\right)\right] \\
&\quad +\frac{a_j(T)}{a_j(0)}(1+G_j)^T\left(\frac{\omega(\widehat{k})+\pi(\widehat{k})}{\widehat{y}_j(0)(r^\star-G_j)}\right)
\end{aligned}$$

Using $a_t(j) = a_j(T)\ \forall t \geq T$, then we can write A as

$$
\begin{aligned}
A = \quad & \frac{\omega(\widehat{k})+\pi(\widehat{k})}{a_j(0)\widehat{y}_j(0)(1+r^\star)}(1+G_j)^T\left[\textstyle\sum_{t=0}^{T-1}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(a_j(t)-a_j(T)\right)\right] \\
& +\frac{a_j(T)}{a_j(0)}(1+G_j)^T\left(\tfrac{\omega(\widehat{k})+\pi(\widehat{k})}{\widehat{y}_j(0)(r^\star-G_j)}\right) \\
= \quad & \left(1-\tfrac{a_j(T)}{a_j(0)}\right)\left(\frac{\omega(\widehat{k})+\pi(\widehat{k})}{a_j(0)\widehat{y}_j(0)(1+r^\star)}\right)(1+G_j)^T \\
& *\left[\textstyle\sum_{t=0}^{T-1}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(1-\left(\frac{a_j(t)-a_j(0)}{a_j(T)-a_j(0)}\right)\right)\right]+\frac{a_j(T)}{a_j(0)}(1+G_j)^T\left(\tfrac{\omega(\widehat{k})+\pi(\widehat{k})}{\widehat{y}_j(0)(r^\star-G_j)}\right)
\end{aligned}
$$

We then substitute this expression into the capital inflows equation, to obtain:

$$
\begin{aligned}
\frac{\Delta D_j}{Y_j(0)} = & \frac{\widehat{k}-\widehat{k}_j(0)}{\widehat{y}_j(0)}(1+G_j)^T+\frac{\widehat{d}_j(0)}{\widehat{y}_j(0)}((1+G_j)^T-1)+\frac{\widehat{k}}{\widehat{y}_j(0)}\left(\frac{a_j(T)}{a_j(0)}-1\right)(1+G_j)^T \\
& +\left(\frac{a_j(T)}{a_j(0)}-1\right)\left(\frac{\omega(\widehat{k})+\pi(\widehat{k})}{\widehat{y}_j(0)(1+r^\star)}\right)(1+G_j)^T\left[\sum_{t=0}^{T-1}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(1-\left(\frac{a_j(t)-a_j(0)}{a_j(T)-a_j(0)}\right)\right)\right]
\end{aligned}
$$

$$
\begin{aligned}
\frac{\Delta D_j}{Y_j(0)} = & \overbrace{\frac{\widehat{k}-\widehat{k}_j(0)}{\widehat{y}_j(0)}(1+G_j)^T}^{\Delta D^c/Y_0}+\overbrace{\frac{\widehat{d}_j(0)}{\widehat{y}_j(0)}((1+G_j)^T-1)}^{\Delta D^t/Y_0}+\overbrace{\frac{\widehat{k}}{\widehat{y}_j(0)}\left(\frac{a_j(T)}{a_j(0)}-1\right)(1+G_j)^T}^{\Delta D^i/Y_0} \\
& \underbrace{+\left(\frac{a_j(T)}{a_j(0)}-1\right)\left(\frac{\omega(\widehat{k})+\pi(\widehat{k})}{\widehat{y}_j(0)(1+r^\star)}\right)(1+G_j)^T\left[\sum_{t=0}^{T-1}\left(\frac{1+G_j}{1+r^\star}\right)^t\left(1-\left(\frac{a_j(t)-a_j(0)}{a_j(T)-a_j(0)}\right)\right)\right]}_{\Delta D^s/Y_0}
\end{aligned}
$$

In addition, we can use the evolving of the distance to the technological frontier to write:

$$
\begin{aligned}
a_j(t+1) &= \mu_j(t) + \frac{1-\mu_j(t)}{1+g} a_j(t) \\
a_j(t+1) - a_j(T) &= \mu_j(t) - a_j(T) + \frac{1-\mu_j(t)}{1+g} a_j(t), \\
a_j(t+1) - a_j(T) &= \mu_j(t) - a_j(T) + \frac{1-\mu_j(t)}{1+g}(a_j(t) - a_j(T)) + \frac{1-\mu_j(t)}{1+g} a_j(T) \\
a_j(t+1) - a_j(T) &= \mu_j(t) - a_j(T) + \frac{1-\mu_j(t)}{1+g} a_j(T) + \frac{1-\mu_j(t)}{1+g}(a_j(t) - a_j(T)) \\
a_j(t+1) - a_j(T) &= \mu_j(t) - \frac{g+\mu_j(t)}{1+g} a_j(T) + \frac{1-\mu_j(t)}{1+g}(a_j(t) - a_j(T)) \\
a_j(t+1) - a_j(T) &= \mu_j(t) - \frac{g+\mu_j(t)}{1+g} \frac{1+g}{g+\mu_j(t)} \mu_j(t) + \frac{1-\mu_j(t)}{1+g}(a_j(t) - a_j(T)) \\
a_j(t+1) - a_j(T) &= \frac{1-\mu_j(t)}{1+g}\big(a_j(t) - a_j(T)\big)
\end{aligned}
$$

By induction, it follows that:

$$
\begin{aligned}
a_j(t) - a_j(T) &= \left(\frac{1-\mu_j(t)}{1+g}\right)^t \big(a_j(0) - a_j(T)\big) \\
\left(\frac{a_j(t) - a_j(T)}{a_j(0) - a_j(T)}\right) &= \left(\frac{a_j(T) - a_j(t)}{a_j(T) - a_j(0)}\right) = \left(\frac{1-\mu_j(t)}{1+g}\right)^t \\
1 - \left(\frac{a_j(T) - a_j(t)}{a_j(T) - a_j(0)}\right) &= \left(\frac{a_j(t) - a_j(0)}{a_j(T) - a_j(0)}\right) = 1 - \left(\frac{1-\mu_j(t)}{1+g}\right)^t \equiv f(t)
\end{aligned}
$$

where $f(t) \leq 1$ and $f(t) = 1$ for $t \geq T$.

Thus, the ratio of cumulated net capital inflows to initial output between $t = 0$ and $t = T$

becomes:

$$\frac{\Delta D_j}{Y_j(0)} = \overbrace{\frac{\widehat{k} - \widehat{k}_j(0)}{\widehat{y}_j(0)}(1+G_j)^T}^{\Delta D^c/Y_0} + \overbrace{\frac{\widehat{d}_j(0)}{\widehat{y}_j(0)}((1+G)^T - 1)}^{\Delta D^t/Y_0} + \overbrace{\frac{\widehat{k}}{\widehat{y}_j(0)}\left(\frac{a_j(T)}{a_j(0)} - 1\right)(1+G_j)^T}^{\Delta D^i/Y_0}$$
$$\underbrace{+\left(\frac{a_j(T)}{a_j(0)} - 1\right)\left(\frac{\omega(\widehat{k}) + \pi(\widehat{k})}{\widehat{y}_j(0)(1+r^\star)}\right)(1+G_j)^T\left[\sum_{t=0}^{T-1}\left(\frac{1+G_j}{1+r^\star}\right)^t(1-f(t))\right]}_{\Delta D^s/Y_0} \tag{B.5}$$

B.2 Ratio of cumulated net capital inflows to initial output under imperfect financial market.

Ratio of the debt to initial GDP. We first write the ratio of the debt to initial GDP in terms of per-efficient worker variables.

$$\frac{\Delta D_j}{Y_j(0)} = \frac{D_j(T) - D_j(0)}{Y_j(0)} = \frac{\widehat{d}_j(T)\dfrac{A_j(T)L_j(T)}{A_j(0)L_j(0)} - \widehat{d}_j(0)}{\widehat{y}_j(0)}$$

where $\widehat{d}_j(t) \equiv \dfrac{D_j(t)}{A_j(t)L_j(t)}$ is the per-efficient worker debt and $\widehat{y}_j(t) \equiv \dfrac{Y_j(t)}{A_j(t)L_j(t)}$ is the per-efficient worker GDP, for all $t \geq 0$. Using $a_j(t) \equiv \dfrac{A_j(t)}{\overline{A}(t)}$ the proximity to the frontier, $L_j(T) = L_j(0)(1+n)^T$ and $\overline{A}(T) = \overline{A}(0)(1+g)^T$, we can rewrite the debt ratio as:

$$\frac{\Delta D_j}{Y_j(0)} = \frac{\dfrac{a_j(T)}{a_j(0)}\widehat{d}_j(T)(1+G)^T - \widehat{d}_j(0)}{\widehat{y}_j(0)} \tag{B.6}$$

where $1+G \equiv (1+g)(1+n)$ without loss of generality.

Steady-state debt per effective worker. The law of motion of total assets is given by:

$$\mathscr{A}_j(t+1) = w_j(t)L_j(t) + (1+r^\star)\mathscr{A}_j(t) - C_j(t)$$

where market clearing implies that the assets must be equal to: $\mathscr{A}_j(t) = K_j(t) - D_j(t) + V_j(t)$, where $K_j(t)$ is the stock of physical capital of country j, $D_j(t)$ is the country's j external debt, and $V_j(t) = \int_0^{Q_j(t)} V_j(\nu, t) d\nu$ is the total value of corporate assets. We have:

$$C_j(t) + K_j(t+1) + V_j(t+1) - D_j(t+1) = w_j(t)L_j(t) + (1+r^\star)(K_j(t) + V_j(t) - D_j(t))$$

$$C_j(t) + K_j(t+1) - D_j(t+1) = w_j(t)L_j(t) + (1+r^\star)(K_j(t) - D_j(t)) + (r^\star V_j(t) - \Delta V_j(t))$$

The evolution of the value of the firms in equilibrium is given by $r^\star V_j(t) - \Delta V_j(t) = \Pi_j(t) - (1+\Gamma_j(t))\phi_j \mathscr{F}_j(t)$. We can now write the budget constraint per-efficient worker variables as:

$$\begin{aligned} \widehat{c}_j(t) + (1+g_j(t+1))(1+n_j)\left(\widehat{k}_j(t+1) - \widehat{d}_j(t+1)\right) &= (1+r^\star)\left(\widehat{k}_j(t) - \widehat{d}_j(t)\right) + \omega(\widehat{k}) \\ &\quad + \pi(\widehat{k}) - (1+\Gamma_j)\phi_j \hat{\mathscr{F}}_j(T) \end{aligned}$$

where $g_j(t+1)$ is the growth rate of average productivity, i.e., $g_j(t+1) \equiv \dfrac{A_j(t+1) - A_j(t)}{A_j(t)}$.

After time T, the economy steady growth path is $g_j(t+1) = g$, $\widehat{k}_j(t+1) = \widehat{k}_j(t) = \widehat{k}$, $\widehat{v}_j(t+1) = \widehat{v}_j(t) = \widehat{v}_j(T)$ and $\widehat{d}_j(t+1) = \widehat{d}_j(t) = \widehat{d}_j(T)$, so that the steady-state debt value is given by:

$$\widehat{d}_j(T) = \widehat{k} + \frac{\omega(\widehat{k}) + \pi(\widehat{k}) - (1+\Gamma_j)\phi_j \hat{\mathscr{F}}_j(T) - \widehat{c}_j(T)}{r^\star - G_j} \tag{B.7}$$

Steady-state consumption per-efficient worker. We now compute the steady-state consumption in terms of the proximity to the technological frontier. Steady-state consumption per-efficient worker is defined by:

$$\widehat{c}_j(T) = \frac{c_j(T)}{A_j(T)}$$

We can therefore define the average productivity $A_j(t) = a_j(t)\overline{A}(t) = \overline{A}(0)a_j(t)(1+g)^t$. It follows from the Euler equation:

$$\left(\frac{c_j(t+1)}{c_j(t)}\right)^{\gamma} = \beta(1+r^{\star})(1-\tau_j(t))$$

where $\tau_j(t) = \frac{(1+\Gamma_j(t))q_j(t)}{1+r^{\star}-H_j}$. Then:

$$c_j(t) = c_j(0)(1+g)^t\Phi_j(t)^{min(t,T)}$$

where $\Phi_j(t) = (1-\tau_j(t))^{1/\gamma}$. Using $c_j(T) = c_j(0)(1+g)^T\Phi^T$ and the average productivity definition, we can write:

$$\widehat{c}_j(T) = \frac{c_j(0)\Phi^T(1+g)^T}{a_j(T)\overline{A}_j(0)(1+g)^T}$$

And finally:

$$\widehat{c}_j(T) = \frac{\widehat{c}_j(0)\Phi^T}{a_j(T)/a_j(0)} \tag{B.8}$$

Initial consumption per-efficient worker. The per worker intertemporal budget constraint is:

$$\sum_{t=0}^{\infty}\left(\frac{1+n}{1+r^{\star}}\right)^t c_j(t) = (1+r^{\star})(k_j(0)-d_j(0)) + \sum_{t=0}^{\infty}\left(\frac{1+n}{1+r^{\star}}\right)^t \big(w_j(t)+\pi_j(t)-(1+\Gamma_j)\phi_j\mathscr{F}_j(t)\big)$$

Using $c_j(t) = \widehat{c}_j(0)A_j(0)(1+g)^t\Phi^{min(t,T)}$, we show that the left hand side is given by:

$$\sum_{t=0}^{\infty}\left(\frac{1+n}{1+r^{\star}}\right)^t c_j(t) = \frac{A_j(0)\widehat{c}_j(0)}{\left(1-\frac{1+G}{1+r^{\star}}\right)\Theta}$$

where $\Theta = \dfrac{(1+r^{\star})-(1+G)\Phi}{r^{\star}-G+\left(\frac{1+G}{1+r^{\star}}\right)^T\Phi^T(1+G)(1-\Phi)}$ and using $w_j(t) = \omega(\widehat{k})a_j(t)\overline{A}_j(0)(1+$

$g)^t$, it follows that:

$$\widehat{c}_j(0) = (r^\star - g)\Theta\left(\frac{1}{a_j(0)(1+r^\star)}\sum_{t=0}^{\infty}\left(\frac{1+G}{1+r^\star}\right)^t\left(\omega(\widehat{k})+\pi(\widehat{k})-(1+\Gamma_j)\phi_j\widehat{\mathscr{F}}_j(T)\right)a_j(t)+\left(\widehat{k}_j(0)-\widehat{d}_j(0)\right)\right) \tag{B.9}$$

Ratio of cumulated net capital inflows to initial output between $t = 0$ and $t = T$. Given equations (B.6),(B.7),(B.8) and (B.9), we can finally compute the volume of capital inflows in terms of the exogenous parameters of the model as follow. First, using the initial consumption per-efficient worker equation, we can write steady-state consumption per-efficient worker as:

$$\widehat{c}_j(T) = \frac{a_j(0)}{a_j(T)}(r^\star - g)\Theta\Phi^T\left(\frac{1}{a_j(0)(1+r^\star)}\sum_{t=0}^{\infty}\left(\frac{1+G}{1+r^\star}\right)^t\left(\omega(\widehat{k})+\pi(\widehat{k})-(1+\Gamma_j)\phi_j\widehat{\mathscr{F}}_j(T)\right)a_j(t)+\left(\widehat{k}_j(0)-\widehat{d}_j(0)\right)\right)$$

We then introduce this last into steady-state debt per-worker equation. It follows that:

$$\begin{aligned}\widehat{d}_j(T) \quad &= \widehat{k} + \frac{\omega(\widehat{k})+\pi(\widehat{k})-(1+\Gamma_j)\phi_j\widehat{\mathscr{F}}_j}{r^\star - G} - \frac{a_j(0)}{a_j(T)}\Theta\Phi^T\left(\widehat{k}_j(0)-\widehat{d}_j(0)\right)\\ &-\frac{a_j(0)}{a_j(T)}\Theta\Phi^T\left[\frac{1}{a_j(0)(1+r^\star)}\sum_{t=0}^{\infty}\left(\frac{1+G}{1+r^\star}\right)^t\left(\omega(\widehat{k})+\pi(\widehat{k})-(1+\Gamma_j)\phi_j\widehat{\mathscr{F}}_j(T)\right)a_j(t)\right]\end{aligned}$$

Multiplying both sides by $\frac{a_j(T)}{a_j(0)}(1+G)^T$, we have:

$$\begin{aligned}&\frac{a_j(T)}{a_j(0)}(1+G)^T\widehat{d}_j(T) = \frac{a_j(T)}{a_j(0)}(1+G)^T\widehat{k} + \frac{a_j(T)}{a_j(0)}(1+G)^T\left(\frac{\omega(\widehat{k})+\pi(\widehat{k})-(1+\Gamma_j)\phi_j\widehat{\mathscr{F}}_j}{r^\star - G}\right)\\ &-(1+G)^T\Theta\Phi^T\left(\widehat{k}_j(0)-\widehat{d}_j(0)\right) - \frac{(1+G)^T\Theta\Phi^T}{a_j(0)(1+r^\star)}\sum_{t=0}^{\infty}\left(\frac{1+G}{1+r^\star}\right)^t\left(\omega(\widehat{k})+\pi(\widehat{k})-(1+\Gamma_j)\phi_j\widehat{\mathscr{F}}_j(T)\right)a_j(t)\end{aligned}$$

Introducing in equation (B.6), we finally obtain:

$$\begin{aligned}\frac{\Delta D_j}{Y_j(0)} &= \frac{a_j(T)}{a_j(0)}(1+G)^T\frac{\widehat{k}}{\widehat{y}_j(0)} + \frac{a_j(T)}{a_j(0)}(1+G)^T\left(\frac{\omega(\widehat{k})+\pi(\widehat{k})-(1+\Gamma_j)\phi_j\widehat{\mathscr{F}}_j}{r^\star - G}\right) - \frac{\widehat{d}_j(0)}{\widehat{y}_j(0)}\\ &-(1+G)^T\Theta\Phi^T\left(\frac{\widehat{k}_j(0)}{\widehat{y}_j(0)}-\frac{\widehat{d}_j(0)}{\widehat{y}_j(0)}\right) - \frac{(1+G)^T\Theta\Phi^T}{a_j(0)\widehat{y}_j(0)(1+r^\star)}\sum_{t=0}^{\infty}\left(\frac{1+G}{1+r^\star}\right)^t\omega(\widehat{k})a_j(t)\end{aligned}$$

Let us write:

$$
\begin{aligned}
B &= \sum_{t=0}^{\infty}\left(\frac{1+G}{1+r^{\star}}\right)^{t} a_j(t), \\
&= \sum_{t=0}^{\infty}\left(\frac{1+G}{1+r^{\star}}\right)^{t}\left(a_j(t)+\left(a_j(T)-a_j(T)\right)\Phi^{min(0,t-T)}\right) \\
&= \sum_{t=0}^{\infty}\left(\frac{1+G}{1+r^{\star}}\right)^{t}\left(a_j(t)-a_j(T)\Phi^{min(0,t-T)}\right)-\sum_{t=0}^{\infty}\left(\frac{1+G}{1+r^{\star}}\right)^{t} a_j(T)\Phi^{min(0,t-T)} \\
&= \sum_{t=0}^{T-1}\left(\frac{1+G}{1+r^{\star}}\right)^{t}\left(a_j(t)-a_j(T)\Phi^{(t-T)}\right)+\sum_{t=T}^{\infty}\left(\frac{1+G}{1+r^{\star}}\right)^{t}\left(a_j(t)-a_j(T)\Phi^{(T-T)}\right) \\
&\quad +\sum_{t=0}^{\infty}\left(\frac{1+G}{1+r^{\star}}\right)^{t} a_j(T)\Phi^{min(0,t-T)}
\end{aligned}
$$

Using $a_j(t)=a_j(T)\ \forall t\geq T$; then we have:

$$
\begin{aligned}
B &= \sum_{t=0}^{T-1}\left(\frac{1+G}{1+r^{\star}}\right)^{t}\left(a_j(t)-a_j(T)\Phi^{(t-T)}\right)+a_j(T)\sum_{t=0}^{\infty}\left(\frac{1+G}{1+r^{\star}}\right)^{t}\Phi^{min(0,t-T)} \\
&= \sum_{t=0}^{T-1}\left(\frac{1+G}{1+r^{\star}}\right)^{t}\left(a_j(t)-a_j(T)\Phi^{(t-T)}\right)+a_j(T)\left(\sum_{t=0}^{T-1}\left(\frac{1+G}{1+r^{\star}}\right)^{t}\Phi^{t-T}+\sum_{t=T}^{\infty}\left(\frac{1+G}{1+r^{\star}}\right)^{t}\Phi^{T-T}\right) \\
&= \sum_{t=0}^{T-1}\left(\frac{1+G}{1+r^{\star}}\right)^{t}\left(a_j(t)-a_j(T)\Phi^{(t-T)}\right)+a_j(T)\Phi^{-T}\left(\sum_{t=0}^{T-1}\left(\frac{1+G}{1+r^{\star}}\right)^{t}\Phi^{t}+\sum_{t=T}^{\infty}\left(\frac{1+G}{1+r^{\star}}\right)^{t}\Phi^{T}\right)
\end{aligned}
$$

Finally, using:

$$
\left(\sum_{t=0}^{T-1}\left(\frac{1+G}{1+r^{\star}}\right)^{t}\Phi^{t}+\sum_{t=T}^{\infty}\left(\frac{1+G}{1+r^{\star}}\right)^{t}\Phi^{T}\right)=\frac{1+r^{\star}}{r^{\star}-G}\Theta^{-1}
$$

we obtain:

$$
B=\sum_{t=0}^{T-1}\left(\frac{1+G}{1+r^{\star}}\right)^{t}\left(a_j(t)-a_j(T)\Phi^{(t-T)}\right)+a_j(T)\Phi^{-T}\Theta^{-1}\frac{1+r^{\star}}{r^{\star}-G}
$$

We then reintroduce this expression into the capital inflows equation. That gives:

$$\frac{\Delta D_j}{Y_j(0)} = \frac{a_j(T)}{a_j(0)}(1+G)^T \frac{\widehat{k}}{\widehat{y}_j(0)} - (1+G)^T \Theta\Phi^T \left(\frac{\widehat{k}_j(0)}{\widehat{y}_j(0)} - \frac{\widehat{d}_j(0)}{\widehat{y}_j(0)}\right) - \frac{\widehat{d}_j(0)}{\widehat{y}_j(0)}$$
$$- \left(\frac{\omega(\widehat{k}) + \pi(\widehat{k}) - (1+\Gamma_j)\phi_j \widehat{\mathscr{F}}_j(T)}{a_j(0)\widehat{y}_j(0)(1+r^\star)}\right)(1+G)^T \Theta\Phi^T \sum_{t=0}^{T-1}\left(\frac{1+G}{1+r^\star}\right)^t \left(a_j(t) - a_j(T)\Phi^{(t-T)}\right)$$

Thus, the ratio of cumulated net capital inflows to initial output between $t=0$ and $t=T$ becomes:

$$\frac{\Delta D_j}{Y_j(0)} = \overbrace{\left(\frac{\widehat{k} - \Theta_j \Phi_j^T \widehat{k}_j(0)}{\widehat{y}_j(0)}\right)(1+G_j)^T}^{\Delta D^c/Y_0} + \overbrace{\frac{\widehat{d}_j(0)}{\widehat{y}_j(0)}((1+G_j)^T \Theta_j \Phi_j^T - 1)}^{\Delta D^t/Y_0} + \overbrace{\left(\frac{a_j(T)}{a_j(0)} - 1\right)\frac{\widehat{k}}{\widehat{y}_j(0)}(1+G_j)^T}^{\Delta D^i/Y_0}$$
$$\underbrace{+ \left(\frac{a_j(T)}{a_j(0)} - 1\right)\left(\frac{\omega(\widehat{k}) + \pi(\widehat{k}) - (1+\Gamma_j)\phi_j \widehat{\mathscr{F}}_j}{\widehat{y}_j(0)(1+r^\star)}\right)((1+G_j)^T \Theta_j \Phi_j^T)\left[\sum_{t=0}^{T-1}\left(\frac{1+G_j}{1+r^\star}\right)^t \left(\frac{a_j(T)\Phi_j^{(t-T)} - a_j(t)}{a_j(T) - a_j(0)}\right)\right]}_{\Delta D^s/Y_0}$$

B.3 Problem of the entrepreneur under credit constraint.

Assume that an entrepreneur in country j wants to undertake a new project and have a limited access to credit. She can only borrow the amount $B_j(\nu,t)$ from a financial institution and self-finance a fraction $\mathscr{A}_j(\nu,t)$ of her total wealth with respectively returns $\eta(t)$ and $\upsilon(t)$ to invest in R&D. She pays back the loan and recovers her self-financed amount if and only if she succeeds with probability $\mu(\nu,t)$. The entrepreneur cannot invest more than her self-finance plus the amount borrowed from the financial institution. Therefore, we can write:

$$B_j(\nu,t) + \mathscr{A}_j(\nu,t) \geq Z(\nu,t) \tag{B.10}$$

We also assume that the expected return of the loan and the expected return of the self-financed are not greater than a risk-free return to ensure a non-arbitrage between the two returns. This is represented by these equations:

$$\lambda \frac{Z_j(\nu,t)}{\bar{A}(t)}(1+\eta(t))B_j(\nu,t) \geq (1+r^{\star})B_j(\nu,t) \tag{B.11}$$

and

$$\lambda \frac{Z_j(\nu,t)}{\bar{A}(t)}(1+\upsilon(t))\mathscr{A}_j(\nu,t) \geq (1+r^{\star})\mathscr{A}_j(\nu,t) \tag{B.12}$$

Finally, we assume that the entrepreneur can defraud the financial institution; she can pay a cost $H_j Z_j(\nu,t)$ to hide her successful result to the financial institution and if she does, she will not pay back his loan $\lambda \frac{Z_j(\nu,t)}{\bar{A}(t)}(1+\eta(t))B_j(\nu,t)$. To ensure she will pay the loan, we assume that the cost of defraud is greater than the repayment of the loan:

$$H_j(t)Z_j(\nu,t) \geq \lambda \frac{Z_j(\nu,t)}{\bar{A}(t)}(1+\eta(t))B_j(\nu,t) \tag{B.13}$$

The entrepreneur problem is to maximize the expected net profit of becoming the incumbent in the next period. It is given by the expected value of being the incumbent minus the discounted refund of the total investment in R&D, namely:

$$\max_{\{Z_j(\nu,t),B_j(\nu,t),\mathscr{A}_j(\nu,t),\rho(t),\upsilon(t)\}} \lambda \frac{Z_j(\nu,t)}{\bar{A}(t)} \left(V_j(\nu,t+1) - \frac{1}{1+r^{\star}}\left((1+\eta(t))B_j(\nu,t) + (1+\upsilon(t))\mathscr{A}_j(\nu,t)\right)\right) \tag{B.14}$$

subject to B.10, B.11, B.12 and B.13.

By combining constraints B.10, B.11, B.12 and B.13, the innovator problem can be rewrite as:

$$\begin{aligned} &\max_{\{Z_j(\nu,t)\}} && \lambda \frac{Z_j(\nu,t)}{\bar{A}(t)} V_j(\nu,t+1) - Z_j(\nu,t) \\ &\text{subject to} && Z_j(\nu,t) \leq \phi \mathscr{A}_j(\nu,t) \end{aligned} \tag{B.15}$$

where $\phi_j = \frac{1+r^{\star}}{1+r^{\star}-H_j}$ and $\phi_j \in [1,\infty)$.

CHAPTER II

EXTERNAL CAPITAL AND ECONOMIC GROWTH IN DEVELOPING COUNTRIES: THE THRESHOLD EFFECT OF FINANCIAL DEVELOPMENT

Abstract

This study provides evidence supporting the non-linear effect of external capital on economic growth. It analyzes aggregate flows as well as private and public flows separately. Using two econometric methods, there appears to be threshold of level of financial development beyond which aggregate capital begins to promote economic growth. Otherwise, total capital flows harm economic growth. Distinguishing between the types of flows shows that public flows may be growth detrimental,, while private flows are growth-enhancing when the financial market does not reach the threshold. A more in-depth analysis of private flows shows that a well-functioning financial market benefits from FDI and private debt flows. Regarding portfolio equity flows, they promote growth below the estimated threshold and reduce growth otherwise. Hence, this suggests that developing the domestic financial markets may be critical for countries in order to take advantage of FDI and private debt flows, but also to reverse the sign of the correlation linked with public flows.

KEYWORDS: Capital flows, Financial development, Economic growth, Threshold effects, Dynamic panel threshold

JEL: C23, F21, O47, O16

2.1 Introduction

Do foreign capital inflows to developing countries foster or harm domestic economic growth? In the context of a rapid increase in capital mobility and financial integration in the recent decades, this question takes an added importance. International capital flows introduce new technologies and expertise to the host countries, besides being an additional source of funding for investment and allowing for consumption smoothing. In this sense, external capital flows promote growth. On the other hand, external capital flows also come with risks of inflation and real overvaluation of currency for the host country, which may be damaging for growth.[1] Therefore, the effects of external capital depend on the economic and financial conditions in the host country. The recent economic and financial crises have also renewed the debate among academics and policymakers on whether countries should increase the use of capital controls or let capital flow freely to be efficiently allocated. To the extent that foreign capital may have different effects on economic growth according to their types and the local financial market, it is worth understanding better the relationship between these various capital flows and economic growth. This might be helpful for developing countries to adopt appropriate policies on capital flows.

Recent papers have shown that the relationship between external capital flows and growth is mixed. The textbook neoclassical growth model predicts that capital should flow into countries where the marginal product is higher. However, empirical studies show that the correlation with GDP growth is positive for private capital flows (Foreign Direct Investment, private debt, and portfolio equity), while negative for public flows (e.g. Gourinchas and Jeanne (2013); Alfaro et al. (2014)). These papers showed that the so-called "Lucas puzzle" and "Allocation puzzle" are more related to public capital flows (defined as flows from or to the public sector, comprised of the central bank and the government, while private flows are the residual).[2] [3] Therefore, devel-

1. See for instance Prasad et al. (2007)

2. The "Lucas puzzle" (Lucas, 1990) is related to the low volume of capital flowing from rich to poor countries, while the "Allocation puzzle" (Gourinchas and Jeanne, 2013) refers to the fact that lower productivity growth countries receive more capital relative to higher growth countries

3. In Alfaro et al. (2014), "private capital flows" include flows of foreign direct investment (FDI),

oping countries should benefit from private flows, while public flows are the ones that are negatively correlated with economic growth. Nonetheless, certain economic conditions are required for that external capital flows to be growth-enhancing. For instance, a minimum stock of human capital (Borensztein et al., 1998), good quality of the institutions (Peres et al., 2018), and well-developed infrastructures (Kinoshita and Lu, 2006) are some requirements for FDI inflows to promote economic growth in developing countries. In addition, local financial conditions are essential for countries to take advantage of external capital flows. Developed financial markets should be able to pool domestic savings and direct investments towards the most productive sectors; in this context, foreign capital may supplement domestic capital and enhance growth by increasing investment. Otherwise, foreign capital may have perverse effects in the host country through a misallocation of investments due to a malfunctioning domestic financial market. Therefore, shedding more light on this threshold effect of capital flows on growth and knowing the cut-off point of financial development may be helpful for effective policies.

This paper provides some new evidence on the effect of external capital flows on economic growth in developing countries, using dynamic panel estimation and dynamic panel threshold estimation. Mainly, the paper emphasizes the level of financial development as the threshold variable and analyzes the non-linearity and non-monotonic relationship between capital flows and economic growth. As the relationship may depend on the nature of capital flows, this article not only investigates aggregate flows but also distinguishes private capital flows and public capital flows. I find that aggregate flows begin to promote economic growth only when the level of financial market development reaches a certain threshold. Otherwise, aggregate flows hurt growth. This finding holds for the two econometric specifications used for the investigations. Moreover, the dynamic panel threshold model predicts a threshold value of financial development around 45%.[4 5] A well-functioning financial market may help to absorb

portfolio equity investment, and private debt while "Public capital flows" include grant, concessional aid, or any government-guaranteed debt, where reserves is netted out.

4. The level of financial development is defined as the ratio of private credit to GDP.

5. Around 80% of my sample is below this threshold value of financial development.

external capital and may thus render this capital to be growth-enhancing. By providing better monitoring and lowering information asymmetries, the financial market should be able to direct domestic as well as external investments towards the most productive projects. Resources are efficiently allocated thanks to the financial market, and this helps to reduce the effect of external capital inflows on real exchange rate appreciation. Regarding public flows, I also find evidence that these flows begin to promote economic growth only above a certain threshold of financial development. Otherwise, external public flows harm economic growth. The estimation shows that external public flows harm economic growth only for countries where the ratio of private credit to GDP is below 16.24%. For private flows, the dynamic panel threshold model finds that those flows only promote growth below the estimated threshold value of 53.42% and do not affect growth above. Analyzing each type of private flows shows mixed results. The interaction variable estimation does not show any evidence of a threshold effect for portfolio equity flows; in contrast, FDI and private debt flows appear to have a positive effect on economic growth above a certain threshold. The dynamic panel threshold estimation corroborates this finding and estimates threshold values of 45.87%, and 26.80%, respectively for FDI flows and private debt flows. Below these values, FDI and private debt do not affect growth when controlling for growth determinants. The dynamic panel threshold estimation also shows that portfolio equity flows foster economic growth below the estimated threshold value of 37.08% and are harmful above.

To evaluate how capital flows affect economic growth using the level of financial development as the threshold, this paper uses different empirical strategies and a sufficiently large panel data (60 developing countries over the period 1980-2015). Most of the previous studies on this topic use interaction term to analyze this threshold effect. This methodology is limited by the *a priori* restriction on a monotonic and symmetric relationship between capital flows and growth. However, capital flows may begin affecting growth only above some threshold value. Besides, the effects below and above the threshold may not be identical in terms of range. Other papers split samples into underdeveloped and developed financial markets using the median value of financial development as the cut-off. These two strategies do not allow to estimate the threshold value, as the cut-off is predetermined or remains unknown. The dynamic panel threshold model overcomes these concerns and tackles issues linked with omitted variables and endogeneity.

The contribution of this study to the literature is threefold. First, this paper employs the novel dynamic panel threshold model proposed by Seo and Shin (2016). This methodology is an extension of the threshold model developed by Hansen (1999). The Hansen's original static model has been extended to the dynamic panel threshold model (Hsiao et al., 2002; Ramırez-Rondán, 2013), and to dynamic panel threshold model that allows for the endogeneity of both threshold variable and the vector of regressors (Seo and Shin, 2016; Seo et al., 2019). Moreover, this estimation strategy overcomes the assumption of monotonic and symmetric relationship between capital flows and growth imposed in estimation using interaction terms (Prasad et al., 2007; Bailliu, 2000), and it also determines the threshold value of financial development. The methodology used in this paper also differs from previous studies that used the static threshold model. For instance, Baharumshah et al. (2017) used the static threshold model of Hansen (2000) to evaluate the threshold effect of private capital flows on economic growth in a cross-section estimation. They also used the strategy developed by Caner and Hansen (2004) to deal with the endogeneity of the regressors. They used the lag of capital flows as an instrument to overcome the simultaneity bias concern. The strategy employed in this study is similar to the one used in the previous paper, adapted for dynamic panel regression.

Second, this study contributes to the debate on the relationship between capital flows and economic growth. In particular, it investigates the effects of different types of capital flows on growth, according to the level of financial development of the recipient country. Besides differentiating for the effects of private flows and those effects of public flows on growth, it analyzes the distinct impact of each private flow (FDI, portfolio equity, and private debt). Previous papers had investigated the relationship between aggregate or disaggregated capital flows and growth. For instance, Gourinchas and Jeanne (2013) showed that the negative correlation between capital flows and productivity growth is more related to public flows. They suggested that distortion on the local financial market may explain this negative correlation. Koch and Zongo (2018) extended the previous study and showed that one only found the negative correlation for countries with a low level of financial development that prevents them from advancing towards the technological frontier. This current chapter provides empirical evidence supporting the previous finding. It also corroborates the findings of Prasad et al. (2007), who found that capital flows have a significant effect on growth only when the development of the financial market reaches a certain threshold. As an additional contribution, this chapter provides estimates for the threshold values of financial development with respect to each type of capital flows.

Third, this paper contributes to the debate on the relationship between financial development and growth. To date, there is no consensus on a positive or negative effect of the level of financial development on growth. However, studies suggest that financial development is growth-enhancing only below a certain threshold and may be harmful, or at best, have a positive but vanishing effect on growth (Aghion et al., 2005; Arcand et al., 2015; Law and Singh, 2014). My results corroborate these findings and also suggest that too much finance may harm economic growth. Countries with a low level of financial development may benefit from their financial markets and grow faster.

The paper is organized as follows: Section 2 lays out the methodology and the model specification. Section 3 describes the data used for the study. Section 4 presents and discusses the empirical results, and section 5 concludes.

2.2 Methodology and Model Specification

In this section, I present the two specifications adopted to analyze the effects of domestic financial development and the international capital flows on growth.

2.2.1 The Dynamic Panel Model

To test the relationship between financial development, capital flows, and growth, I adopt the following dynamic growth equation:

$$y_{i,t} - y_{i,t-1} = \delta y_{i,t-1} + \beta X_{i,t} + \nu_i + \varepsilon_{i,t}, \tag{2.1}$$

where $i = 1, 2, \ldots, N$ denotes the country, $t = 1, 2, \ldots, T$ denotes each five-year period, ν_i is the unobserved country-specific effect, and $\varepsilon_{i,t}$ is the error term. $y_{i,t}$ is the logarithm of real GDP per-capita, so that $y_{i,t} - y_{i,t-1}$ is the growth rate of real GDP per-capita.

$X_{i,t}$ is a row vector of explanatory variables, other than lagged per-capita GDP but including the level of financial development and various measures of capital flows. [6] Real GDP per capita is measured at the beginning of each five-year period, while the other explanatory variables are measured as averages over the five-year period. I also include time dummies to account for time fixed effects.

In order to ensure that the estimated coefficients capture the effect of the variables of interest, I also include explanatory regressors that have been identified as important determinants for growth. Among other things, I consider the ratio of investment to GDP, the ratio of government expenditure to GDP, a index of human capital [7], and the population growth rate. Next, I add an interaction variable between financial development and capital flow variables in the explanatory regressors to assess the non-linearity of their effects on economic growth.

Equation (2.1) can be rewritten as follows:

$$y_{i,t} = \alpha y_{i,t-1} + \beta X_{i,t} + \mu_i + \varepsilon_{i,t}, \tag{2.2}$$

where $\alpha = (1+\delta)$. Estimating equation (2.2) raises two challenges, which are the presence of unobserved country-specific effects μ_i and the endogeneity of the explanatory regressors. [8] To tackle these challenges, I use dynamic panel estimators, and more specifically the system generalized method-of-moments estimators developed by Arellano and Bover (1995); Blundell and Bond (1998). This estimation method is suitable for a relatively small period and large individuals panel sample. The system GMM estimators use the first-difference [9] equation to eliminate the unobserved country-specific effects and the original equation to add more instruments.

6. Capital flows are aggregate flows, private flows (FDI flows, portfolio equity flows or debt equity flows), or public flows.

7. This index is based on years of schooling (Barro and Lee, 2013) and returns to education (Psacharopoulos, 1994).

8. Note that the presence of unobserved period-specific effects may also be a concern, but the inclusion of period dummies tackles this concern.

9. As my panel sample is unbalanced because of data availability, I use orthogonal deviation instead to maximize data coverage.

Following Arellano and Bond (1991), the first-difference of equation (2.2) gives:

$$(y_{i,t} - y_{i,t-1}) = \alpha(y_{i,t-1} - y_{i,t-2}) + \beta(X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}). \tag{2.3}$$

By construction, the error term in $(\varepsilon_{i,t} - \varepsilon_{i,t-1})$ is now correlated with the lagged dependant variable $(y_{i,t-1} - y_{i,t-2})$, introducing a new bias; estimating equation (2.3) with ordinary least squares may not be appropriate. Under the assumption that the error term is not serially correlated and that explanatory variables are weakly exogenous (i.e uncorrelated with future realizations of the error term), the difference estimator uses the following moment conditions:

$$E\left[y_{i,t-s}\left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)\right] = 0, \quad s \geq 2; \quad t = 3, \ldots, T, \tag{2.4}$$

$$E\left[X_{i,t-s}\left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)\right] = 0, \quad s \geq 2; \quad t = 3, \ldots, T. \tag{2.5}$$

Using these moment conditions, the two-step estimator gives an asymptotically more efficient estimate than the one-step; the residuals of the first step (the error term is independent and homoskedastic by assumption) are used to construct a consistent estimate of the variance-covariance matrix.

Because difference estimator may augment the potential biases, I use a system of equations that combines the difference regression and the level regression as proposed by Arellano and Bover (1995); Blundell and Bond (1998). The estimator associated with this system is consistent and more efficient relative to the difference regression. The moment conditions associated to level regression are as follows:

$$E\left[\left(y_{i,t-1} - y_{i,t-2}\right)\left(\nu_i + \varepsilon_{i,t}\right)\right] = 0, \tag{2.6}$$

$$E\left[\left(X_{i,t-1} - X_{i,t-2}\right)\left(\nu_i + \varepsilon_{i,t}\right)\right] = 0. \tag{2.7}$$

Thus, I obtain consistent and efficient estimates using the system panel estimator and the four moment conditions mentioned above. Next, I test the validity of the instruments using the a Hansen test of over-identifying restrictions and the absence of serial correlation of error terms using the Arellano-Bond second-order correlation test on the differenced error term (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998)

2.2.2 The Threshold Dynamic Panel Model

This section describes an extension of the threshold model developed by Hansen (1999). Hansen's original static model has been extended to the dynamic panel threshold model (Hsiao et al., 2002; Ramırez-Rondán, 2013) to accommodate the endogeneity of both the threshold variable and the vector of regressors (Seo and Shin, 2016; Seo et al., 2019). In order to further investigate the nonlinear asymmetric effect of the financial development and capital flows on growth economic, I rely on the following dynamic panel threshold model:

$$g_{i,t} = \beta_1 X_{i,t} I(q_{i,t} \leq \gamma) + \beta_2 X_{i,t} I(q_{i,t} > \gamma) + \mu_i + \varepsilon_{i,t}, \tag{2.8}$$

where the $I(.)$ is an indicator function, $q_{i,t}$ is the threshold variable (here the level of financial market development), and γ is the threshold level. $g_{i,t} = (y_{i,t} - y_{i,t-1})$ is the growth rate of real GDP per-capita and $X_{i,t}$ the same set of explanatory regressors mentioned above. Note that in this application, financial development is both the endogenous threshold variable and one of the endogenous regressors.

Equation (2.8) is estimated using the GMM method of Seo and Shin (2016); Seo et al. (2019). First of all, the first-difference transformation of equation (2.8) is done to remove the country-specific effects μ_i, as proposed by Arellano and Bond (1991). Again, estimating the first-difference transformation of equation (2.8) by the ordinary least squares is not appropriate, since the transformed regressors are now correlated with the new error term. Thus, the lagged variables are used as instruments. [10] As discussed by Seo and Shin (2016); Seo et al. (2019), first-difference GMM estimation of dynamic panel threshold allows for obtaining a consistent estimator and determining the threshold level endogenously.

The level of financial development, which is the threshold variable $q_{i,t}$, is endogenous in my regression model. Thus, I consider a two-step GMM estimation, as suggested by Seo and Shin (2016). Instead of splitting the sample and applying the linear GMM for each subsample, this method minimizes the GMM criterion function using a grid search

10. Notice that the instrument variables may include lagged values of the endogenous regressors as well as the lagged values of the threshold variable.

procedure over all the possible values of the threshold variable γ. The minimization is feasible and more practical, since the model is linear with respect to β for each fixed γ, and the objective function is not continuous in γ. Given that the grid search algorithm is time-consuming, I use a grid of 300 search steps with a 15% trim rate. [11] The estimators obtained by the first difference GMM method follow a normal distribution asymptotically and allow for making inference about the parameters.

The method allows testing also for the linearity, as well as for the exogeneity of the threshold variable. For the first test, the model is linear under the null hypothesis; Seo and Shin (2016); Seo et al. (2019) proposed a bootstrap procedure to compute the p-value for the test. Failing to reject the null hypothesis suggests that there is no threshold effect in the specification. The bootstrapped p-values were computed using 100 replications. For the second test, the method uses (Hausman, 1978) testing procedure, where the threshold variable is exogenous under the null hypothesis.

2.3 Data Description

This paper uses an initial sample containing 101 developing countries over the 1980-2015 period. The dataset includes a measure of financial development, capital flows, real GDP per capita, and the other control variables, averaged over seven 5-year periods to take into account the long-run relationship. The sample is selected according to the availability of data for capital flows and financial development measures. [12]

11. The grid search begins at 15% and ends at 85% of the threshold variable distribution. The results are not affected when performing a grid of 100 search steps and 5%. The default grid number and trim rate are respectively 20 and 40% in Seo et al. (2019).

12. Because the threshold dynamic panel model estimation requires a balanced panel, the sample size is reduced for those estimates. The number of countries included is given in the tables presenting the results. I also perform the dynamic panel model estimation with the reduced sample. This does not change the qualitative nature of the results.

Measures of capital flows

To measure capital flows, I use the international capital flows database constructed by Alfaro et al. (2014)[13]. It contains measures of aggregate capital flows available for more than 200 countries over the 1970-2015 period. However, data on private and public flows are only available for developing countries. All private flows consist of FDI flows, portfolio equity investment, and private debt, while public flows consist of concessional aid or any government-guaranteed debt, where reserves are netted out (Alfaro et al., 2014). Net aggregate flows are measured as the negative of the current account balance in current U.S. dollars, normalized by GDP in current U.S. dollars. The other type of flows are also in current U.S. dollars and normalized by GDP in current U.S. dollars. Net private flows are obtained by subtracting public flows from net aggregate flows. The decomposition of the current account balance into public and private flows follows Lane and Milesi-Ferretti (2001) and can be written as:

$$-CA = \underbrace{(NetFDI + NetEQ + NetPrivD - EO)}_{\text{Net Private Flows}} + \underbrace{(NetPubD + IMF + EF - \Delta Res)}_{\text{Net Public Flows}}. \tag{2.9}$$

where $NetFDI$, $NetEQ$, $NetPrivD$[14], and $NetPubD$ are respectively FDI, portfolio equity, private debt, and public debt net flows (i.e. liabilities minus assets). EO is net errors and omissions, IMF is the International Monetary Fund credit, EF is exceptional financing, and ΔRes is the changes in reserve assets controlled by the domestic authorities.

For the aim of this paper, this database is more suitable because it distinguishes clearly between private and public flows, unlike the IMF's International Financial Statistics (IFS) and the World Bank's Global Development Finance (GDF) databases. Alfaro et al. (2014) decomposed total debt into private and private debt, allowing for a decomposition of net aggregate flows into public and private flows as presented in equation (2.9).

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13. Available at http://www.sovereign-to-sovereign-flows.com.

14. In Alfaro et al. (2014), private debts consist of portfolio debt, loans, and other instruments including financial derivatives, currency and deposits, financial leases, and trade credits

The measure of financial development

To measure the level of financial development, I follow what is standard in the literature by using the ratio of private credit to GDP as a proxy of financial development. It measures the total credit to the private sector relative to GDP and excludes all other types of credit, such as credit to the government, public sector, and state-owned companies. For King and Levine (1993); Levine and Zervos (1998), it is the preferred measure of domestic financial development because it takes into account only the volume of credit to the private sector in a given country. Therefore, a higher level of the ratio of private credit to GDP means a higher level of financial development, according to Beck et al. (2000). I also present the results with some alternative measures of the level of financial development as a robustness check. Data on financial development is from the World Bank's Global Financial Development Database (Čihák et al., 2012). [15]

The dependent variable and the control variables

Real per-capita GDP growth rate is the dependent variable. As it customary the literature, macroeconomic indicators are include as controls for other potential determinants of economic growth. Inter alia, I control for convergence using initial per-capita GDP, for human capital accumulation using an index of human capital (based on years of schooling and returns to education), for the growth of the labor force using population growth,for investment in physical capital using the share of gross capital formation to GDP, and for government expenditure using the share of government consumption to GDP. All control variables are from version 9.1 of the Penn World Table, developed by Feenstra et al. (2015). [16] I also use additional control variables for robustness checks, such as the exchange rate, capital account openness index (Chinn and Ito, 2008), and the quality of the institutions. Data on exchange rate come from the World Development Indicators and data on institutional quality is from the International Country Risk

15. https://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database.

16. Available at www.ggdc.net/pwt.

Table 2.1: Summary statistics

	Mean	Standard Deviation	Minimum	Maximum
Real GDP per capita growth	1.509	2.822	-12.178	20.244
Aggregate flows	5.332	8.367	-25.019	57.407
Private flows	-0.557	9.166	-43.359	36.719
Public flows	5.893	10.137	-17.563	76.410
Foreign direct investment/GDP	2.985	5.119	-9.430	79.429
Portfolio equity/GDP	-0.029	1.199	-28.157	1.990
Private debt/GDP	0.455	5.561	-30.129	35.680
Reserve flows	1.413	2.231	-6.633	21.316
Private credit/GDP	29.025	30.363	0.009	441.340
Government/GDP	19.762	9.269	0.951	59.234
Investment/GDP	19.038	9.075	0.166	65.001
Human Capital	2.021	0.614	1.017	3.590
Population growth	1.762	1.271	-3.674	5.535
Capital account openness	-0.361	1.159	-1.889	2.390
Exchange rate	390.099	1513.778	0.000	18612.917
Institutions	7.285	1.260	3.833	10.900

Guide (ICRG). [17] Table 2.1 summarizes the variables used for the analysis. [18]

2.4 Empirical Results

This section presents and discusses the results from the estimation for of the system GMM dynamic panel model, as well as for the first-difference GMM dynamic panel threshold model.

2.4.1 Panel Regression

Table 2.2 shows the results of the system GMM estimation. For each type of flows, the first column shows the estimation for the baseline specification, while the second

17. Available respectively at https://databank.worldbank.org and https://www.prsgroup.com.

18. More details on the definitions and sources of the variables are provided in the Appendix, Table A.1.

column shows the estimation adding the interaction term. All regressions control for the macroeconomic variables mentioned above. The Hansen and serial correlation tests presented below the table state a good specification for all the models.

Table 2.2: Dynamic panel GMM regressions
Dependent variable: growth rate of real per-capita GDP
Sample Period: 1980-2015 (5-year average)

	Aggregate Flows		Private Flows		Public Flows	
	(1)	(2)	(3)	(4)	(5)	(6)
Private credit/GDP	0.0113	-0.0255*	0.00567	0.00463	0.0138*	-0.0144
	(1.64)	(-1.79)	(1.61)	(0.98)	(1.69)	(-1.63)
All flows	-0.111***	-0.172***				
	(-2.89)	(-4.92)				
Private credit/GDP*All flows		0.00107***				
		(4.31)				
Private flows			0.0258	0.0423		
			(0.83)	(1.44)		
Private credit/GDP*Private flows				-0.000120		
				(-0.67)		
Public flows					-0.129**	-0.142***
					(-2.52)	(-3.18)
Private credit/GDP*Public flows						0.000575***
						(3.79)
Observations	619	619	619	619	619	619
Hansen p-value	0.32	0.43	0.18	0.22	0.18	0.32
AR(1)	0.00	0.00	0.00	0.00	0.00	0.00
AR(2)	0.82	0.83	0.40	0.37	0.79	0.91

Note: The flow variables are defined as a share of GDP. All estimates include growth determinant variables (Log of initial GDP per-capita, human capital, population growth, investment, and government size), time dummies, and a constant. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels. P-values for statistical inadequacy specifications tests are provided.

For aggregate flows, the ratio of private credit to GDP has a positive effect on economic growth, but this effect is not statistically significant. Capital flows also enter the regression negatively and significantly at the 1% level (column (1)). Looking at private and public flows, the results show that the negative effect of public flows drives the negative effect of aggregate flows on growth. The coefficient of public flows is, in fact, negative and statistically significant at the 5% level (column (5)), while the coefficient of private flows is positive but statistically non-significant (column (3)). Notice also that the ratio of private credit to GDP is positive but only significant at the 10% level for public flows.

Adding the interaction between the ratio of private credit to GDP and capital flows to the regressions shows that the effect of aggregate capital flows becomes positive when the development of the financial market reaches a certain level. The coefficient on the interaction term with the aggregate flows is, in fact, positive and statistically significant at the 1% level, as shown in column (2). Looking at the interaction terms, one notes that the coefficient is negative for the interaction between private credit/GDP and private flows/GDP, as shown in column (4), but non-significant; concerning the interaction between private credit/GDP and public flows/GDP, the coefficient is positive and statistically significant at the 1% level, as shown in column (6). This finding shows that total capital flows promote growth only in countries where banks and other financial institutions ease access to credit. Otherwise, total capital flows may be harmful for economic growth. Moreover, the results show that this negative effect is driven by public flows, while private flows do not have any significant effect on economic growth. In the meantime, the result also shows that, overall, the ratio of private credit to GDP does not have a significant effect on growth.

Next, I investigate for each type of private flows whether these flows have non-significant effects on economic growth. Table 2.3 presents the regressions for each type of private flows, using the same specification as above.

As shown in columns (1), (3), and (5) of Table 2.3, none of the private flows has a significant effect on economic growth. The coefficients of FDI flows and private debt flows are positive, while negative for portfolio equity flows. However, one notes that the interaction between FDI flows and the ratio of private credit to GDP is positive and statistically significant at the 10% level, as shown in column (2). This result indicates that FDI flows may promote economic growth only when the development of the financial market reaches a certain level. The results show the same threshold effect of private debt on growth with a positive and significant (at the 1% level) coefficient of the interaction variable.

These results show that the effect of private flows on growth is mixed when looking at each type of flows. While none of the private flows has an effect on economic growth,

Table 2.3: Dynamic panel GMM regressions
Dependent variable: growth rate of real per-capita GDP
Sample Period: 1980-2015 (5-year average)

	FDI		Portfolio Equity		Private Debt	
	(1)	(2)	(3)	(4)	(5)	(6)
Private credit/GDP	0.00358	-0.00862	0.00345	0.00351	0.00339	-0.000758
	(0.74)	(-1.45)	(0.96)	(1.06)	(0.86)	(-0.16)
Foreign direct investment	0.0280	-0.191				
	(1.17)	(-1.50)				
Private credit/GDP*FDI		0.00104*				
		(1.89)				
Portfolio equity			-0.110	-0.233		
			(-0.49)	(-0.28)		
Private credit/GDP*Portfolio equity				0.00110		
				(0.14)		
Private debt					0.0830	-0.0131
					(1.39)	(-0.18)
Private credit/GDP*Private debt						0.00331***
						(3.23)
Observations	608	608	582	582	617	617
Hansen p-value	0.17	0.28	0.20	0.32	0.18	0.19
AR(1)	0.00	0.00	0.00	0.00	0.00	0.00
AR(2)	0.26	0.29	0.29	0.25	0.25	0.23

Note: The flow variables are defined as a share of GDP. All estimates include growth determinant variables (Log of initial GDP per-capita, human capital, population growth, investment, and government size), time dummies, and a constant. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels. P-values for statistical inadequacy specifications tests are provided.

the estimations with interaction variables show that FDI and private debt flows may promote growth above a certain level of financial development. In the next section, I investigate further on the non-linearity of each type of flows and determine the estimated threshold level of financial development.

The results presented in this section recommend that the effect of foreign capital inflows on economic growth is non-linear. The next section formally uses a suitable procedure to take into account this threshold effect in the estimations.

2.4.2 The Panel Threshold Regression

Tables 2.4 and 2.5 present the results for the dynamic panel threshold model. For each type of flows, I estimate the model with and without the macroeconomic control variables mentioned above. I also perform the bootstrap linearity test procedure proposed by Seo and Shin (2016) to test for the presence of a threshold effect. The bootstrapped p-value is presented in Tables 2.4 and 2.5, using 100 replications. Under the null hypothesis, the model is linear.

Table 2.4: Dynamic panel threshold regressions
Dependent variable: growth rate of real per-capita GDP
Sample Period: 1980-2015 (5-year average)

	Aggregate Flows		Private Flows		Public Flows	
	(1)	(2)	(3)	(4)	(5)	(6)
	Low level of Financial Development ($FinDev \leq \gamma$)					
FinDev	0.052***	0.009***	-0.003**	0.001***	0.053***	0.011***
	(0.005)	(0.003)	(0.001)	(0.000)	(0.005)	(0.004)
Net Flows	-0.009***	-0.007***	0.004***	0.002***	-0.008***	-0.009***
	(0.002)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
	High level of Financial Development ($FinDev > \gamma$)					
FinDev	-0.048***	-0.015***	0.001	-0.004***	-0.050***	-0.012***
	(0.005)	(0.001)	(0.002)	(0.000)	(0.005)	(0.004)
Net Flows	0.013***	0.021***	0.005***	0.000	-0.014***	-0.000
	(0.002)	(0.005)	(0.001)	(0.002)	(0.002)	(0.001)
Threshold value	16.75***	45.03***	35.39***	53.42***	13.78***	16.24***
	(2.285)	(4.768)	(7.641)	(4.838)	(1.870)	(3.472)
Control variables	No	Yes	No	Yes	No	Yes
No. countries	61	54	61	54	61	54
Test of nonlinearity, p-value	0.46	0.00	0.49	0.00	0.68	0.00

Note: The flow variables are defined as a share of GDP. (1), (3), and (5) are equations without macroeconomic controls. (2), (4), and (6) include growth determinant variables (Log of initial GDP per-capita, human capital, population growth, investment, and government size), and a constant. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.

Table 2.4 presents the results for aggregate flows, as well as for private and public flows. The bootstrap p-values state rejection or non-rejection of the null hypothesis and therefore confirm the presence or absence of a threshold effect for each specification. Following this result, each country in each period may belong either to the group of underdeveloped financial markets (when the ratio of private credit to GDP is below the estimated threshold value) or to the group of developed financial markets (when the ratio of private credit to GDP is above the estimated threshold value).

For aggregate flows, foreign capital promotes economic growth only when the ratio of private credit to GDP is above 45.03 %, as shown in column (2). The estimated threshold value is statistically significant at the 1% level. In my sample, around 80% of the financial markets are below the estimated threshold value. The coefficient is negative when the ratio of private credit to GDP is less than the estimated threshold value and positive otherwise. Both coefficients are significant at the 1% level, but different in magnitude. The effect is greater in absolute value above the threshold. In addition, domestic financial development promotes growth for underdeveloped financial markets while better developed financial markets decrease growth; the associated coefficients are statistically significant at the 1% level. By not controlling for the other macroeconomic variables, the estimated threshold value is lower (16.75%), as indicated in column (1). This result suggests that good economic conditions may help some countries to benefit from external capital flows.

Table 2.5: Dynamic panel threshold regressions: private flows
Dependent variable: growth rate of real per-capita GDP
Sample Period: 1980-2015 (5-year average)

	FDI		Portfolio Equity		Private Debt	
	(1)	(2)	(3)	(4)	(5)	(6)
	Low level of Financial Development ($FinDev \leq \gamma$)					
FinDev	0.050***	0.003***	-0.027***	0.001	0.109***	-0.005*
	(0.010)	(0.001)	(0.005)	(0.002)	(0.011)	(0.001)
Net Flows	0.070***	0.005	1.475***	0.084***	0.025***	-0.001
	(0.008)	(0.004)	(0.143)	(0.032)	(0.002)	(0.001)
	High level of Financial Development ($FinDev > \gamma$)					
FinDev	-0.047***	-0.006***	0.032***	-0.003	-0.108***	0.003*
	(0.010)	(0.001)	(0.005)	(0.002)	(0.012)	(0.002)
Net Flows	-0.053***	0.010**	-1.478***	-0.089***	-0.012***	0.015***
	(0.008)	(0.004)	(0.141)	(0.034)	(0.002)	(0.003)
Threshold value	10.95***	45.87***	16.81***	37.08***	11.68***	26.80***
	(1.615)	(3.927)	(0.432)	(12.017)	(1.491)	(7.621)
Control variables	No	Yes	No	Yes	No	Yes
No. countries	61	54	46	45	60	53
Test of nonlinearity, p-value	0.20	0.00	0.00	0.00	0.08	0.00

Note: The flow variables are defined as a share of GDP. (1), (3), and (5) are equations without macroeconomic controls. (2), (4), and (6) include growth determinant variables (Log of initial GDP per-capita, human capital, population growth, investment, and government size), and a constant. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.

Regarding private capital flows, the estimated threshold value is 53.42% (also significant at the 1% level). Below this level of financial development, private capital flows have a positive effect on economic growth (around 86% of the sample is below the estimated threshold). The estimated coefficient is positive and statistically significant at the 1% level. Otherwise, the coefficient remains positive but non-significant when controlling for the other determinants of growth. Countries with an underdeveloped financial market benefit from external private flows, while countries with well-functioning financial markets do not benefit from private flows. On the other hand, public capital flows have a negative effect on economic growth for countries with an underdeveloped financial market. The coefficient is negative and significant at the 1% level. The estimated threshold value is 16.24%. Above this value, public flows do not affect economic growth. The coefficient is null and non-significant [19]

Next, I disentangle private capital flows – namely, FDI flows, portfolio equity flows, and private debt flows, and investigate the threshold effect of financial development on economic growth for each flows. Table 2.5 presents the results of the dynamic panel threshold model for each type of private flows; it contains the estimations with and without the macroeconomic control variables and also the bootstrapped p-values. Except for the model with FDI flows without control variables (bootstrapped p-value is 0.20), the linearity test is in favour of the presence of threshold effect in all specifications, with their bootstrapped p-value being zero (except for column (5), whose p-value is 0.08).

As per column (1), FDI flows have a positive and significant effect (at the 1% level) on growth for countries with a ratio of private credit to GDP below the estimated threshold value (10.95%). Above this threshold, the effect becomes negative and also significant at the 1% level. However, the bootstrapped p-value fails to reject the null hypothesis of linearity in the model. Adding control variables increases the estimated threshold value to 45.87%, with the bootstrapped p-value supporting non-linearity, as shown in column (2). The effect of FDI flows on growth remains positive but non-significant for less developed financial markets. The effect becomes positive above the estimated threshold and statistically significant at the 1% level. This result highlights how domestic

19. When I do not control for the other variables, the coefficient is negative and significant. However, the bootstrap p-value reveals that there is no threshold effect for aggregate and private flows.

economic conditions matter for FDI flows to be growth enhancing.

Turning to the portfolio equity flows, the estimated threshold value is 16.81% for the regression without the control variables, and the bootstrapped p-value also rejects the null hypothesis of linearity of the model. Therefore, one can distinguish between low and high developed financial markets. As shown in column (3), portfolio equity flows have a positive and significant effect on economic growth below the estimated threshold value. Furthermore, the effect is negative and also significant at the 1%. Adding control variables decreases the magnitudes of the coefficients, but the signs and significant levels are the same as per column (4). The estimated threshold is higher (37.08%) and the bootstrapped p-value also rejects the null hypothesis. At the same time, the level of financial development becomes non-significant below and above the threshold.

Columns (5) and (6) show respectively regressions without and with control variables for public debt flows. The bootstrapped p-values reject the null hypothesis of linearity for both regressions against the alternative of a threshold effect. The estimated threshold values are 11.68% and 26.80% for the regression without and the regression with the control variables, respectively. Without the control variables, private debt flows have positive effect on economic growth below the estimated threshold and a negative effect above. Both coefficients are significant at the 1% level. However, the effect becomes non-significant below the threshold and significant at the 1% level above.

Capital flows have different effects on growth, according to the type of capital flows and the level of development of the financial markets relative to the estimated threshold value.

2.4.3 Discussion

My analysis uncovers two main pieces of evidence. Based on two different estimation methods – the dynamic panel with interaction variables and threshold dynamic panel, it reveals that aggregate capital flows appears to be beneficial to economic growth only when financial market development reaches a certain threshold. The relationship between capital flows and economic growth have been widely discussed in the literature. The observed capital flows are negatively correlated with economic growth, in contradiction to the prediction of the standard neoclassical growth model. My analysis shows that this relationship may depend on the type of capital flow (private vs Public). Furthermore, I show evidences that the relationship is non-linear, according to the development of the financial market. My results are consistent with previous findings (Gourinchas and Jeanne, 2013; Koch and Zongo, 2018; Prasad et al., 2007). Besides analyzing the non-linear effect of different types of capital flows, this article proposes an estimated threshold of financial development that allows for separating economies between low and highly developed financial markets. An explanation of this asymmetric effect of capital flows on economic growth may lie in the ability of the local financial market to reallocate funding (local as well as foreign) to more productive sectors, in order to foster economic growth. For instance, Prasad et al. (2007) argued that capital inflows may harm growth in underdeveloped financial countries by increasing real wages, appreciating the currency, and also by reducing the marginal product of investment.

In addition, to explain the discrepancy, other papers proposed to analyze private flows, and public flows separately (Aguiar and Amador, 2011; Gourinchas and Jeanne, 2013; Alfaro et al., 2014). They stated that public flows are negatively correlated with economic growth, while private flows are positively correlated, as predicted by the neoclassical growth model. My results corroborate the former. Furthermore, I show that the negative (positive) correlation of public (private) flows with economic growth is more relevant for countries with less developed financial markets. For countries with well-functioning financial markets, there is no statistically significant relationship when taking into account the other growth determinants.

Why are public flows not beneficial to countries with an underdeveloped financial market? An answer to this question may lie in the large international reserve's accumulation in those countries. Traditionally, developing countries accumulate foreign reserves because of precautionary and mercantilist motives.[20] This accumulation may increase if the domestic financial market is underdeveloped. Dominguez (2009) argued that, because the private sector is credit constrained in countries with underdeveloped financial markets, the public sector accumulates more foreign reserves to compensate

20. See, among others, Aizenman and Lee (2007); Dooley et al. (2003); Frenkel and Jovanovic (1981).

for the private sector external underinsurance problem. Cruz and Kriesler (2010) also showed that part of the large accumulation of foreign reserves is a waste of resources, which could be an alternative source of financing for productive projects, and therefore enhance growth. Because the accumulation of international reserves also leads to a decrease in aggregate demand, public flows may harm growth. At the same time, the other public flows – namely, aids and grants, may enhance growth if the domestic economic conditions allow them to absorb and redirect funds towards productive investment.

According to my results, total private flows have a positive effect on economic growth or, at best, no effect above the estimated threshold value. This finding corroborates the results of Gourinchas and Jeanne (2013); Alfaro et al. (2014). Nevertheless, the results are mixed when looking at individual types of private flows. The results show that only portfolio equity flows have a positive and significant effect on economic growth below the estimated threshold values. Also, FDI and private debt flows promote growth, while portfolio equity flows become harmful for economic growth. This result implies that countries with underdeveloped financial markets should prioritize portfolio equity flows while countries with well-functioning financial markets should promote FDI and private debt flows.

An extensive literature states the benefits of FDI flows for economic growth, mostly in countries with well-functioning financial markets (e.g., Alfaro et al. (2004, 2009, 2010); Azman-Saini et al. (2010)). The arguments in favour of these findings is that firms in a given country have to invest in upgrading their technology or in adopting new technologies that come with the FDI; a developed financial market may ease these investments so that the country can take advantage of the FDI.[21] In contrast, Hsu and Wu (2009) showed that FDI flows are not necessary growth-enhancing for countries with well-functioning financial markets. Using various econometric methods to avoid the endogeneity concern, they found strong evidence that weak instruments may bias the estimated effect of FDI on economic growth through financial market development. My investigation provides evidence supporting the hypothesis that FDI flows promote

21. Another argument relies on the need of a minimum stock of human capital in the country to take advantage of FDI flows (Borensztein et al., 1998). Other determinants such as institutional quality (Peres et al., 2018) and infrastructures (Kinoshita and Lu, 2006) may help underdeveloped financial markets to benefit from FDI flows.

growth in countries with well-functioning financial markets.

Portfolio equities differ from FDI because they are not subjected to ownership and control. Therefore, there is no a priori reason for their flows affecting similarly economic growth. In the literature, there is no consensus on the effect of portfolio equity flows on economic growth. While some works found positive effect (Ferreira and Laux, 2009), other studies stated that portfolio equity flows have negative effect on growth (Choong et al., 2010; Kose et al., 2009). Durham (2004) showed that the effect of equity foreign portfolio investment on growth is mixed when considering financial development and institutions. Aizenman et al. (2013) also found a smaller and less stable effect of equity flows on growth. My investigation shows that equity flows promote economic growth up to a certain level of financial development. Otherwise, the effect becomes negative. When the domestic financial market fails to grant sufficient credit to investors, they raise funds abroad to finance their productive projects. Therefore, equity flows boost growth in countries with underdeveloped financial markets.

The effect of private debt flows on growth is also mixed, as found in previous articles Durham (2004). In contrast with FDI and equities, the creditor issues liabilities and the borrower must repay the debts. Therefore, debts are granted according to the risk of default of the borrower as well as the profitability of the project. A well-functioning financial market reflects lower transaction costs, excellent information about investment, allocation of resources, monitoring, and pooling of risk. Therefore, foreign lenders are more willing to grant credit to investors in countries with developed financial markets. This additional investment is thus innovation promoting and enhances growth enhancing.

Looking at the magnitude of the coefficients below the threshold values, it appears that portfolio flows may be driving the positive effect of private flows. Above the thresholds, the negative effect of portfolio flows is larger relative to the combined positive effects of FDI and private debts flows. That may explain why private flows exhibit positive effects below the threshold and no effect above.

A second interesting result I document is that financial development may be promoting growth only below some estimated level. Beyond that treshold, the level of financial development might be harmful to economic growth, consistent with previous findings. [22] I find in most of my regressions that financial development promotes growth below the estimated threshold values and becomes harmful or non-significant above. A higher level of financial development may be harmful to growth because it may increase output volatility (Easterly et al., 2001). It may also generate competition for scarce resources between the financial sector and the other sectors (Cecchetti and Kharroubi, 2012). However, my estimated threshold values beyond which private credit becomes harmful for growth are much lower than those found previously in the literature (88% in Law and Singh (2014), 90% in Cecchetti and Kharroubi (2012), and 100% in Easterly et al. (2001)). Notice that none of those works include external capital in their investigations. In contrast, Aghion et al. (2005) found that the positive effect of financial development on economic growth vanishes beyond 39%, which is somewhat close to most of the estimated thresholds I find.

2.5 Robustness Checks

This section examines the sensitivity of the results for the dynamic panel threshold model to various robustness checks. Mainly, I use alternative financial development indicators, consider additional growth determinant variables, treat individually gross inflows and gross outflows, and deal with the influence of outliers in the regressions. Table 2.6 presents the results using the ratio of domestic credit to GDP and the ratio bank assets to GDP. As in column (1), aggregate capital flows still have a negative effect below the estimated threshold value when using the ratio of domestic credit as the financial development indicator. Above, the effect is also positive. Both effects are statistically significant at the 1% level. The estimated threshold value is 24.79%, significant at the 1% level, and the bootstrap p-value reveals non-linearity. At this threshold, aggregate capital flows foster economic growth for around 55% of the sample. Column (4) shows that the result is similar when using the ratio of bank assets to GDP as the financial development indicator. In this case, the estimated threshold is 23.50%, significant at the 1% level, and the bootstrap p-value also suggests a non-linearity. Aggregate

22. See Aghion et al. (2005); Arcand et al. (2015); Cecchetti and Kharroubi (2012); Easterly et al. (2001); Law and Singh (2014) among others.

capital flows are growth-enhancing for 57% of the sample.

Table 2.6: Dynamic panel threshold: alternative financial development indicators
Dependent variable: growth rate of real per-capita GDP
Sample Period: 1980-2015 (5-year average)

	FinDev = Domestic Credit/GDP			FinDev = Bank Assets/GDP		
	Total	Private	Public	Total	Private	Public
	Low level of Financial Development ($FinDev \leq \gamma$)					
FinDev	-0.010***	-0.002***	0.045***	0.006	-0.000	-0.003*
	(0.002)	(0.000)	(0.009)	(0.004)	(0.003)	(0.001)
Net Flows	-0.007***	0.002***	-0.006**	-0.009***	0.002***	-0.000
	(0.002)	(0.000)	(0.002)	(0.001)	(0.000)	(0.000)
	High level of Financial Development ($FinDev > \gamma$)					
FinDev	0.009***	0.003**	-0.046***	-0.009**	-0.002	-0.003*
	(0.002)	(0.001)	(0.008)	(0.003)	(0.004)	(0.001)
Net Flows	0.008***	-0.003*	0.000	0.013***	-0.000	0.016***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)
Threshold value	24.79***	73.33***	13.60***	23.50***	23.08***	42.91***
	(7.980)	(3.488)	(1.889)	(6.141)	(8.389)	(2.914)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
No. countries	54	54	54	53	53	53
Test of nonlinearity, p-value	0.00	0.00	0.00	0.00	0.00	0.00

Note: All estimates include growth determinant variables (Log of initial GDP per-capita, human capital, population growth, investment, and government size), and a constant. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.

Concerning private capital flows, the effect is also positive and significant below the threshold when using the two alternative indicators. Above the threshold, the effect is negative and significant at a small level (10%) only when using domestic credit as the indicator of financial development. The estimated threshold value is 73.33% (only 8% of the sample is above this threshold value) when domestic credit is used as the indicator and 23.08% when using bank assets. For public flows, the results exhibit a nil effect below the threshold value when using bank assets as an alternative measure for the level of financial development; the effect is also nil above the threshold value when using domestic credit as an alternative measure for the level of financial development. The estimated threshold is 13.60% when using domestic credit and 42.91% when using bank assets as an indicator of financial development. Compared to the estimation using private credit, the estimation using bank assets exhibit a larger estimated threshold value. This might explain the insignificance of the effect of public flows below the threshold when using bank assets as the indicator of financial development. Overall, using two alternative financial development indicators does not significantly alter the results. My results suggest that aggregate flows harm economic growth below the estimated threshold and are growth-enhancing above. The results with respect to private flows suggest a positive effect on growth for countries with an underdeveloped financial market, while the results for public flows suggest an adverse effect for those countries. The bootstrap p-values suggest non-linearity for all of types of flows.

Table 2.7: Dynamic panel threshold regressions: other robustness checks
Dependent variable: growth rate of real per-capita GDP
Sample Period: 1980-2015 (5-year average)

	Additional Control Variables[a]			Winsorized Data[b]			Positions	
	Total	Private	Public	Total	Private	Public	Liabilities/GDP	Assets/GDP
	Low level of Financial Development ($FinDev \leq \gamma$)							
FinDev	-0.001	-0.002	0.007	0.006**	0.001	-0.001	0.006*	-0.004
	(0.004)	(0.000)	(0.004)	(0.003)	(0.000)	(0.007)	(0.003)	(0.006)
Net Flows	-0.001	-0.005	-0.008***	-0.017***	0.001***	-0.016***		
	(0.003)	(0.005)	(0.002)	(0.005)	(0.000)	(0.002)		
Gross Flows							-0.005***	-0.006***
							(0.001)	(0.002)
	High level of Financial Development ($FinDev > \gamma$)							
FinDev	0.000	0.003	-0.010*	-0.010***	-0.003***	0.000	-0.006**	0.004
	(0.005)	(0.010)	(0.006)	(0.003)	(0.000)	(0.008)	(0.003)	(.006)
Net Flows	0.028**	0.027***	0.000	0.020***	-0.002	0.001		
	(0.011)	(0.001)	(0.011)	(0.003)	(0.002)	(0.002)		
Gross Flows							0.005***	0.007***
							(0.001)	(0.001)
Threshold value	46.16***	18.83***	43.91***	21.75***	53.42***	14.41***	16.51***	14.62***
	(2.779)	(8.510)	(7.139)	(8.241)	(5.154)	(5.356)	(2.06)	(3.23)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. countries	45	45	45	54	54	54	54	54
Test of nonlinearity, p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: All estimates include growth determinant variables (Log of initial GDP per-capita, human capital, population growth, investment, and government size), and a constant. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.
[a]Estimates also include institutions, exchange rates, and capital account openness.
[b]the dependent variable and capital flows are winsorized at the 2.5 percentile

Furthermore, I perform a robustness check using additional variables that may matter for growth. Hence, I add a capital account openness index, the exchange rate, and the quality of institutions amongst the regressors. The results are presented in columns (1), (2), and (3) of Table 2.7. With respect to aggregate flows, the estimated threshold value is close to that of the main regression. However, the coefficient of aggregate flows below the threshold becomes not statistically significant. Those additional variables might moderate or mute the negative effect of aggregate flows on growth in countries with an underdeveloped financial market. For private flows, the coefficient below the threshold becomes non-significant; the coefficient above the threshold is positive and significant. Nonetheless, the estimated threshold value is lower than the threshold on the main regression. For public flows, even if the estimated threshold is higher, the result shows that the coefficient below the threshold remains negative and significant for the main regression.

Having analyzed the effect of net capital flows (gross inflows minus gross outflows) on economic growth, I now turn to the effect of each gross flows (inflows and outflows) on economic growth to verify whether only one of these flows drives the net effect. Columns (7) and (8) of Table 2.7 show that both gross flows have significant effects on economic growth. Further, the effects are similar to the effects of net flows. Below the estimates threshold values, both gross inflows and outflows have negative effects on economic growth. In contrast, the effects become positive above the estimated threshold. However, the estimated threshold values are smaller relative to the threshold for net flows. These values are 16.51 and 14.62, respectively, for total liabilities and total assets.

Lastly, I deal with the outliers in the regressions. My sample for the dynamic panel threshold model is already reduced because it requires a balanced panel. Using the traditional tests to detect and remove outliers might further decrease the sample size. Therefore, the dependent variable and capital flows are winsorized at the 2.5 percentile to eliminate the influence of extreme observations. The estimations results are presented in Table 2.7, columns (4), (5), and (6). Apart from the fact that the estimated threshold value is much lower (21.75% instead of 45.03% for the main regression), the results are relatively similar and confirm the robustness of my findings.

2.6 Conclusion

An extensive literature has analyzed the relationship between external capital and economic growth. To understand why international capital does not flow to high growth countries as predicted by the standard neoclassical model, a strand of the literature proposes to investigate capital flows by type (private and public), while another strand focuses on domestic economic conditions. This study emphasizes the level of financial development as the threshold variable and analyzes the non-linearity and non-monotonic relationship between external capital flows and economic growth. To do so, the study uses two econometric methods – namely, a dynamic panel model with interaction variables and a dynamic panel threshold model.

I found evidence that aggregate capital flows may foster economic growth only when the country achieves a certain level of financial development. Otherwise, external capital may have adverse effects on growth. Furthermore, the dynamic panel threshold model allows for the estimation of this threshold value. As the relationship may be different according to the type of capital flows, I investigate private flows and public flows separately. I found that private flows may be growth-enhancing in countries with an underdeveloped financial market, while public flows may harm growth. For countries that have achieved a level of financial development above the estimated threshold value, none of those flows have a statistically significant effect on economic growth.

Lastly, I analyze private capital flows separately. The empirical evidence shows that countries with underdeveloped financial markets benefit only from portfolio equity flows. In contrast, FDI and private debt flows may foster growth only when the financial market reaches the estimated threshold values. The results also show that the positive effect of portfolio flows drives the positive effect of private flows for underdeveloped financial markets. For well-functioning financial markets, its negative effect inhibits the positive effect of FDI and private debt flows. This may explain why the results regarding private flows exhibit positive effects below the threshold and no effect above.

In light of these findings, it appears that developing the domestic financial markets is critical for countries in order to take advantage of FDI and private debt flows, but also to avoid the adverse effects of public flows. My findings suggest that public flows may be harmful to countries with underdeveloped financial markets. However, many of those countries rely on external aids and grants to implement development policies. It may be worthwhile to examine deeper the effects of the various types of flows on growth.

APPENDIX A

Table A.1: Variable definitions and sources

Variable	Definition	Source
Real GDP per capita growth	Growth rate of real GDP per capita at constant 2005 national prices	Penn World Table, version 9.1
Aggregate capital flows	Net capital flows. Average of the annual observations for the negative of the current account balance normalized by the annual nominal GDP (-CA/GDP), in U.S. dollars.	Alfaro et al. (2014)
Private capital flows	Net private capital flows. Sum of net flows of foreign direct investment (FDI), portfolio equity investment, and private debt (% GDP).	Alfaro et al. (2014)
Public capital flows	Net public capital flows. Comprise grants, concessional aid, or any government-guaranteed debt, where reserves is netted out (% GDP).	Alfaro et al. (2014)
Foreign direct investment/ GDP	Net FDI flows. Liabilities minus assets of Foreign Direct Investment (% GDP).	Alfaro et al. (2014)
Portfolio equity/GDP	Net portfolio equity flows. Liabilities minus assets of portfolio equity (% GDP).	Alfaro et al. (2014)
Private debt/GDP	Net private debt flows. Liabilities minus assets of private debt (% GDP). Comprise portfolio debt, loans, and other instruments including financial derivatives, currency and deposits, financial leases, and trade credits	Alfaro et al. (2014)
Private sector credit/ GDP	Total credit to the private sector relative to GDP, excluding all other types of credit, such as credit to the government, public sector, and state-owned companies.	World Bank's Global Financial Development Database (Čihák et al., 2012)

Continues on next page

Table A.1 – Continued from previous page

Variable	Definition	Source
Domestic credit/GDP	Domestic credit to private sector refers to financial resources provided to the private sector (% GDP).	World Bank's Global Financial Development Database (Čihák et al., 2012)
Bank assets/GDP	Total assets held by deposit money banks as a share of sum of deposit money bank and Central Bank claims on domestic non-financial real sector (% GDP).	World Bank's Global Financial Development Database (Čihák et al., 2012)
Government spending/ GDP	Government consumption share as a percentage of GDP.	Penn World Table, version 9.1
Investment /GDP	Investment share as a percentage of GDP.	Penn World Table, version 9.1
Human capital	Index of human capital per person, based on years of schooling (Barro and Lee, 2013) and returns to education Psacharopoulos (1994)	Penn World Table, version 9.1
Population growth	Annual population growth rate	Penn World Table, version 9.1
Capital account openness	Chinn and Ito index. It measures the openness in capital account transactions.	Chinn and Ito (2008)
Exchange rate	Determined by national authorities or according to the rate determined in the legally sanctioned exchange market. Calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar).	World Bank World Development Indicators
Institutions	Index of investment profile, based on the factors that affect the risk to investment. Comprises risk rating for contract Viability/Expropriation, profits repatriation, and payment delays.	International Country Risk Guide (ICRG)

APPENDIX B

LIST OF COUNTRIES

Full Sample

Albania; Argentina; Benin; Burkina Faso; Bangladesh; Bulgaria; Belize; Bolivia; Brazil; Barbados; Botswana; Chile; China; Cote d'Ivoire; Cameroon; Congo. Rep.; Colombia; Comoros; Cabo Verde; Costa Rica; Dominica; Dominican Republic; Algeria; Ecuador; Egypt. Arab Rep.; Ethiopia; Fiji; Gabon; Ghana; Gambia. The; Guinea-Bissau; Grenada; Guatemala; Honduras; Hungary; Indonesia; India; Iran. Islamic Rep.; Jamaica; Jordan; Kenya; Korea. Rep.; Lao PDR; Liberia; St. Lucia; Sri Lanka; Lesotho; Morocco; Madagascar; Maldives; Mexico; Mali; Malta; Mongolia; Mozambique; Mauritania; Mauritius; Malawi; Malaysia; Niger; Nigeria; Nicaragua; Nepal; Oman; Pakistan; Panama; Peru; Philippines; Paraguay; Rwanda; Sudan; Senegal; Sierra Leone; El Salvador; Eswatini; Seychelles; Syrian Arab Republic; Togo; Thailand; Trinidad and Tobago; Tunisia; Turkey; Uganda; Uruguay; St. Vincent and the Grenadines; Venezuela. RB; Zambia; Zimbabwe;

Balanced Panel for Threshold Regressions

Argentina; Benin; Bangladesh; Belize; Bolivia; Brazil; Botswana; Chile; China; Cote d'Ivoire; Cameroon; Colombia; Comoros; Cabo Verde; Costa Rica; Dominica; Dominican Republic; Egypt. Arab Rep.; Fiji; Ghana; Grenada; Guatemala; Honduras; Hungary; Indonesia; India; Jamaica; Jordan; Kenya; St. Lucia; Sri Lanka; Morocco; Madagascar; Maldives; Mexico; Mali; Mauritius; Malaysia; Niger; Nigeria; Nicaragua; Pakistan; Panama; Philippines; Paraguay; Rwanda; Sudan; Senegal; Sierra Leone; El Salvador; Eswatini; Seychelles; Syrian Arab Republic; Togo; Thailand; Tunisia; Turkey; Uganda; Uruguay; St. Vincent and the Grenadines; Venezuela. RB;

CHAPTER III

BILATERAL CROSS-BORDER BANKING FLOWS: THE ROLE OF THE FINANCIAL DEVELOPMENT OF HOST AND SOURCE COUNTRIES

Abstract

This paper analyzes the role of the financial development in both source and host countries on cross-border banking flows. It attempts to fill the gap on the underexplored effect of financial development on capital flows, especially on cross-border banking flows, by providing empirical evidence. Using the Bank for International Settlements (BIS) dyadic banking flows data, I assess the responsiveness of cross-border banks' transactions to differences between the home country's and the foreign's financial markets. The study uses instrumental variables to address endogeneity concerns and suitable fixed effects to identify appropriately the role of financial development. The data are made up of bilateral cross-border transactions between banks located in 24 reporter countries and all sectors (banks and non-banks) located in 165 counterparty countries. The main finding suggests that bank flows go from well-functioning financial markets to underdeveloped financial markets, only when the transaction is financed by debt security. Otherwise, i.e. when the financing instrument is loan, I show evidence that banks in countries with a developed financial market lend more to non-banks in countries with also well-functioning financial markets. The findings conciliate the ambiguity on the relationship between domestic financial conditions and capital flows in the literature by showing that the relationship may be positive or negative, according to the financing instrument and the borrowing sector. I also find that foreign and domestic financial markets complement each other for cross-border banking flows.

KEYWORDS: Bilateral capital flows, Cross-border banking flows, Financial development, Productivity growth

JEL:C23, C26, F34, O16

3.1 Introduction

The 2008's Global Financial Crisis has highlighted how interlinked financial markets are. It also renewed the debate on the role of financial market conditions as potential drivers of international banking flows. However, although there are empirical evidences emphasizing the importance of financial market conditions of source and host countries separately, the simultaneous effect of these markets on capital flows remains underexplored. Moreover, prior to 2008, most of these studies focused on net flows to the detriment of gross flows. Purchases of domestic assets by foreigners (gross inflows) were an almost perfect reflection of net flows; thus, it was appropriate to ignore purchases of foreign assets by domestic agents (gross outflows) and study only net flows. Since the early nineties and mostly in the aftermath of the crisis, gross outflows as well as gross inflows have increased enormously, while net flows remained relatively stable as shown in Figure 3.1.[1] To the extent that gross capital inflows and outflows are highly correlated and both are more volatile than net flows (Broner et al., 2013; Bruno and Shin, 2015), it is worth revisiting the drivers of capital flows. In response to these various gaps in the literature, this current article provides an empirical insight on the effects of financial market development in both source and host countries on gross banking flows, as well as on net flows.

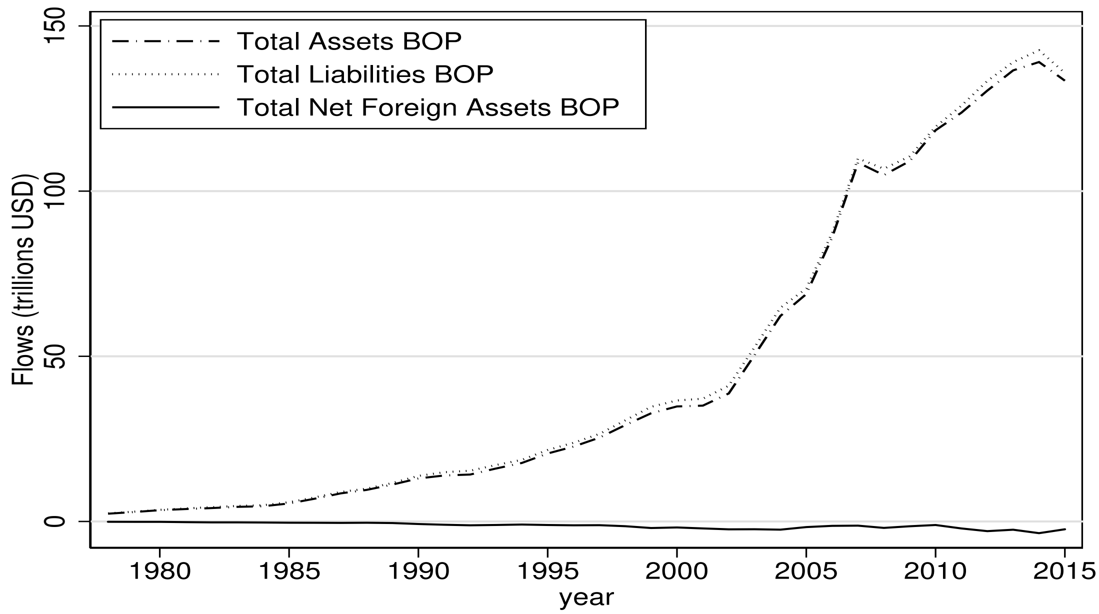
The focus is on cross-border banking flows, as the effects of financial development on this type of flows have received less attention in the literature. Starting with Forbes and Warnock (2012), one of the first papers to advocate the importance of analyzing gross capital flows, successive papers have aimed to analyze the drivers and the effects of these flows on economic activities.[2] Various papers have identified and analyzed some drivers of cross-border banking flows, but few articles, to the best of my knowledge, have analyzed the responsiveness of both gross and net cross-border banking flows to the simultaneous financial market conditions of both host and source countries.[3] The

1. See also Figure A.1 for cross-border banking flows.

2. For example Avdjiev et al. (2020); Broner et al. (2013); Bruno and Shin (2015); Davis et al. (2019)

3. For example, Correa et al. (2018) analyze monetary policies as determinant of cross-border banking flows. Choi and Furceri (2019); Wang (2018) study the effects of uncertainty on international banking flows. Lanau (2011) analyze the effect of domestic financial regulation on non-banks external borrowing.

Figure 3.1: Annual aggregate capital flows



BoP: Balance of Payments

existing few studies on the relationship between financial development and gross flows have focused more on portfolio equity flows, portfolio debt flows, and Foreign Direct Investment (FDI) flows, but the relationship with banking flows remains unexplored. [4] However, national financial markets may affect cross-border banking flows as national banks and non-banks may have different motives to borrow or lend abroad according to domestic and foreign financial conditions. [5] Shedding more light on the role of the financial development on gross capital flows should help to explain some discrepancies between theoretical predictions and empirical findings on capital flows. Since the relationship between economic growth and capital flows is a puzzle in the literature, the current study shows that this relationship may be positive or negative according to the

4. Figures 3.2 and 3.3 show that the bank's assets and liabilities are not negligible compared to the aggregate assets and liabilities of the balance of payment. It also shows that banking flows track very well aggregate gross flows.

5. For example, Avdjiev et al. (2020) showed that national banking systems had played an important role in the responsiveness of gross cross-border banking flows (in the form of bank lending and international bond issuance) to the U.S. monetary policies and global risk.

financing instrument and the borrowers' sector.

More specifically, I address the following research questions: first, how do domestic and foreign financial markets conditions affect cross-border banking flows? Second, the borrowers' or lenders' motives may differ according to the sector (bank or non-bank). The level of risk may also differ according to the financing instrument (debt securities or loans). Therefore, are these effects similar regardless of the sectors and the financing instrument? Third, to which extent are foreign and domestic financial markets interlinked for cross-border banking flows? The effect of financial development on capital flows is ambiguous. A well-functioning financial market may increase savings and increase the possibility to invest or lend to countries with higher productivity growth and a higher probability of profit. Besides, the need for external borrowing may be lower in a country with a developed financial market. On the other hand, the need for external borrowing may increase when the financial market is underdeveloped and domestic investors have limited access to credit (Hale, 2011; Gozzi et al., 2010). As mentioned above, capital may flow to these countries, mostly when productivity growth is high. An underdeveloped financial market may also reflect the difficulties of the market to manage risks, mobilize investment towards the most profitable projects, and this may discourage capital inflows.

This paper shows evidence that, overall, banks and non-banks in countries with a better developed financial market lend more abroad while banks and non-banks in countries with underdeveloped financial markets borrow more from abroad. In addition, economics growth drives cross-border flows for countries with a minimum level of financial development. This finding corroborates the hypothesis that a well-functioning financial market fosters bank lending abroad. At the same time, the need for raising funds abroad to finance projects plays an important role in bank flows into countries with an underdeveloped financial market, but where the potential of growth is high. However, disaggregating banking flows according to the sectors, and the financing instruments show that banks in countries with a less developed financial market lend more to non-banks in countries with a better developed financial market when the financing instrument is loans and deposits. From this evidence, one can argue that the ambiguity on the effect of financial development on banking inflows is more related to the financing instrument. Because debt securities are safer (but with lower yields) than loans, foreign banks are willing to lend to non-bank sectors using loans instrument only in countries where the financial market ensures a high probability of refund. Regarding debt securities, an underdeveloped financial market may reflect the lack of the country to grant credit to domestic investors. Even if the risk of defrauding is also high in these countries, foreign banks are willing to lend to domestic banks and non-banks because this instrument assures that the loan will be fully refunded, and also because this type of debt is highly tradeable. Following these findings, this paper also shows evidence that domestic and foreign financial markets complement each other for banking flows. A well-functioning financial market allows mobilization of savings and direct investment towards more productive projects. However, investors should also invest abroad to diversify their risk, and they will do it in countries where the expected return is high. At the same time, countries with an underdeveloped financial market may have a high potential of growth, but the financial market is unable to mobilize savings towards the most productive sectors. Therefore, the foreign financial market appears to be a complementary source of funding.

In order to analyze the effect of credit tightness in both host and source countries on cross-border bank flows, I use data on gross bilateral cross-border transactions between banks located in 24 reporter countries and all sectors (banks and non-banks) in 165 counterparty countries during the period 1995-2015. The database comes from the Locational Banking Statistics (LBS) of the Bank for International Settlements (BIS). A significant challenge for the current study is to clearly identify the effect of financial development of host and source countries on cross-border banking flows, while taking into account global factors that may affect both source and host countries (global output growth, global interest rate, and global risk aversion) and bilateral variables (distance, common language, common legal origins, and common colonial relationship).[6] To overcome this issue, I use time fixed effects to control for the global factors and also country-pairs fixed effects to control for the unobserved bilateral factors, while controlling for other macroeconomic factors that may affect cross-border banking flows. As

6. Global factor is the key driver of cross-border flows (Miranda-Agrippino and Rey, 2015). A vast literature has already shown the importance of "gravity" factors and global factor for capital flows (Hellmanzik and Schmitz, 2017; Lane and Milesi-Ferretti, 2008). As this paper aims to analyze the effect of financial development, I control for these effects but do not analyze as much these effects on cross-border banking flows.

capital inflows may affect the domestic financial market condition, I use instrumental variable estimation to tackle this reverse causality and also address the omitted variables bias concerns. In particular, I follow Donaubauer et al. (2019) and use the level of financial development of geographically contiguous countries as an instrument for the financial market condition of the host country.

This paper is first related to the extensive literature on the effects of financial market conditions on capital flows. Few papers in this literature have focused on the financial development in both source and recipient countries. Desbordes and Wei (2014) showed at the firms' level that a better financial market in both host and source countries encourages foreign investment.[7] Donaubauer et al. (2019) completed this finding by showing with a broader host and source countries sample that the level of financial development and bilateral FDI are positively related and also that financial markets in host and source countries could substitute each other. Other studies argue that countries with relatively young financial markets but with a great potential of productivity growth tend to raise capital abroad to complement the lack of domestic credit (Hale, 2011; Gozzi et al., 2010; Henderson et al., 2006). This current article uses bilateral cross-border banking flows and contributes to the literature by showing that the effect of financial development on capital flows may differ according to the financing instrument (debt securities or loans) and the borrowing sector. I also show that foreign and domestic financial markets complement each other for cross-border flows.[8] This paper is also closely related to Sen Gupta and Atri (2018), who showed a threshold effect of financial development on cross-border capital flows. However, contrary to Sen Gupta and Atri (2018), I use bilateral cross-border flows.

Second, this paper is also related to the growing literature on the determinants of cross-border banking flows. Recent papers have used panel regressions with fixed effects to analyze the potential determinants of cross-border banking flows, such as monetary policies and uncertainty. In Correa et al. (2018), cross-border bank lending increases with a tightening of monetary policy in source countries because of the decrease of do-

7. See also (Di Giovanni, 2005).

8. (Donaubauer et al., 2019) find that foreign and domestic financial markets substitute each other for FDI flows, while Gozzi et al. (2010) they are complements for international debt issuances.

mestic credit induced by the monetary policy. According to Choi and Furceri (2019), cross-border banking inflows and outflows decrease with the level of uncertainty. Regarding the effect of financial market conditions on cross-border banking flows, Lanau (2011) showed that non-banks in countries under tighter domestic financial regulation tend to borrow more from banks abroad. This current paper fills a gap in this literature by providing empirical evidence on the role of the financial market conditions on international banking flows. Further, it shows that non-banks in countries under tighter credit constraints borrow more from banks abroad only when the financing instrument is debt securities.

Third, this paper is related to the literature on the relationship between productivity growth and capital flows. Since Lucas (1990), many papers used different methodologies to explain the discrepancy between the theory and observed data about capital flows and productivity growth. Gourinchas and Jeanne (2013) distinguished public capital flows from private capital flows and showed that the contradiction between the data and the theoretical prediction is relevant only for public capital flows.[9] Some papers in this literature have suggested that domestic financial frictions could explain the negative correlation between capital flows and productivity growth (Caballero et al., 2008; Carroll and Jeanne, 2009; Koch and Zongo, 2018; Mendoza et al., 2009). In accordance with these papers, my results show the importance of credit constraints on the relationship between capital flows and economic growth. I also show that overall, productivity growth and cross-border banking flows are positively correlated.

The rest of the paper is organized as follows. Section 2 presents the econometric specification. Section 3 presents the data sources and descriptions. Section 4 describes the results of the baseline specification and the results following different subsamples. Section 5 presents some robustness checks, and section 6 concludes.

9. See also Alfaro et al. (2014).

3.2 Empirical Specifications

To identify the effect of financial development on cross-border bank inflows to counterparty countries, I first estimate equation (3.1) following Correa et al. (2018) :

$$\begin{aligned} CF_{ij,t} = \quad & \alpha_r G_{i,t-1} + \alpha_c G_{j,t-1} + \beta_r F_{i,t-1} + \beta_c F_{j,t-1} + \phi_r X_{i,t-1} \\ & + \phi_c X_{j,t-1} + \gamma_{ij} + \nu_t + \varepsilon_{ij,t}, \end{aligned} \tag{3.1}$$

where i and j indicate the reporting and counterparty countries respectively, and t denotes time. The dependent variables are gross capital inflows into country j from country i, gross capital outflows from country j to country i, or net inflows in country j (gross capital inflows minus gross capital outflows). Gross inflows and outflows are measured respectively as the annual growth in cross-border claims of banks in a country i to all sectors in a country j and the annual growth in cross-border bank liabilities of banks in a country i to all sectors in a country j. $F_{i,t}$ and $F_{j,t}$ represent the levels of reporting and counterparty countries' financial development; $G_{i,t}$ and $G_{j,t}$ are the growth rate of TFP of reporting and counterparty countries; $X_{i,t}$ and $X_{j,t}$ a set of macroeconomic control variables of reporting and counterparty countries. γ_{ij} represents country-pair fixed effects and controls for bilateral factors (such as geographical, political, and historical variables). ν_t represents time fixed effects and captures unobserved global factor and time heterogeneity. Standard errors are clustered at the source-recipient pair level. All variables are lagged by one period.

This specification allows to capture the effect of financial development and productivity growth of both source and recipient countries on cross-border flows , while controlling for the other factors.

In recipient countries, domestic agents may increase their demand for international capital when they face a higher constraint to borrow in the domestic market if one assumes that external borrowing could substitute for the lack of internal funds. Therefore, one can expect a negative effect of financial development in the recipient country on capital inflows. On the other hand, higher productivity growth may attract more external capital as predicted by the theory. One must expect that the productivity growth of the host country has a positive effect on capital inflows.

Donaubauer et al. (2019) argue that host and source countries financial market may substitute for one another with respect to bilateral FDI. In other words, they find that the positive effect of better developed financial markets in the host country becomes less important with better financial market development in the source country. In order to test this conditional effect of the financial conditions of host and source countries on cross-border flows, I also extend equation (3.1) by allowing for some interaction between the levels of financial development of host countries and source countries. Hence, it may be possible to account possibly for substitutability or complementarity.

$$\begin{aligned} CF_{ij,t} = \quad & \alpha_r G_{i,t-1} + \alpha_c G_{j,t-1} + \beta_r F_{i,t-1} + \beta_c F_{j,t-1} + \beta(F_{i,t-1} * F_{j,t-1}) \\ & + \phi_r X_{i,t-1} + \phi_c X_{j,t-1} + \gamma_{ij} + \nu_t + \varepsilon_{ij,t}, \end{aligned} \tag{3.2}$$

In the previous specifications, I use the one-period lags of each independent variable to reduce reverse causality concern. However, the use of a suitable instrument is preferable when there is potentially omitted variables bias and reverse causality concerns (capital inflows may affect the ratio of credit to GDP granted by financial institutions to the economy in the host country). Therefore, I follow Donaubauer et al. (2019) and use the level of financial development of geographically contiguous countries as an instrument for the level of financial development of a given host country. Geographic contiguity is defined as the intersection of the homeland territory of two states by a common boundary or separated by water by a distance up to 400 miles (Douglas et al., 2002). [10] This measure is highly correlated with a country's financial development and therefore, a strong predictor of domestic financial development. To be valid, the instrument must also fulfill the exclusion restriction. I follow Donaubauer et al. (2019) and make a plausible assumption that financial development in geographically contiguous neighboring countries does not directly affect cross-border-banking flows, nor indirectly through an omitted time-varying variable. This instrument has already been used to analyze the relationship between financial development and capital inflows, especially FDI inward (Donaubauer et al., 2019), and found to be a good instrument. [11]

10. Data on contiguity is taken from http://www.correlatesofwar.org.

11. Traditionally, variables such as the legal origin and settler mortality are used as instruments for the level of financial development. However, those variables are time-invariant and not suitable for this study.

3.3 Data Sources

For the study, I use sample of 24 reporting countries and 165 counterparty countries over the period 1995 to 2015. The dataset consists of cross-border banking flows data, financial development measure, and other control data. This section describes the sources and the suitability of the data to analyze the role of financial development and productivity growth on capital flows.

Capital Flows

I use bilateral data on cross-border claims and liabilities taken from the Bank for International Settlements (BIS)' Locational Banking Statistics (LBS). It captures more than 90% of all cross-border banks lending to non-banks sectors according to Avdjiev et al. (2020) and around 95% of all cross-border banking transactions according to the Bank for International Settlements (2018). The BIS collects and compiles the data following the residency principle, consistent with the balance of payment statistics. Furthermore, the Locational Banking Statistics provides information about the geographical breakdown of the recipient countries, the sectors in the recipient countries (banks and non-banks), the types of instruments (debt securities, loans and deposits), the currency composition (domestic and foreign currency), and the measure of cross-border banks claims and liabilities, defined as the amounts of outstanding and exchange-rate adjusted flows. Therefore, this dataset is uniquely suited to study cross-border banking activities.

Banks located in 47 countries ("*reporter*") report to the LBS their stock of assets and liabilities vis-a-vis both banks and non-banks residing in more than 200 countries ("*counterparty*"). The dataset is available on a quarterly basis from 1977 to 2018, with some countries started reporting to the BIS from 1990 on or later.[12] Based on data availability, I construct annual exchange rate-adjusted stocks of claims (and liabilities) by merely adding successively the exchange rate adjusted flows to the initial stock of claims (and liabilities) in order to take into account the exchange rate valuation effects. Following the literature on capital flows, one can interpret the exchange rate adjusted

12. As some data in the LBS are confidential or unreported, I treat them as missing values and include zeros as they are.

Figure 3.2: Annual total assets (BoP versus BIS)

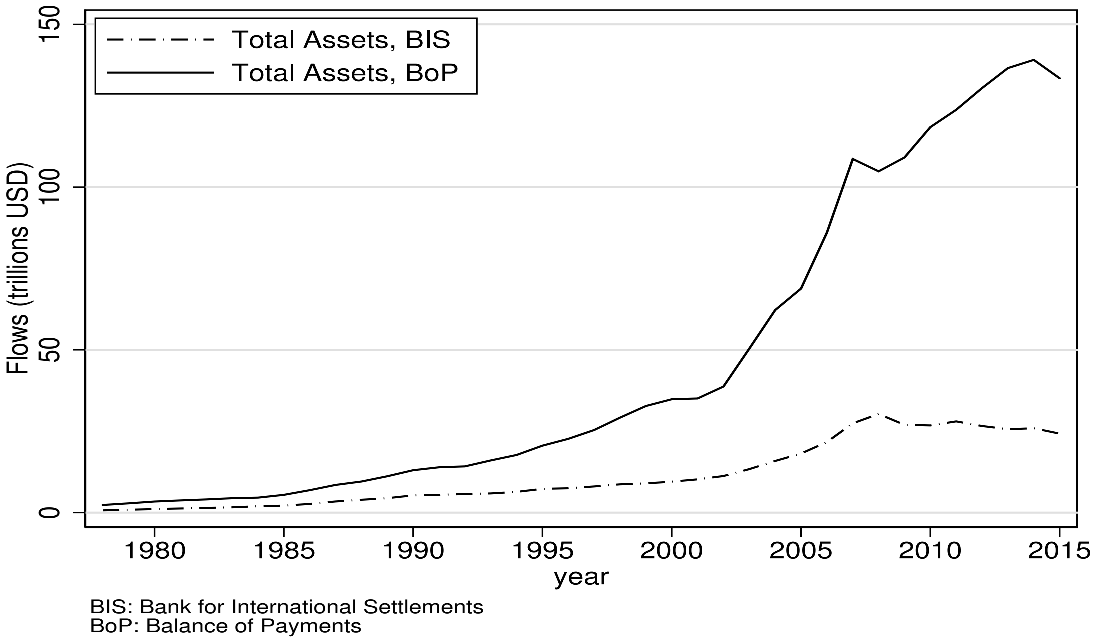
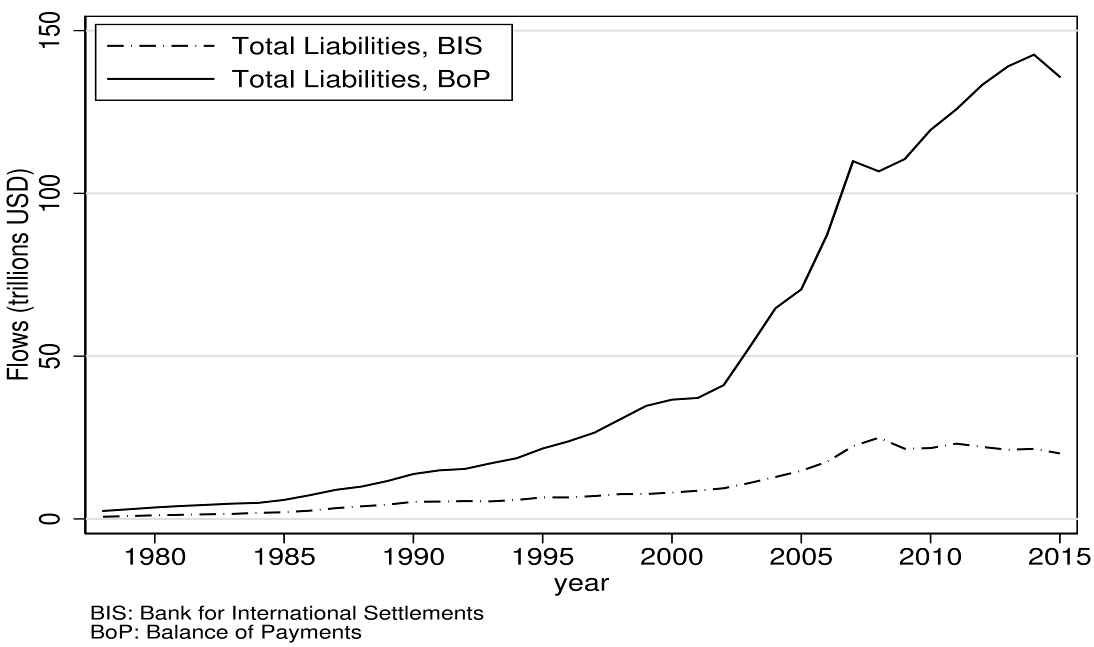


Figure 3.3: Annual total liabilities (BoP versus BIS)



change in the total assets reported by banks in country i as gross capital outflows from country i and capital inflow to country j. Similarly, the exchange rate adjusted growth in the total liabilities reported by banks in country i is gross capital inflows to the country i and capital outflows from country j. Therefore, net capital flow is measured as the difference between gross capital inflows and gross capital outflows.

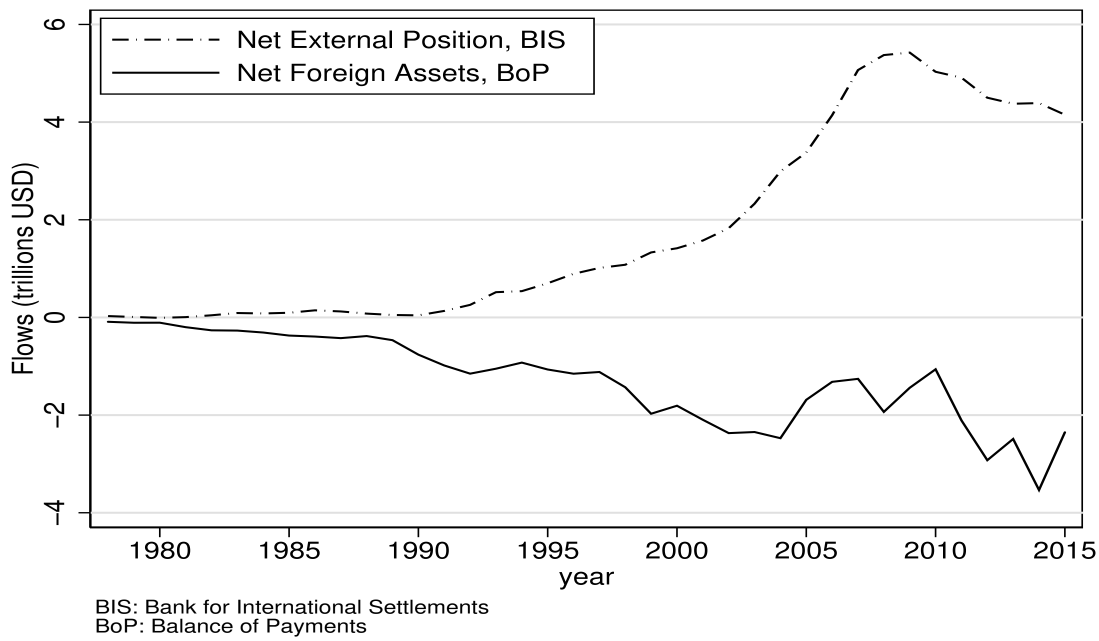
The BIS cross-border banking flows data obviously does not account for aggregate capital flows, as observed with the Balance of Payment Statistics. The LBS only reports the flows from banks in the reporting countries to all sectors in the counterparty countries and does not include portfolio debts flow, equities flow, or FDI flow. Nevertheless, flows reported in the LBS belong to the "other investment flows" subcategory of the Balance of Payment statistics and track very well the aggregate capital flows reported by the BoP statistics, as showed by Figures 3.2 and 3.3.

Figure 3.2 plots the aggregate annual total assets from the BoP statistics and the annual banks total assets from the BIS. Since 1980, the total assets from the BoP statistics have grown from 5 trillion up to 135 trillion in 2015 while banks total assets from the BIS have grown from 0.90 trillion up to 25 trillion. One can observe the same pattern in Figure 3.3, which plots annual total liabilities from the BoP statistics and bank's total liabilities from the BIS. In Figure 3.4, I plot together the net external position from the LBS and the net foreign assets form the BoP. A quick look at Figure A.1 shows a slowdown a slowdown in bank's total assets and liabilities from 2008.

The LBS dataset has recently been used in the literature to examine the relationship between capital flows and uncertainty, procyclicality of capital flows, and other macroeconomics variables (Choi and Furceri, 2019; Avdjiev et al., 2020). According to the conclusions, cross-border banking flows data suits to study capital flows, as much as capital flows of the BoP statistics. In addition, the bilateral and disaggregated nature of the LBS data offers other opportunities for research that other data do not allow.

I follow Correa et al. (2018)) and drop countries classified as offshore financial centers by the IMF, and also observations on outstanding claims and liabilities lower than 5 million or negative. Growth in claims and liabilities are winsorized at the 2.5 percentile.

Figure 3.4: Net external position (BoP versus BIS)



Other Variables

Growth: According to the neoclassical growth model, higher productivity growth leads to a higher marginal product of capital, which should stimulate investment and attract more capital into the country. For this study, I use the growth rate of Total Factor Productivity as my primary measure of growth. [13] TFP is strongly and positively correlated with GDP growth as argued by Prasad et al. (2007). [14] In addition, differences in TFP explain most of the income and growth differences across countries rather than factor accumulation (Easterly and Levine, 2001; Prescott, 1998).

I construct TFP growth following the development accounting literature (Caselli, 2005) and assuming a Cobb-Douglas production function. Data on output and investment come from the Penn World Tables 9.0 (Feenstra et al., 2015). The capital stock is con-

13. In Gourinchas and Jeanne (2013), they used productivity catch up, Alfaro et al. (2014) used GDP growth

14. I use GDP growth rather than TFP growth for a robustness exercise and results are similar.

structed using the perpetual inventory method. First, initial capital stock is computed using $K_0 = I_0/(g_i + \delta)$, where δ is the rate of depreciation set to 0.06 and g_i is the geometric average of investment growth rates over 1985-1995. Productivity is therefore obtained by using $A_t = (y_t/k_t^{\alpha})^{1/1-\alpha}$ where α is set to 0.3. Finally, I apply an Hodrick-Prescott filter to smooth the TFP series in order to consider only the long-run trends.

Financial Development: As there is no direct measure of the level of financial development, I follow what is standard in the literature by using the ratio of private credit to GDP as a proxy of financial development. It measures the total credit to the private sector relative to GDP and excludes all other types of credit, such as credit to the government, public sector, and state-owned companies. For King and Levine (1993); Levine and Zervos (1998), it is the preferred measure of domestic financial development because it takes into account only the volume of credit to the private sector in a given country. Therefore, a higher level of the ratio of private credit to GDP is related to higher financial development, according to Beck et al. (2000). I also present results with some alternative measures of the level of financial development as a robustness check. Data on financial development comes from the World Bank's Global Financial Development Database (Čihák et al., 2012). [15]

Other control: Following the existent literature on bilateral capital flows, I use a set of macroeconomic control variables for both reporter and counterparty countries, including capital account openness index (Chinn and Ito, 2008), the inflation rate, the debt-to-GDP ratio, and uncertainty (measured by the World Uncertainty Index WUI (Ahir et al., 2018)). These variables have been found to have a significant effect on cross-border banking flows (Bruno and Shin, 2015; Correa et al., 2018; Choi and Furceri, 2019).

Table 3.1 summarizes the variables used for the analysis. [16]

15. https://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database

16. More details on the definitions and sources of the variables are provided in the Appendix, Table B.1, as well as the list of reporter and counterparty countries in the sample.

Table 3.1: Summary statistics

	Mean	Standard Deviation	Minimum	Maximum
Gross Inflows	8.577	47.006	-114.851	149.971
Gross Outflows	8.209	49.066	-119.503	152.235
TFP growth$_i$	1.731	1.020	-0.018	4.326
TFP growth$_j$	1.949	2.311	-3.502	8.054
Private credit/GDP$_i$	114.941	40.337	27.592	185.189
Private credit/GDP$_j$	56.983	45.619	2.796	163.210
Debt/GDP$_i$	67.209	42.825	3.900	236.100
Debt/GDP$_j$	55.997	36.326	0.000	347.400
Inflation$_i$	1.731	1.355	-0.356	8.939
Inflation$_j$	5.641	7.621	-0.847	44.804
Uncertainty$_j$	21.234	9.381	7.907	49.187
Uncertainty$_i$	20.053	7.148	9.697	41.853

Note: All variables are in percentage points and growth rates are annual. i and j indicate the reporting and counterparty countries respectively. Gross inflows and outflows are measured respectively as the annual growth in cross-border claims of banks in a country i to all sectors in a country j and the annual growth in cross-border bank liabilities of banks in a country i to all sectors in a country j.

3.4 Estimation Results

3.4.1 Baseline regressions

Table 3.2 reports results of the baseline regressions. Columns (1), (3), and (5) present respectively the baseline specification for gross inflows, gross outflows, and net inflows. Columns (2), (4) and (6) present the estimations with the interaction between the level of financial development of host countries and source countries for respectively gross inflows, gross outflows, and net inflows. [17] Control variables as the ratio of debt to GDP, inflation, capital openness, and uncertainty of both source and recipient countries are included consistent with the literature. All regressions include source-recipient and time fixed effects, and standard errors are clustered at the source-recipient pair level.

17. "Gross capital inflows" in the tables refer to capital flowing from reporter countries to counterparty countries. Thus, reporter countries are the source countries, and counterparty countries are the recipients. Similarly, "gross capital outflows" refers to capital flowing from counterparty countries to reporter countries, and counterparty countries become source countries, and reporter countries become the recipients.

Table 3.2: Baseline estimation results

	Gross Inflows to j		Gross Outflows from j		Net Inflows to j	
	(1)	(2)	(3)	(4)	(5)	(6)
Credit/GDP$_{i,t-1}$	0.0113	-0.114*	-0.0684**	-0.119**	0.0872*	0.0108
	(0.0375)	(0.0645)	(0.0331)	(0.0596)	(0.0455)	(0.0883)
Credit/GDP$_{j,t-1}$	-0.0895**	-0.242***	0.0649*	0.00323	-0.158***	-0.251**
	(0.0375)	(0.0660)	(0.0352)	(0.0772)	(0.0477)	(0.0977)
TFPgrowth$_{i,t-1}$	3.856	2.970	4.594**	4.251**	-0.283	-0.825
	(2.663)	(2.693)	(1.972)	(1.992)	(2.813)	(2.857)
TFPgrowth$_{j,t-1}$	4.559***	4.693***	2.124**	2.178**	2.401	2.479
	(1.179)	(1.183)	(1.075)	(1.079)	(1.632)	(1.638)
Openness$_{i,t-1}$	0.0708**	0.0666*	-0.0225	-0.0245	0.104**	0.101**
	(0.0353)	(0.0354)	(0.0350)	(0.0351)	(0.0425)	(0.0425)
Openness$_{j,t-1}$	-0.0112	-0.0101	0.000914	0.00133	-0.00852	-0.00787
	(0.0127)	(0.0127)	(0.0109)	(0.0109)	(0.0157)	(0.0157)
Debt/GDP$_{i,t-1}$	0.106***	0.0823**	0.128***	0.118***	-0.0169	-0.0314
	(0.0386)	(0.0402)	(0.0392)	(0.0406)	(0.0526)	(0.0548)
Debt/GDP$_{j,t-1}$	-0.0676	-0.0774*	0.00869	0.00480	-0.0805	-0.0864*
	(0.0457)	(0.0451)	(0.0374)	(0.0377)	(0.0503)	(0.0509)
Inflation$_{i,t-1}$	0.255	0.303	-0.224	-0.206	0.331	0.363
	(0.603)	(0.605)	(0.690)	(0.691)	(0.870)	(0.870)
Inflation$_{j,t-1}$	-0.126	-0.140	0.188	0.182	-0.278	-0.287
	(0.176)	(0.175)	(0.181)	(0.181)	(0.247)	(0.246)
Uncertainty$_{i,t-1}$	-0.795***	-0.806***	-0.364*	-0.368*	-0.432*	-0.438*
	(0.197)	(0.197)	(0.196)	(0.196)	(0.262)	(0.262)
Uncertainty$_{j,t-1}$	-0.142	-0.149	-0.0957	-0.0986	-0.0653	-0.0698
	(0.0907)	(0.0907)	(0.0977)	(0.0979)	(0.126)	(0.126)
Credit/GDP$_{i,t-1}$*Credit/GDP$_{j,t-1}$		0.00127***		0.000515		0.000777
		(0.000483)		(0.000564)		(0.000728)
Observations	9843	9843	9822	9822	9668	9668
R^2	0.154	0.155	0.112	0.112	0.080	0.080

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims (gross inflows), the growth rate of exchange rate-adjusted cross-border liabilities (gross outflows), and the growth rate of exchange rate-adjusted cross-border claims net of cross-border liabilities (net inflows). All estimations include dyad fixed effects and year fixed effects. All independent variables are lagged by one year. Standard errors are clustered at the reporting-counterpartycountry levels. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.

With regard to the primary variable of interest, the level of financial development, I find that gross inflows decrease with a better with better developed financial markets in the host country. As shown in column (1), the coefficient associated to the ratio of private credit to GDP is negative (-0.08) and significant at the 5% level. Concerning the source country, I find no statistically significant evidence that the financial market development has an effect on gross inflows. The level of financial development indicates the constraint faced by agents to access the credit in their domestic financial market. In a country with a low level of financial development, investors have limited access to credit to finance their projects. Therefore, they have to use an alternative source of funds, either by using their savings and/or external borrowing to undertake their projects. [18] Financially less developed countries may attract more foreign loans. When adding the interaction between the ratio of private credit to GDP in host and source country, the coefficient is positive and significant at the 1% level for gross inflows, as shown in column (2). It suggests that better developed financial markets in the source country complement for less developed financial markets in the host country for gross inflows.

Column (3) shows the estimation where the dependent variable is gross outflows from the counterparty country. Gross outflows increase with a better developed financial market in the source country and decrease with a better developed financial market in the host country. The coefficients of the ratio of private credit are respectively positive (0.06 and statistically significant at the 10% level) for the source country and negative (-0.06 and statistically significant at the 5% level) for the host country. This result suggests that banks and non-banks in countries with a better developed financial market lend more abroad, especially to banks in countries with less developed financial markets. When adding the interaction between the ratio of private credit to GDP in host and source country, I find no statistically significant evidence that better financial market in the source country complement for less developed financial markets in the host country, as shown in column (4).

The level of financial development has two opposite effects on the direction of gross flows. First, a well-functioning financial market may increase savings and augments

18. Since savings increase with the level of financial development, investors in less financially developed countries should rely more on foreign financial resources.

the possibility to invest or lend to countries with a higher probability of profit, due to faster productivity growth in these countries. In addition, a better financial development market may increase access to domestic credit and therefore reduces the need for external borrowing. The former is smaller than the latter, as suggested by the results in the previous sections. Unsurprisingly, net inflows decrease with a better developed financial market in the host country and increase with also a better developed financial market in the source country. As shown in column (5), the associated coefficients are respectively negative (-0.15 and significant at the 1% level) and positive (0.08 and significant at the 10% level). As for gross outflows, I find no statistically significant evidence that better financial market in the source country complement for less developed financial markets in the host country (column (6)), when adding the interaction between the ratio of private credit to GDP in host and source country.

TFP growth rates of both source and recipient countries have a positive effect on gross inflows, but significant at the 1% level only for recipient countries, as shown in column (1). In the recipient countries, an increase of 1% point of TFP growth leads to an increase of 4.5% point of gross capital inflows. One can observe that the positive effect of TFP growth in source countries is much lower relative to the effect of TFP growth in the recipient countries. When foreign countries grow at a higher rate, the higher return on investment motivates domestic agents to invest abroad. Therefore, the higher a country's growth rate, the more the country attracts foreign investment, and gross capital inflows increase with productivity growth. Similarly, foreign agents retire their investment in bad times, when the potential profit is lower. This result is consistent with the theoretical predictions and previous empirical findings on the strong and positive relationship between gross capital inflows and domestic output growth.

TFP growth of the source country has a positive and significant effect on gross outflows. As shown in column (3), the estimated coefficient of TFP growth (2.12). The estimated coefficient of TFP growth of the recipient country is negative (-0.11) and significant at the %5 level, consistent with the result in the previous paragraph. Higher productivity growth in source country is also associated with higher gross capital outflows. Domestic agents also increase their investments abroad when their productivity grows faster. Concerning net inflows, I find no statistically significant evidence that TFP growth has effect on these flows. As shown in column (5), none of the associated coefficient is significant.

The effect of financial development on the current account balance and therefore, on capital flows is ambiguous in the literature. While some theoretical and empirical findings suggest a positive correlation between financial development and the current account deficit, other studies find that a better financially developed market may raise the national saving rate and therefore decrease capital inflows. The explanation supporting the negative correlation between the level of financial development and net capital inflows is built over the positive relationship between financial development and saving. According to this view, a better financially developed market may lower transaction costs, facilitate risk management, therefore encourage saving. The increase in savings leads to a decrease in demand for foreign capital and also to an increase in the supply of credit. The negative effect of financial development on net capital inflows suggested by the finding above is consistent with this view.

Turning to the other control variables, I find that gross inflows (column (1)) increase with capital openness and the ratio of debt to GDP of the source country, while decrease with uncertainty of the source country. The associated coefficients are statistically significant. On the other hand, none of these variables of the host country has a statistically significant effect on gross inflows. Gross outflows (column(3)) increase with the ratio of debt to GDP and decrease with uncertainty of the host country. Net inflows (column (5)) increase with capital openness and decrease with uncertainty of the source country.

3.4.2 Instrumental Variable Estimations

In the previous section, I use the one-period lag of each independent variable to reduce reverse causality concern. In this section, I present the results for the baseline estimation and the specification with the interaction between the level of financial development of host and source countries, using IV two-stage least squares (2SLS) approach. I use the level of financial development of geographically contiguous countries to instrument the level of financial development of a given country. Also, the interaction is between the instrumental variables. Table 3.3 presents the IV estimation results for the full sample. [19]

Table 3.3: Instrumental variable estimation results

	Gross Inflows to j		Gross Outflows from j		Net Inflows to j	
	(1)	(2)	(3)	(4)	(5)	(6)
Credit/GDP$_{i,t-1}$	-0.514*	-0.861***	-0.365	-0.425	-0.173	-0.507
	(0.266)	(0.307)	(0.232)	(0.270)	(0.314)	(0.390)
Credit/GDP$_{j,t-1}$	-0.331**	-0.943***	0.0782	-0.0291	-0.444***	-1.034***
	(0.134)	(0.324)	(0.121)	(0.296)	(0.153)	(0.398)
TFPgrowth$_{i,t-1}$	-5.350	-3.993	-3.078	-2.819	-2.226	-0.971
	(7.481)	(6.678)	(5.862)	(5.864)	(8.409)	(7.982)
TFPgrowth$_{j,t-1}$	-0.0980	1.367	2.461	2.720	-2.869	-1.516
	(2.069)	(2.030)	(1.784)	(1.929)	(2.522)	(2.652)
Openness$_{i,t-1}$	-0.137	-0.0909	-0.158*	-0.151*	0.0358	0.0802
	(0.105)	(0.0982)	(0.0875)	(0.0896)	(0.121)	(0.119)
Openness$_{j,t-1}$	-0.0272	-0.0187	-0.0111	-0.00961	-0.00934	-0.00108
	(0.0177)	(0.0182)	(0.0140)	(0.0143)	(0.0195)	(0.0210)
Debt/GDP$_{i,t-1}$	-0.162	-0.121	-0.109	-0.101	-0.0503	-0.00790
	(0.159)	(0.138)	(0.128)	(0.129)	(0.170)	(0.160)
Debt/GDP$_{j,t-1}$	-0.215***	-0.234***	0.0268	0.0236	-0.244***	-0.262***
	(0.0610)	(0.0536)	(0.0581)	(0.0572)	(0.0716)	(0.0696)
Inflation$_{i,t-1}$	-0.391	-0.0166	-0.239	-0.176	-0.273	0.102
	(0.784)	(0.795)	(0.804)	(0.835)	(1.061)	(1.084)
Inflation$_{j,t-1}$	0.0129	-0.0599	0.116	0.104	-0.0489	-0.119
	(0.200)	(0.200)	(0.207)	(0.208)	(0.272)	(0.273)
Uncertainty$_{i,t-1}$	-0.240	-0.497	-0.0633	-0.109	-0.125	-0.376
	(0.392)	(0.374)	(0.327)	(0.352)	(0.457)	(0.466)
Uncertainty$_{j,t-1}$	0.104	0.0643	-0.0100	-0.0174	0.103	0.0659
	(0.112)	(0.111)	(0.115)	(0.117)	(0.147)	(0.148)
Credit/GDP$_{i,t-1}$*Credit/GDP$_{j,t-1}$		0.00564**		0.000988		0.00540
		(0.00265)		(0.00259)		(0.00338)
Observations	7061	7061	7091	7091	6961	6961

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims (gross inflows), rate-adjusted cross-border claims net of cross-border liabilities (net inflows). All estimations include dyad fixed effects and year fixed effects. All independent variables are lagged by one year. Standard errors are clustered at the reporting-counterpartycountry levels. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.

As shown in column (1), gross inflows decrease with a better developed financial development in the host country. The associated coefficient is negative (-0.33) and statistically significant at the 5% level. Similarly, gross inflows also decrease with a better de-

19. The equation is exactly identified in all regression, so I cannot test the validity of the instruments. Also, there is no test for the exclusion restriction. In the first stage regressions, the t-statistics indicate that the instruments are strong; results for the first stage are available upon request.

veloped financial development in the source country (the estimated coefficient is -0.51 and significant at the 10% level). When adding the interaction between the ratio of private credit to GDP in host and source country, the coefficient is positive and significant at the 1% level for gross inflows, as shown in column (2). This result supports the previous one that suggested that better developed financial markets in the source country complement for less developed financial markets in the host country for gross inflows. With respect with gross outflows, I find no statistically significant evidence on the effect of the financial development on these flows, using the IV estimation. Contrary to the baseline estimation, the coefficients associated to the level of financial development of source and host countries become not statistically significant. Concerning net inflows, a better developed financial market in the host country decrease these flows, as shown by the estimated coefficient in column (5); it is negative and statistically significant at the 1% level. Overall, the IV estimation supports the previous results. Qualitatively, the coefficients are similar, but some coefficient becomes non statistically significant with the IV estimation. Nevertheless, the IV estimation shows evidence that the level of financial development of the source and host countries has negative effects on gross inflows. It also shows evidence on the complementarity between foreign and domestic financial markets for cross-border banking flows. I also find that the coefficient of the level of financial development is larger with the IV estimation. That could be attributable to the possible omitted variables bias in the non-IV estimation.

3.4.3 Breakdown by Sector and Financing Instrument

In this section, I exploit the disentangled dataset of the LBS to gauge how the macroeconomic and financial market conditions affect cross-border banking flows according to the counterparty sectors (banks or non-banks). Specifically, I examine whether cross-border transactions between banks behave similarly as cross-border transactions between banks and non-banks (Non-bank financial institutions, Non-financial corporations, General government, and households) following changes in the financial and macroeconomics conditions of host and source countries. Cross-border bank flows might also be affected by domestic and foreign economic conditions according to the type of financing instruments (debt securities or loans and deposits). I also examine in this section whether the financial market conditions affect cross-border flows according to the type of instrument. For this analysis, I focus on gross inflows, as the results for gross outflows and net inflows do not exhibit major differences with what I have found so far. Nonetheless, I report additional tables for gross outflows and net inflows in the appendix.

Table 3.4 reports the estimations according to sectors in the counterparty countries and the type of financing instruments. Recall that only banks in reporting countries i report their claims and liabilities vis-a-vis banks and non-banks in counterparty countries j to the LBS. Therefore, the results in Table 3.4 are related to gross inflows from banks to all sectors (columns (1), (4), and (7)), from bank to bank (columns (2), (5), and (8)), and from banks to non-banks (columns (3), (6), and (9)).

Table 3.4: Gross inflows by sector and financing instrument

	All Instruments, Inflows to j			Debt Securities, Inflows to j			Loans and Deposits, Inflows to j		
	(1) All Sectors	(2) Banks	(3) Non-Banks	(4) All Sectors	(5) Banks	(6) Non-Banks	(7) All Sectors	(8) Banks	(9) Non-Banks
Credit/GDP$_{i,t-1}$	0.0113 (0.0375)	-0.0388 (0.0566)	0.0288 (0.0407)	-0.00536 (0.109)	-0.220* (0.124)	0.126 (0.0974)	-0.0336 (0.0327)	-0.0426 (0.0523)	-0.103*** (0.0387)
Credit/GDP$_{j,t-1}$	-0.0895** (0.0375)	-0.112** (0.0563)	-0.0195 (0.0463)	-0.470*** (0.0983)	-0.361*** (0.112)	-0.421*** (0.112)	-0.0275 (0.0349)	-0.103* (0.0583)	0.114*** (0.0406)
TFPgrowth$_{i,t-1}$	3.856 (2.663)	8.100** (3.213)	11.61*** (2.876)	31.16*** (4.618)	15.13*** (5.161)	28.75*** (4.532)	0.576 (1.737)	3.069 (2.841)	1.597 (1.889)
TFPgrowth$_{j,t-1}$	4.559*** (1.179)	7.707*** (1.911)	3.204** (1.475)	5.988* (3.167)	13.63*** (3.416)	-0.129 (3.017)	4.019*** (1.011)	4.835** (1.902)	5.233*** (1.183)
Openness$_{i,t-1}$	0.0708** (0.0353)	-0.0750 (0.0634)	0.176*** (0.0425)	-0.00542 (0.0953)	-0.0643 (0.0936)	0.00901 (0.0953)	0.0524* (0.0298)	-0.132* (0.0688)	0.185*** (0.0365)
Openness$_{j,t-1}$	-0.0112 (0.0127)	0.00385 (0.0250)	-0.0159 (0.0130)	-0.0159 (0.0386)	0.0720 (0.0438)	0.0160 (0.0284)	-0.0180* (0.0108)	-0.00157 (0.0213)	-0.0158 (0.0136)
Debt/GDP$_{i,t-1}$	0.106*** (0.0386)	0.196*** (0.0681)	0.0919** (0.0440)	0.0807 (0.143)	-0.161 (0.153)	0.192 (0.130)	-0.0119 (0.0490)	0.0214 (0.0855)	-0.0122 (0.0558)
Debt/GDP$_{j,t-1}$	-0.0676 (0.0457)	-0.0703 (0.0775)	-0.0732 (0.0544)	-0.0387 (0.134)	0.0728 (0.133)	-0.219* (0.120)	-0.0317 (0.0408)	-0.0352 (0.0765)	0.0577 (0.0513)
Inflation$_{i,t-1}$	0.255 (0.603)	0.699 (1.183)	-0.324 (0.678)	1.333 (1.746)	2.661 (2.075)	-2.256 (1.860)	0.185 (0.615)	2.026 (1.284)	-1.238* (0.734)
Inflation$_{j,t-1}$	-0.126 (0.176)	-0.351 (0.330)	0.195 (0.191)	-0.000653 (0.438)	0.121 (0.616)	0.216 (0.466)	0.143 (0.153)	-0.676** (0.305)	0.386** (0.168)
Uncertainty$_{i,t-1}$	-0.795*** (0.197)	-0.748** (0.355)	-0.633*** (0.234)	0.0962 (0.572)	0.228 (0.649)	0.0331 (0.651)	-0.730*** (0.181)	-1.003** (0.449)	-0.394* (0.226)
Uncertainty$_{j,t-1}$	-0.142 (0.0907)	-0.226 (0.177)	-0.180* (0.109)	-0.136 (0.270)	-0.485 (0.344)	0.00409 (0.241)	-0.256*** (0.0838)	-0.268 (0.172)	-0.169* (0.0980)
Observations	9843	8457	8480	7489	6594	6411	7755	6710	6766
R^2	0.154	0.115	0.115	0.101	0.097	0.086	0.166	0.122	0.132

Note: The dependent variable is the growth rate of exchange rate-adjusted cross-border claims. All estimations include dyad fixed effects and year fixed effects. All independent variables are lagged by one year. Standard errors are clustered at the reporting-counterpartycountry levels. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.

With regard to gross inflows disentangled by borrowing sectors in the recipient country, I find statistically significant evidence that these flows decrease with a better developed financial market in the host country, only when the borrowers are banks. As shown in column (2), the coefficient is negative (-0.11) and significant at the 5% level. Regarding non-banks, the effect of the financial development is not statistically significant (column (3)). This result shows that the negative and significant effect of the development of financial markets in the host country on gross inflows (column (1)) is driven by inter-bank transactions. Likewise, the effect of the financial market development of the source country on gross inflows is not statistically significant, regardless the borrowing sector in the host country. In accordance with the results of the previous sections, I find statistically significant evidence that gross inflows increase with TFP growth of both source and host countries, regardless the borrowing sector in the host country (columns (2) and (3)). Moreover, the effects of the development of the financial market become significant when one disentangles by borrowing sectors in the host country.

Turning to gross inflows disentangled by financing instruments, the results are qualitatively similar to the ones of the previous sections, when the financing instrument is debt security. In other words, I find statistically significant evidence that gross inflows decrease with a better developed financial market in the host country (column (4), (5), and (6)); the effect of the financial market development of the source country is not statistically significant, except when the borrowers are banks (the coefficient is -0.22 and statistically significant at the 10% level). Columns (4), (5), and (6) also show positive and significant effects of both source and host countries' TFP growth on gross inflows. However, one notices a huge effect of the TFP growth of the source country (31.16 for all borrowing sectors, 15.13 when the borrower are banks and 28.75 when the borrowers are non-banks). Similarly, the effect of the host country's TFP growth is high when the borrowers are banks (13.63). By contrast, the effect of the host country's TFP growth is not statistically significant when the borrowers are non-banks.

When the financing instrument is loan, the effect of the financial market development of both source and host countries is not statistically significant when considering all the sectors together (column (7)). However, the effect of the financial market development of the host country is negative (-0.10) and statistically significant at the 10% level when the borrowers are banks (column (8)). It becomes positive (0.11) and significant at the 5% level when the borrowers are non-banks, as shown in column (9). The latter is the opposite of what I have found so far. This result suggests that banking flows go from banks in countries with an underdeveloped financial market to non-banks in countries with a well-functioning financial market, when the financing instrument is loan. Columns (7), (8), and (9) also show that only the host country's TFP growth has a significant effect on gross inflows, regardless the borrower sector.

The development of the financial market in the host country has different effects on cross-border banking flows, according to the instrument type and the borrower sector. Overall, gross inflows decrease with the development of the financial market in the host country, except for loans going from banks to non-banks. An explanation of this discrepancy may lie in the nexus between the risk level of the type of financing instruments, the borrower sector, and the need for funds in the domestic countries. A well-functioning financial market may mobilize savings and direct investments towards highly productive projects. Therefore, banks in countries with underdeveloped financial market issue bonds to raise funds abroad to supply credit on the domestic market because of the lack of domestic savings. Banks also use cross-border loans for the same reasons. Similarly, non-banks also issue bonds abroad to finance their projects because of the limitation of domestic credit. On the other hand, an underdeveloped financial market may decrease cross-border loans; a developed financial market reflects a well-functioning credit market and a lower probability of defrauding. As loans are riskier than debt securities, a better monitoring of the non-bank sector may reduce the probability of defrauding and increase the propensity of foreign banks to lend abroad, as suggested in the theoretical literature. Regarding debt securities, the explanation of the negative correlation of the level of financial development and cross-border borrowing may lie in the fund's needs for domestic banks to cater to the domestic supply of credit because of the lack of domestic savings. Meanwhile, non-banks need to raise funds abroad because of the limitation of domestic credit.

3.4.4 Capital Flows at Difference Stage of Growth

Table 3.5: Cross-border bank flows at different stages of growth

	Low Growth			Medium Growth			High Growth		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Inflows to j	Outflows from j	Net Inflows to j	Inflows to j	Outflows from j	Net Inflows to j	Inflows to j	Outflows from j	Net Inflows to j
Credit/GDP$_{i,t-1}$	-0.0952	-0.0203	-0.0958	0.00647	-0.0748	0.0851	-0.0627	-0.0512	-0.00987
	(0.0795)	(0.0637)	(0.0975)	(0.0635)	(0.0470)	(0.0711)	(0.0560)	(0.0474)	(0.0614)
Credit/GDP$_{j,t-1}$	-0.213**	-0.0804	-0.161	-0.149***	-0.0726	-0.0806	-0.00369	0.0998	-0.102
	(0.0901)	(0.0769)	(0.106)	(0.0457)	(0.0456)	(0.0625)	(0.0644)	(0.0672)	(0.0928)
TFPgrowth$_{i,t-1}$	0.0683	3.989	-4.264	2.358	2.402	0.631	3.999	5.062	0.191
	(4.566)	(3.922)	(5.264)	(3.285)	(3.336)	(4.430)	(3.263)	(3.366)	(3.929)
TFPgrowth$_{j,t-1}$	4.110*	1.942	1.880	9.367***	-1.508	10.51***	4.263***	1.620	2.235
	(2.408)	(2.179)	(3.518)	(2.610)	(2.804)	(3.772)	(1.390)	(1.494)	(1.932)
Openness$_{i,t-1}$	-0.0886	-0.0781	-0.00400	0.0402	-0.109*	0.130*	0.0746	0.00158	0.0931
	(0.0656)	(0.0625)	(0.0920)	(0.0579)	(0.0619)	(0.0692)	(0.0699)	(0.0587)	(0.0762)
Openness$_{j,t-1}$	-0.0161	0.0306	-0.0473	0.0105	-0.0865***	0.100***	-0.0282*	0.00229	-0.0277
	(0.0247)	(0.0194)	(0.0300)	(0.0228)	(0.0229)	(0.0311)	(0.0166)	(0.0153)	(0.0213)
Debt/GDP$_{i,t-1}$	0.0201	0.0785	-0.0755	0.0877	0.0733	0.00605	0.0900	0.201***	-0.118*
	(0.0925)	(0.0675)	(0.106)	(0.0628)	(0.0778)	(0.0959)	(0.0558)	(0.0491)	(0.0713)
Debt/GDP$_{j,t-1}$	-0.00350	0.0252	-0.0554	-0.187***	0.0109	-0.209***	-0.0253	-0.0157	-0.0216
	(0.0569)	(0.0322)	(0.0633)	(0.0593)	(0.0534)	(0.0792)	(0.0546)	(0.0443)	(0.0705)
Inflation$_{i,t-1}$	1.623	0.993	0.586	-0.268	-1.201	0.928	-2.180**	-0.518	-1.665
	(1.373)	(1.385)	(1.865)	(0.900)	(1.080)	(1.348)	(0.985)	(1.077)	(1.403)
Inflation$_{j,t-1}$	-0.535**	-0.0792	-0.512	0.00311	-0.140	0.222	0.0137	0.350**	-0.364
	(0.222)	(0.215)	(0.319)	(0.153)	(0.186)	(0.227)	(0.218)	(0.167)	(0.267)
Observations	3712	3924	3570	4585	4648	4511	4913	5088	4759
R^2	0.168	0.136	0.117	0.206	0.137	0.133	0.159	0.128	0.104

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims (gross inflows), the growth rate of exchange rate-adjusted cross-border liabilities (gross outflows), and the growth rate of exchange rate-adjusted cross-border claims net of cross-border liabilities (net inflows). All estimations include dyad fixed effects and year fixed effects. All independent variables are lagged by one year. Standard errors are clustered at the reporting-counterpartycountry levels. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.

In this section, I analyze whether the effects of the financial market development on gross and net flows are similar or not, following different stages of productivity growth. To this end, I divide counterparty j countries into three groups using the tercile values of TFP growth rate as a cut-off. Low-growth countries are those belonging to the first tercile, medium-growth countries are those belonging to the second tercile and high-growth countries are those belonging to the third tercile. Table 3.5 reports the results of the estimations for each group.

Column (1) shows that gross inflows decrease with a better developed financial market in host country. The effect of the source country's financial market development is not statistically significant. This is in accordance with the results in previous sections. Concerning gross outflows (column (2)) and net inflows (column (3)), the development of the financial market in neither the host country nor the source country have a significant effect on these flows. The medium growth countries exhibit the same pattern as shown in columns (4), (5), and (6). However, with regard to the high-growth countries, the development of the financial market in neither the host country nor the source country have a significant effect on none of these flows as shown in columns (7), (8), and (9). On the other hand, one notices that only the effect of TFP growth of the host country has a positive and significant effect on gross inflows, for the group of low-growth countries. It is statistically significant at the 10% level. With regard to the medium and high-growth countries, the effects of host country's TFP growth on gross inflows are positive (respectively 9.36 and 4.26) and significant at the 1% level.

The distinction between growth groups shows different behavior of capital flows following changes in productivity growth and financial development. For the low growth group, while productivity growth of host countries has a significant effect only for gross inflows, gross inflows decrease with a better developed financial market in the host country. Capital does not flow to these countries because of a higher expected return motive induced by higher growth, but to supply the lack of domestic credit granted to all sectors. The less the ratio of private credit to GDP is, the more the demand for foreign credit is. Similarly, a better developed financial market may increase investment in high return projects by facilitating risk management (Beck et al., 2000). That may mobilize the domestic financial resources that will be directed towards domestic projects and thereby decrease the supply of domestic finance in the international financial market. In the medium group, countries also import more foreign capital because of the expectation of higher profit due to the higher growth. This capital inflow is enhanced in countries with underdeveloped financial markets.

3.4.5 Capital Flows at Different Level of Financial Development

As in the previous section, I divide counterparty j countries into three groups using the quartile values of the ratio of private credit to GDP of the whole sample as a cut-off. Low-developed financial market countries are those belonging to the first quartile, medium-developed financial market countries are those belonging to the two middle quartiles and high-developed financial market countries are those belonging to the last quartile. Table 3.6 reports the results of the estimations for each group.

With regard to the group of low developed financial market countries, neither a better developed financial market, nor faster TFP growth do not affect significantly none of cross-border banking flows, as shown in columns (1), (2), and (3). However, one observes with the medium developed financial market countries (column (4)) that gross inflows decrease with better developed financial markets in both source and host countries. One also observes gross inflows increase with a faster TFP growth in the host country. Column (5) and (6) show that only host country's TFP growth has a positive and significant effect on gross outflows and net inflows. Lastly, only the development of the financial market and TFP growth of the host country have significant effects on gross inflows for high developed financial market countries; as shown in column (7), the former is negative (-0.09) and statistically significant at the 5% level while the latter is positive (8.17) and statistically significant at the 1% level. Column (8) also shows a negative (-0.13) and significant (at the 1% level) effect of the financial market development of host country on gross outflows. Column (9) shows that the financial market development of source country has a positive (0.10) and significant (at the 10% level) effect on net inflows. The same is true for the host country's TFP growth with an estimated coefficient of 8.73, significant at the 1% level. However, net inflows decrease with a better developed financial market in the host country; the estimated coefficient is negative (0.12) and significant at the 10% level.

Table 3.6: Cross-border bank flows according to the financial development group

	Low Fin Dev			Medium Fin Dev			High Fin Dev		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Inflows to j	Outflows from j	Net Inflows to j	Inflows to j	Outflows from j	Net Inflows to j	Inflows to j	Outflows from j	Net Inflows to j
Credit/GDP$_{i,t-1}$	0.0253	-0.0132	0.0179	-0.0892**	-0.0426	-0.0381	-0.0327	-0.133***	0.105*
	(0.114)	(0.0964)	(0.156)	(0.0450)	(0.0403)	(0.0625)	(0.0439)	(0.0454)	(0.0537)
Credit/GDP$_{j,t-1}$	0.365	-0.182	0.824	-0.185**	-0.0933	-0.0957	-0.0961**	0.0156	-0.126*
	(0.614)	(0.495)	(0.760)	(0.0840)	(0.0650)	(0.105)	(0.0480)	(0.0559)	(0.0709)
TFPgrowth$_{i,t-1}$	3.696	3.992	1.010	-1.313	1.320	-2.011	1.903	3.918	-1.834
	(4.981)	(4.807)	(7.413)	(3.256)	(2.813)	(3.670)	(3.289)	(2.561)	(3.629)
TFPgrowth$_{j,t-1}$	2.305	0.395	2.331	3.496***	1.834**	1.458	8.170***	-0.693	8.736***
	(1.819)	(1.086)	(2.559)	(0.941)	(0.799)	(1.223)	(2.133)	(1.914)	(2.583)
Openness$_{i,t-1}$	-0.0427	0.0414	-0.00339	0.0285	-0.0123	0.0726	0.0695	-0.00367	0.0715
	(0.176)	(0.165)	(0.324)	(0.0612)	(0.0552)	(0.0641)	(0.0445)	(0.0408)	(0.0516)
Openness$_{j,t-1}$	0.0551	-0.0139	0.0696	-0.0202	0.000573	-0.0164	0.0275	0.0174	0.00743
	(0.0414)	(0.0338)	(0.0621)	(0.0123)	(0.0109)	(0.0153)	(0.0189)	(0.0163)	(0.0220)
Debt/GDP$_{i,t-1}$	-0.0349	0.153*	-0.267*	0.123**	0.125***	0.000263	-0.0190	0.0367	-0.0560
	(0.111)	(0.0815)	(0.146)	(0.0524)	(0.0457)	(0.0699)	(0.0605)	(0.0577)	(0.0710)
Debt/GDP$_{j,t-1}$	-0.0123	0.0456	-0.0656	-0.0507	-0.0329	-0.0346	-0.0584	0.0290	-0.102
	(0.0623)	(0.0344)	(0.0697)	(0.0599)	(0.0452)	(0.0843)	(0.0614)	(0.0504)	(0.0663)
Inflation$_{i,t-1}$	-1.231	2.626	-1.926	-1.269	-1.224	-0.453	1.023	-0.155	1.204
	(2.582)	(1.953)	(3.053)	(0.839)	(0.937)	(1.170)	(0.733)	(0.905)	(1.151)
Inflation$_{j,t-1}$	-0.493***	-0.111	-0.472*	0.0810	0.408**	-0.343	-0.756	-0.497	-0.241
	(0.172)	(0.172)	(0.243)	(0.198)	(0.170)	(0.248)	(0.498)	(0.711)	(0.867)
Observations	2168	2508	2087	6534	6639	6278	4850	4856	4805
R^2	0.176	0.124	0.141	0.157	0.124	0.106	0.192	0.133	0.098

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims (gross inflows), the growth rate of exchange rate-adjusted cross-border liabilities (gross outflows), and the growth rate of exchange rate-adjusted cross-border claims net of cross-border liabilities (net inflows). All estimations include dyad fixed effects and year fixed effects. All independent variables are lagged by one year. Standard errors are clustered at the reporting-counterpartycountry levels. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.

These results suggest that countries with a sufficient level of financial development may grow faster and, because of the higher-margin product, may attract more foreign capital, as shown in column (4). As they grow faster and have a sufficient level of financial development, those countries are more able to mobilize savings efficiently in the form of accumulated liquid assets (Levine, 1997) and therefore lend abroad. When the domestic financial market reaches a high level of development, the effect of financial development on gross inflows vanishes (Aghion et al., 2005) and gross capital inflows increase with productivity growth, while financial development continues to reduce these flows.

3.4.6 Flows Before and After the Global Financial Crisis

The 2008's great financial crisis has changed the pattern of gross capital inflows and gross capital outflows, as shown in Figure A.1. One observes in this figure that total assets and total liabilities have sharply increased and that net external position have declined since 2008. To analyze whether the previous results may be affected by the crisis, I divide the whole sample into two subsamples, the period before 2008 and the period after 2008. Table 3.7 summarizes the estimated coefficients for these two subsamples.

During the period before 2008, neither productivity growth or the ratio of private credit in both reporter and counterparty countries have a significant effect on gross capital inflows, as shown in column (1). On the other hand, productivity growth in counterparty countries is determinant for gross capital outflows during the period before 2008. Furthermore, the related coefficient is higher relative to the coefficient for gross capital inflows, leading to a negative but insignificant coefficient of productivity growth of recipient countries on net capital flows. Turning to the ratio of private credit to GDP of counterparty countries, its effect on gross capital outflows is positive and significant. During the pre-crisis period, gross capital outflows are increasing with the level of financial development and productivity growth. On the contrary, net capital flows are decreasing with the level of financial development as in the baseline regression.

Looking at the period after 2008, the effect of productivity growth of both reporter and counterparty countries on gross capital outflows sharply increases and become signif-

Table 3.7: Cross-border bank flows before and after the crisis

	Pre 2008			Post 2008		
	(1)	(2)	(3)	(4)	(5)	(6)
	Inflows to j	Outflows from j	Net Inflows to j	Inflows to j	Outflows from j	Net Inflows to j
Credit/GDP$_{i,t-1}$	0.0115	-0.0523	0.0640	-0.152*	-0.183**	0.0392
	(0.0626)	(0.0669)	(0.0807)	(0.0803)	(0.0907)	(0.122)
Credit/GDP$_{j,t-1}$	-0.0103	0.194***	-0.203***	-0.0953	-0.0457	-0.0840
	(0.0545)	(0.0608)	(0.0744)	(0.0834)	(0.0998)	(0.131)
TFPgrowth$_{i,t-1}$	3.810	2.778	1.556	50.80***	56.55***	-10.45
	(3.639)	(3.105)	(3.960)	(16.23)	(18.99)	(23.76)
TFPgrowth$_{j,t-1}$	1.477	4.521**	-2.837	9.640	17.25	-7.735
	(1.759)	(1.805)	(2.533)	(9.938)	(10.74)	(13.37)
Openness$_{i,t-1}$	0.0399	0.247*	-0.207	0.100*	0.0440	0.0659
	(0.0997)	(0.127)	(0.145)	(0.0553)	(0.0566)	(0.0755)
Openness$_{j,t-1}$	0.0259	-0.0287	0.0556**	-0.0374	0.0898***	-0.119***
	(0.0183)	(0.0195)	(0.0254)	(0.0273)	(0.0213)	(0.0328)
Debt/GDP$_{i,t-1}$	0.279***	-0.0976	0.366***	-0.107	-0.0241	-0.0822
	(0.0751)	(0.0735)	(0.0976)	(0.108)	(0.120)	(0.154)
Debt/GDP$_{j,t-1}$	-0.244***	0.0939	-0.340***	0.183*	0.197*	-0.0473
	(0.0833)	(0.0727)	(0.0940)	(0.0956)	(0.104)	(0.129)
Inflation$_{i,t-1}$	-0.0436	-1.526	1.193	0.422	-1.079	1.702
	(1.180)	(1.226)	(1.653)	(0.915)	(1.076)	(1.343)
Inflation$_{j,t-1}$	-0.674**	0.0695	-0.722**	0.387	0.0727	0.414
	(0.267)	(0.238)	(0.337)	(0.389)	(0.450)	(0.582)
Uncertainty$_{i,t-1}$	-0.454	-0.0219	-0.418	-1.040***	-0.590	-0.545
	(0.300)	(0.296)	(0.422)	(0.354)	(0.388)	(0.524)
Uncertainty$_{j,t-1}$	0.208	0.00425	0.182	-0.350**	-0.185	-0.188
	(0.145)	(0.145)	(0.189)	(0.172)	(0.200)	(0.265)
Observations	4609	4594	4565	4525	4523	4416
R^2	0.185	0.122	0.128	0.252	0.187	0.167

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims (gross inflows), the growth rate of exchange rate-adjusted cross-border liabilities (gross outflows), and the growth rate of exchange rate-adjusted cross-border claims net of cross-border liabilities (net inflows). All estimations include dyad fixed effects and year fixed effects. All independent variables are lagged by one year. Standard errors are clustered at the reporting-counterpartycountry levels. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.

icant only for productivity growth of reporter countries as shown in column (5), while it increases but non-significant for counterparty countries and significant for reporter countries on gross capital inflows, as per column (4). Productivity growth in counterparty countries remains negative and non-significant for net capital inflows. This negative relationship is contrary to the theoretical predictions, but consistent with previous empirical findings. Meanwhile, the ratio of private credit to GDP of reporter countries becomes negative and significant for gross inflows and gross outflows. The level of financial development of counterparty countries is still negative and becomes non-significant on all flows. These findings shed light on the directions of gross capital flows before and after the GFC. Before 2008, counterparty countries with faster productivity growth rate and with a better developed financial market were exporting more gross capital to reporting countries, while none of those variables was relevant for gross capital inflows to counterparty countries. In the meantime, counterparty countries' net capital flows were decreasing with their level of financial development and productivity growth rate, although the latter is non-significant. This pattern reverses its direction since 2008. While none of the productivity growth nor the level of financial development of counterparty countries was relevant for gross flows and net flows, the effect of productivity growth of reporter countries on gross capital inflows is positive and becomes significant. On the other hand, the level of financial development in reporter countries also becomes negative and significant on gross capital inflows.

One explanation may lie in the fact that changes in banking flows were the worst during the crisis as stressed in the literature. Before 2008, banks in reporter countries have increased their borrowing gradually from counterparty countries, following the higher productivity growth of these. Gross capital flowing from counterparty countries towards reporter countries was increasing with the productivity growth of the source countries. Reporter countries were also prone to borrow from counterparty countries with a better developed financial market. With the crisis, banks in counterparty countries have rapidly pulled back their foreign investment, especially from riskier countries (countries with a lower level of financial development). Banks in reporter countries have also increased their investment abroad towards higher-growth countries, and one notices that countries with a better financially developed market have invested less abroad.

To sum up, the capital was flowing out exclusively from the highest growth countries, also enhanced by their level of financial development before the GFC. With the crisis, productivity growth in both source and recipient countries was relevant for capital inflows and lower financially developed countries have invested more abroad.

3.5 Robustness Analysis

This section presents a few robustness tests of the baseline specification. In particular, I seek to investigate if the main results are affected by the measure of growth or the measure of the level of financial development, if I consider only countries that are both reporter and counterparty and if I account only for counterparty countries controls. I also present results that use robust standard errors instead of clustering standard errors at the reporter-counterparty countries level, with a sample excluding low-income countries and a sample including offshore centers.

3.5.1 Alternative Measures of Growth and Financial Development

Table 3.8 presents results using the GDP growth rate instead of the TFP growth rate. As one sees, the coefficient associated with growth in counterparty countries is also positive and significant. This suggests that GDP growth of recipient countries is also relevant for gross capital inflows, as found in the literature. GDP growth rate of counterparty countries also has a positive effect on gross capital outflows, although the coefficient is significative at the 1% level. I do not find a significant coefficient of GDP growth on net capital flows. Also, the associated coefficients for all types of flows are smaller, relative to the estimates using TFP growth. However, the level of financial development in the counterparty countries remains negative and highly significant on gross inflows and net flows, as for the estimation using TFP growth. The interaction variable is also positive and significant at the 1% level for gross inflows.

In the baseline specification, I have used the ratio of private credit by deposit money banks and other financial institutions to GDP as my primary measure of the level of financial development. Other measures, such as the ratio of private credit by deposit money banks to GDP and the ratio of liquid liabilities to GDP, have been widely used

Table 3.8: Alternative measures of growth

	Gross Inflows to j		Gross Outflows from j		Net Inflows to j	
	(1)	(2)	(3)	(4)	(5)	(6)
Credit/GDP$_{i,t-1}$	-0.0150	-0.135**	-0.0820***	-0.136**	0.0718*	0.00224
	(0.0338)	(0.0600)	(0.0311)	(0.0565)	(0.0415)	(0.0822)
Credit/GDP$_{j,t-1}$	-0.121***	-0.275***	0.0479	-0.0220	-0.169***	-0.259***
	(0.0355)	(0.0658)	(0.0338)	(0.0769)	(0.0446)	(0.0967)
GDPgrowth$_{i,t-1}$	0.138	0.127	0.319***	0.314***	-0.181	-0.188
	(0.0970)	(0.0972)	(0.114)	(0.114)	(0.141)	(0.141)
GDPgrowth$_{j,t-1}$	0.298***	0.298***	0.111	0.112	0.208**	0.208**
	(0.0696)	(0.0695)	(0.0735)	(0.0736)	(0.100)	(0.0999)
Openness$_{i,t-1}$	0.0603*	0.0587	-0.0429	-0.0439	0.110***	0.109***
	(0.0358)	(0.0359)	(0.0355)	(0.0356)	(0.0419)	(0.0418)
Openness$_{j,t-1}$	-0.0175	-0.0167	-0.00177	-0.00141	-0.0122	-0.0117
	(0.0124)	(0.0123)	(0.0105)	(0.0105)	(0.0152)	(0.0152)
Debt/GDP$_{i,t-1}$	0.0824**	0.0658*	0.101***	0.0934**	-0.0179	-0.0274
	(0.0358)	(0.0365)	(0.0371)	(0.0380)	(0.0485)	(0.0498)
Debt/GDP$_{j,t-1}$	-0.148***	-0.160***	-0.0321	-0.0376	-0.118**	-0.125***
	(0.0384)	(0.0384)	(0.0331)	(0.0337)	(0.0468)	(0.0480)
Inflation$_{i,t-1}$	0.396	0.441	0.0917	0.111	0.171	0.200
	(0.606)	(0.607)	(0.702)	(0.702)	(0.871)	(0.872)
Inflation$_{j,t-1}$	-0.174	-0.189	0.164	0.157	-0.305	-0.314
	(0.177)	(0.175)	(0.179)	(0.179)	(0.247)	(0.246)
Uncertainty$_{i,t-1}$	-0.768***	-0.777***	-0.341*	-0.345*	-0.433*	-0.438*
	(0.196)	(0.196)	(0.194)	(0.195)	(0.262)	(0.262)
Uncertainty$_{j,t-1}$	-0.139	-0.145	-0.0915	-0.0945	-0.0686	-0.0725
	(0.0910)	(0.0911)	(0.0993)	(0.0996)	(0.126)	(0.126)
Credit/GDP$_{i,t-1}$*Credit/GDP$_{j,t-1}$		0.00127***		0.000576		0.000739
		(0.000483)		(0.000553)		(0.000717)
Observations	9843	9843	9822	9822	9668	9668
R^2	0.154	0.155	0.113	0.113	0.080	0.081

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims (gross inflows), the growth rate of exchange rate-adjusted cross-border liabilities (gross outflows), and the growth rate of exchange rate-adjusted cross-border claims net of cross-border liabilities (net inflows). All estimations include dyad fixed effects and year fixed effects. All independent variables are lagged by one year. Standard errors are clustered at the reporting-counterpartycountry levels. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.

in the literature, primarily to assess the relationship between financial development and growth. One problem with the ratio of private credit by deposit money banks and other financial institutions to GDP is that it does not distinguish between credit to (from) domestic agent (banks) and credit to (from) foreign agent (banks). This measure gives a general picture of how domestic agents are credit constrained and how much they have access to credit. As this paper aims to assess the effect of the scarcity of domestic credit on foreign lending and borrowing, I therefore use the ratio of domestic credit to the private sector (% of GDP) as an alternative measure. [20]

Table 3.9 presents the estimations for the different types of capital flows, using alternative measures of the level of financial development. Using the ratio of private credit by deposit money banks to GDP gives similar results. Unsurprisingly, all of the coefficients have slightly the same sign and the same level of significance as in the baseline estimation. This alternative measure is similar to the ratio of private credit by deposit money banks and other financial institutions to GDP, but excludes credit from other financial institutions. With the ratio of liquid liabilities to GDP, the coefficients have the right sign but lose their statistical significance, except for the ratio of liquid liabilities to GDP in the source countries. Again, this result is unsurprising, as this measure of the level of financial development also includes credit to the public sector and therefore, does not measure accurately the scarcity of domestic credit. The use of the ratio of domestic credit to GDP also gives similar results as in the case of the ratio of private credit to GDP. However, the associated coefficients are very wide compared to the other measures. As noted above, this measure accounts only for the credit granted to the domestic private sectors. Overall, the baseline estimates survive to the using of different measures of growth and level of financial development. Next, I test the robustness, using different sets of samples.

20. All of these variables are also from the World Bank's Global Financial Development

Table 3.9: Alternative measures of financial development

	Private credit			Liquid Liabiity			Domestic credit		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Inflows to j	Outflows from j	Net Inflows to j	Inflows to j	Outflows from j	Net Inflows to j	Inflows to j	Outflows from j	Net Inflows to j
TFPgrowth$_{i,t-1}$	2.689	4.937**	-1.787	1.786	5.204**	-2.907	3.895	5.028***	-0.451
	(2.778)	(1.994)	(2.898)	(3.016)	(2.171)	(3.148)	(2.671)	(1.920)	(2.814)
TFPgrowth$_{j,t-1}$	3.865***	1.955*	1.872	4.949***	1.652	3.297**	4.686***	1.689	3.017*
	(1.183)	(1.097)	(1.645)	(1.122)	(1.062)	(1.579)	(1.135)	(1.035)	(1.585)
Openness$_{i,t-1}$	0.0653*	-0.0174	0.0926**	0.0570	-0.0178	0.0847*	0.0743**	-0.0120	0.0916**
	(0.0354)	(0.0348)	(0.0426)	(0.0358)	(0.0361)	(0.0439)	(0.0341)	(0.0331)	(0.0403)
Openness$_{j,t-1}$	-0.0122	0.00155	-0.0101	-0.0138	0.00161	-0.0121	-0.0102	0.00196	-0.00869
	(0.0126)	(0.0109)	(0.0157)	(0.0129)	(0.0109)	(0.0159)	(0.0124)	(0.0105)	(0.0159)
Debt/GDP$_{i,t-1}$	0.0745	0.120***	-0.0388	0.0782**	0.149***	-0.0665	0.112***	0.131***	-0.0426
	(0.0464)	(0.0436)	(0.0587)	(0.0391)	(0.0392)	(0.0533)	(0.0434)	(0.0404)	(0.0570)
Debt/GDP$_{j,t-1}$	-0.101**	0.00981	-0.115**	-0.0452	-0.00888	-0.0391	-0.0759*	0.00309	-0.0758
	(0.0454)	(0.0394)	(0.0536)	(0.0447)	(0.0362)	(0.0485)	(0.0457)	(0.0378)	(0.0533)
Inflation$_{i,t-1}$	0.247	-0.148	0.243	0.378	-0.164	0.382	0.316	-0.186	0.460
	(0.603)	(0.694)	(0.872)	(0.607)	(0.700)	(0.880)	(0.605)	(0.693)	(0.871)
Inflation$_{j,t-1}$	-0.135	0.188	-0.287	-0.173	0.183	-0.319	-0.173	0.197	-0.353
	(0.176)	(0.182)	(0.247)	(0.173)	(0.185)	(0.252)	(0.174)	(0.184)	(0.254)
Uncertainty$_{i,t-1}$	-0.741***	-0.368*	-0.374	-0.735***	-0.414**	-0.314	-0.763***	-0.378*	-0.340
	(0.197)	(0.196)	(0.266)	(0.197)	(0.198)	(0.262)	(0.197)	(0.195)	(0.259)
Uncertainty$_{j,t-1}$	-0.100	-0.0982	-0.0209	-0.167*	-0.0663	-0.118	-0.122	-0.0911	-0.0517
	(0.0910)	(0.0990)	(0.127)	(0.0899)	(0.0963)	(0.124)	(0.0907)	(0.0975)	(0.125)
BanksCredit/GDP$_{i,t-1}$	-0.0300	-0.0447	0.0211						
	(0.0343)	(0.0303)	(0.0428)						
BanksCredit/GDP$_{j,t-1}$	-0.113***	0.0383	-0.154***						
	(0.0325)	(0.0289)	(0.0367)						
Liabilities/GDP$_{i,t-1}$				-0.0897	-0.0483	-0.0312			
				(0.0609)	(0.0522)	(0.0767)			
Liabilities/GDP$_{j,t-1}$				-0.116**	0.0128	-0.129**			
				(0.0540)	(0.0463)	(0.0656)			
DomesticCredit/GDP$_{i,t-1}$							1.612	-4.096	6.564
							(3.571)	(3.051)	(4.266)
DomesticCredit/GDP$_{j,t-1}$							-6.638**	2.005	-9.517***
							(2.974)	(2.908)	(3.551)
N	9843	9822	9668	9767	9752	9598	9965	9947	9673
R^2	0.155	0.112	0.080	0.155	0.111	0.078	0.153	0.110	0.079

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims (gross inflows), the growth rate of exchange rate-adjusted cross-border liabilities (gross outflows), and the growth rate of exchange rate-adjusted cross-border claims net of cross-border liabilities (net inflows). All estimations include dyad fixed effects and year fixed effects. All independent variables are lagged by one year. Standard errors are clustered at the reporting-counterpartycountry levels. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.

3.5.2 Flows within LBS Reporter Countries and with Non-Reporter Countries

As noted above, the LBS reporter countries are mostly developed and emerging countries, while counterparty countries comprise of other developing countries also. I consider two subsamples to assess if my baseline estimates vary for cross-border flows between countries that are both reporter and counterparty or not. The first subsample contains countries that are both reporter and counterparty; the second one excludes LBS reporter countries from the group of counterparty countries. (and the counterparty countries are not LBS reporter). Table 3.10 estimates the baseline specification for each subsample.

For reporter countries lending (borrowing) to (from) each other, I find that productivity growth in the counterparty countries has a positive and 5% significant level effect on both gross capital inflows and net capital flows, but negative and non-significant on gross outflows. Productivity growth in reporter countries has a positive but insignificant effect on all types of flows. I also find a negative and significant effect of the ratio of private credit to GDP on gross capital inflows (although this effect is smaller relative to the estimate with the whole sample) and net capital flows, but insignificant for gross capital outflows. More interestingly, I find that private credit in reporter countries has a negative effect on gross capital outflows, positive on net capital flows, and becomes significant (1%). This finding reveals that only the level of financial development in the recipient matters for gross capital inflows when one considers only reporter countries together. As the financial development of source countries is not relevant for gross outflows, the negative effect of the level of financial development on net capital flows is driven mostly by its negative effect on gross inflows.

Turning to the second subsample, the effect of productivity growth in the counterparty countries is positive on all types of flows, but significant only for gross flows. The effect is wider on gross flows and smaller on net flows, relative to the previous subsample. On the other hand, I find a more substantial, positive, and significant effect of the productivity growth of reporter countries on gross capital outflows. The effect is also more substantial and significant on net capital flows, but negative. The level of financial development in reporting countries is insignificant for all types of capital flows, while the associated coefficients in counterparty countries remain negative and significant for

Table 3.10: Flows within LBS reporter countries and with non-reporter countries

	Both reporter and counterparty			Only reporter or counterparty		
	(1)	(2)	(3)	(4)	(5)	(6)
	Inflows to j	Outflows from j	Net Inflows to j	Inflows to j	Outflows from j	Net Inflows to j
Credit/GDP$_{i,t-1}$	0.0420	-0.121***	0.169***	-0.0607	-0.0277	-0.0229
	(0.0471)	(0.0419)	(0.0521)	(0.0600)	(0.0513)	(0.0792)
Credit/GDP$_{j,t-1}$	-0.0562	0.0240	-0.0738	-0.125*	0.125*	-0.271***
	(0.0443)	(0.0422)	(0.0579)	(0.0721)	(0.0670)	(0.0859)
TFPgrowth$_{i,t-1}$	6.902*	4.739**	2.367	-0.529	4.123	-3.943
	(3.662)	(2.309)	(3.636)	(3.782)	(3.254)	(4.357)
TFPgrowth$_{j,t-1}$	6.783***	0.282	6.392**	6.294***	6.969***	-0.790
	(2.500)	(1.951)	(2.553)	(1.873)	(1.754)	(2.584)
Openness$_{i,t-1}$	0.0531	-0.0521	0.115**	0.136**	0.0392	0.108
	(0.0421)	(0.0377)	(0.0452)	(0.0638)	(0.0727)	(0.0933)
Openness$_{j,t-1}$	-0.00982	-0.0318	0.0260	-0.0102	0.0298**	-0.0364*
	(0.0200)	(0.0237)	(0.0261)	(0.0166)	(0.0130)	(0.0208)
Debt/GDP$_{i,t-1}$	0.107**	0.0269	0.0780	0.110*	0.275***	-0.152*
	(0.0478)	(0.0451)	(0.0557)	(0.0639)	(0.0645)	(0.0914)
Debt/GDP$_{j,t-1}$	-0.0663	0.0672	-0.138**	-0.0265	0.0231	-0.0516
	(0.0730)	(0.0492)	(0.0684)	(0.0683)	(0.0678)	(0.0879)
Inflation$_{i,t-1}$	0.629	0.167	0.409	-0.232	-0.774	0.358
	(0.729)	(0.873)	(1.033)	(1.013)	(1.112)	(1.487)
Inflation$_{j,t-1}$	0.108	0.808**	-0.705	-0.211	-0.0291	-0.139
	(0.361)	(0.407)	(0.543)	(0.202)	(0.201)	(0.284)
Uncertainty$_{i,t-1}$	-0.554**	-0.218	-0.351	-1.119***	-0.644*	-0.470
	(0.229)	(0.230)	(0.309)	(0.351)	(0.340)	(0.461)
Uncertainty$_{j,t-1}$	-0.0701	-0.152	0.0604	-0.197	0.0970	-0.312*
	(0.154)	(0.174)	(0.207)	(0.130)	(0.133)	(0.181)
Observations	4986	4992	4953	4857	4830	4715
R^2	0.161	0.118	0.075	0.158	0.131	0.098

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims (gross inflows), the growth rate of exchange rate-adjusted cross-border liabilities (gross outflows), and the growth rate of exchange rate-adjusted cross-border claims net of cross-border liabilities (net inflows). All estimations include dyad fixed effects and year fixed effects. All independent variables are lagged by one year. Standard errors are clustered at the reporting-counterpartycountry levels. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.

gross inflows and net flows as in the baseline estimations. Overall, the effect of the level of financial development on the different types of capital flows I have found with my baseline estimation is not affected by this separation of the sample. However, this robustness test reveals an additional finding – cross-border inflows depend negatively on the level of financial development (reporter and counterparty) when countries are both reporter and counterparty, and also negatively on the level of financial development of only counterparty countries.

3.5.3 Other Robustness Checks

Table 3.11: Alternative specification: only counterparty or reporting countries characteristics

	Only Counterparty			Only Reporter		
	(1)	(2)	(3)	(4)	(5)	(6)
	Inflows to j	Outflows from j	Net Inflows to j	Inflows to j	Outflows from j	Net Inflows to j
Credit/GDP$_{j,t-1}$	-0.0244*	0.00540	-0.0339*			
	(0.0139)	(0.0123)	(0.0178)			
TFPgrowth$_{j,t-1}$	0.837***	0.324*	0.461*			
	(0.286)	(0.169)	(0.259)			
Openness$_{j,t-1}$	0.00638	-0.00113	0.00821*			
	(0.00418)	(0.00294)	(0.00425)			
Debt/GDP$_{j,t-1}$	-0.0585**	-0.0301**	-0.0272			
	(0.0208)	(0.0115)	(0.0212)			
Inflation$_{j,t-1}$	-0.211**	-0.0105	-0.209			
	(0.0948)	(0.0756)	(0.125)			
Credit/GDP$_{i,t-1}$				-0.00436	-0.00474	0.00920
				(0.00985)	(0.0178)	(0.0180)
TFPgrowth$_{i,t-1}$				1.202	1.464**	-0.266
				(0.819)	(0.619)	(0.774)
Openness$_{i,t-1}$				-0.0368***	-0.0144	-0.0219*
				(0.00758)	(0.0123)	(0.0116)
Debt/GDP$_{i,t-1}$				0.0249	0.00667	0.0209
				(0.0259)	(0.0161)	(0.0131)
Inflation$_{i,t-1}$				0.00433	0.684	-0.491
				(0.431)	(0.620)	(0.602)
Observations	15854	16447	15419	18716	19650	18062
R^2	0.084	0.084	0.054	0.260	0.229	0.225

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims (gross inflows), the growth rate of exchange rate-adjusted cross-border liabilities (gross outflows), and the growth rate of exchange rate-adjusted cross-border claims net of cross-border liabilities (net inflows). All estimations include dyad fixed effects and year fixed effects. All independent variables are lagged by one year. Standard errors are clustered at the reporting-counterpartycountry levels. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.

Table 3.12: Baseline results with robust standard errors and excluding OECD countries

	Robust Standard Errors			Excluding OECD Countries		
	(1)	(2)	(3)	(4)	(5)	(6)
	Inflows to j	Outflows from j	Net Inflows to j	Inflows to j	Outflows from j	Net Inflows to j
Credit/GDP$_{i,t-1}$	0.0113	-0.0684*	0.0872*	-0.0990	-0.0429	-0.0493
	(0.0354)	(0.0382)	(0.0496)	(0.0604)	(0.0452)	(0.0776)
Credit/GDP$_{j,t-1}$	-0.0895**	0.0649*	-0.158***	-0.0424	0.131**	-0.181*
	(0.0370)	(0.0391)	(0.0495)	(0.0827)	(0.0638)	(0.0956)
TFPgrowth$_{i,t-1}$	3.856*	4.594**	-0.283	0.837	4.247	-2.832
	(2.109)	(2.112)	(2.790)	(4.040)	(3.038)	(4.334)
TFPgrowth$_{j,t-1}$	4.559***	2.124*	2.401	5.130***	5.448***	-0.245
	(1.058)	(1.095)	(1.500)	(1.838)	(1.584)	(2.471)
Openness$_{i,t-1}$	0.0708**	-0.0225	0.104**	0.114*	-0.000449	0.135*
	(0.0332)	(0.0381)	(0.0458)	(0.0581)	(0.0599)	(0.0746)
Openness$_{j,t-1}$	-0.0112	0.000914	-0.00852	-0.0293**	0.0106	-0.0348*
	(0.0114)	(0.0112)	(0.0160)	(0.0143)	(0.0128)	(0.0184)
Debt/GDP$_{i,t-1}$	0.106***	0.128***	-0.0169	0.141**	0.243***	-0.0928
	(0.0388)	(0.0441)	(0.0568)	(0.0629)	(0.0547)	(0.0855)
Debt/GDP$_{j,t-1}$	-0.0676*	0.00869	-0.0805	0.0634	0.00829	0.0541
	(0.0403)	(0.0442)	(0.0573)	(0.0855)	(0.0737)	(0.117)
Inflation$_{i,t-1}$	0.255	-0.224	0.331	-0.243	0.0232	-0.465
	(0.566)	(0.718)	(0.895)	(0.956)	(1.066)	(1.387)
Inflation$_{j,t-1}$	-0.126	0.188	-0.278	-0.298*	-0.0299	-0.224
	(0.160)	(0.179)	(0.241)	(0.179)	(0.191)	(0.262)
Uncertainty$_{i,t-1}$	-0.795***	-0.364*	-0.432	-0.955***	-0.607*	-0.357
	(0.184)	(0.206)	(0.270)	(0.306)	(0.337)	(0.458)
Uncertainty$_{j,t-1}$	-0.142	-0.0957	-0.0653	-0.0624	0.133	-0.214
	(0.0884)	(0.104)	(0.133)	(0.126)	(0.131)	(0.175)
Observations	9843	9822	9668	5085	5056	4940
R^2	0.154	0.112	0.080	0.164	0.131	0.107

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims (gross inflows), the growth rate of exchange rate-adjusted cross-border liabilities (gross outflows), and the growth rate of exchange rate-adjusted cross-border claims net of cross-border liabilities (net inflows). All estimations include dyad fixed effects and year fixed effects. All independent variables are lagged by one year. Standard errors are clustered at the reporting-counterpartycountry levels. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.

In the baseline estimates, I control for macroeconomic and financial conditions of both source and host countries. I also use fixed effects to control for bilateral time-invariant and global factors affecting both source and host countries.[21] With this specification, the results suggest that the level of financial development of the host country matter for gross inflows while controlling for the global factor. However, the global factor may affect both the level of financial development and capital flows in both source and host countries. I check in this section if the level of financial development still has a significant effect on gross flows without controlling for the global factor. Therefore, I estimate an equation similar to the baseline equation. However, I control only for reporter (counterparty) countries macroeconomic variables and use counterparty*time (reporting*time) fixed effect instead of country pair and time fixed effects to control for demand conditions in the counterparty (reporting) country. Table 3.11 presents the result of the estimates and shows that my findings with the baseline estimates hold even by not controlling for the global factor. In particular, the level of financial development in the host country still has a negative and significant effect on gross inflows, while the level of financial development of the source country still has a non-significant effect with the full sample. Overall, the results are not affected by these different specifications.

The results of the baseline estimates are also robust to the use of robust standard error instead of clustering the standard errors. In addition, the coefficients have the same sign, but the level of financial development of the host country becomes non-significant for gross inflows by excluding OECD counterparty countries (Table 3.12).

3.6 Conclusion

Analyzing gross flows instead of net flows have gained particular attention since the early 1990s. The extensive existing literature has examined the potential driver of capital flows, but the role of the financial market conditions on capital flows, especially cross-border banking flows, is unexplored. This paper uses the dyadic structure of the BIS dataset to bring a shred of empirical evidence on the importance of financial de-

21. The standard errors are now double-clustered at the reporting and counterparty country levels.

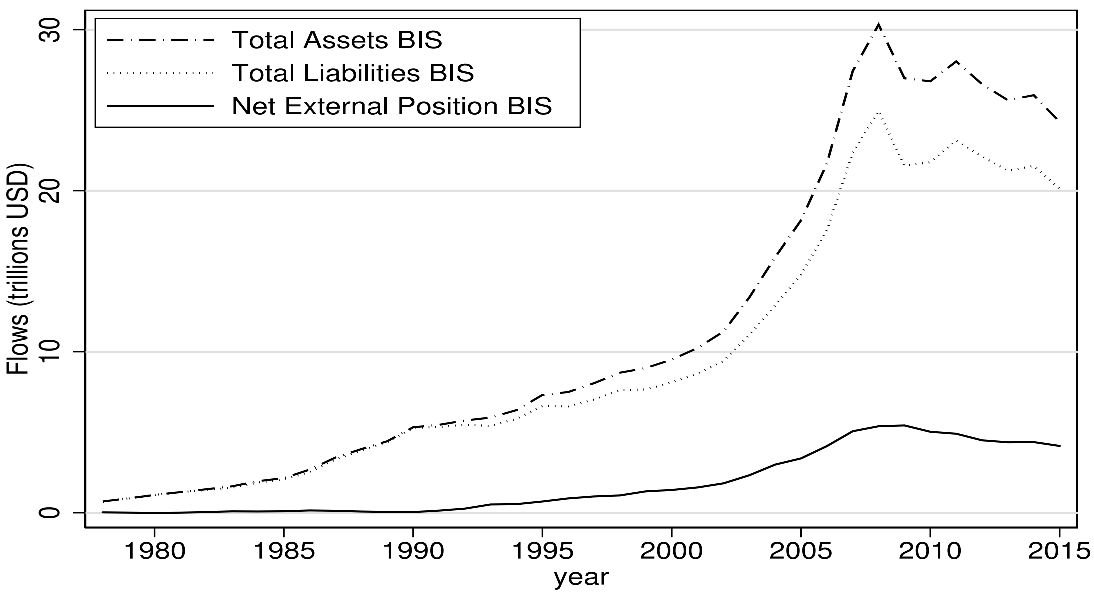
velopment of both source and host countries on bilateral cross-border banks lending and borrowing. My findings suggest that banks and non-banks in countries with lower financial developed markets borrow more abroad from banks in countries with a better financial developed market and lend less to these banks. The paper takes advantage of the dyadic structure of the dataset to identify the effect of the financial development of source and host countries by using suitable fixed effects. I also propose instrumental variable estimates to tackle the potential endogeneity concerns and to support these findings. This pattern is opposite when banks lend to non-banks by using loans and deposits as the financing instrument. I also find that foreign and domestic financial markets complement each other for cross-border banking flows.

This paper renews the question of the relationship between financial development and capital flows. While the theoretical predictions argue that this relationship may be positive, empirical findings are ambiguous. This paper shows that the relationship may depend on the type of capital flows, but also the source or host sectors. In light of these findings, it is worth questioning whether bank lending is gainful or harmful for countries with underdeveloped financial markets and also characterized by a weak capability to absorb foreign capital.

APPENDIX A

ADDITIONAL FIGURES AND TABLES

Figure A.1: Annual cross-border bank flows



BIS: Bank for International Settlements
BoP: Balance of Payments

Table A.1: Gross outflows by sector and financing instrument

	All Instruments Outflows from j			Debt Securities Outflows from j			Loans and Deposits Outflows from j		
	All Sectors	Banks	Non-Banks	All Sectors	Banks	Non-Banks	All Sectors	Banks	Non-Banks
Credit/GDP$_{i,t-1}$	-0.0684**	-0.00852	-0.0437	0.0909*	-0.210***	0.252***	-0.0494*	-0.0751	-0.0496
	(0.0331)	(0.0594)	(0.0422)	(0.0521)	(0.0549)	(0.0511)	(0.0289)	(0.0478)	(0.0350)
Credit/GDP$_{j,t-1}$	0.0649*	0.186***	0.0524	-0.00180	0.0237	-0.0631	0.0573*	0.140***	0.0871**
	(0.0352)	(0.0640)	(0.0397)	(0.0638)	(0.0656)	(0.0520)	(0.0323)	(0.0507)	(0.0379)
TFPgrowth$_{i,t-1}$	4.594**	9.971***	1.118	6.563**	-0.110	12.50***	4.733***	2.056	1.184
	(1.972)	(3.501)	(2.373)	(2.568)	(3.097)	(2.507)	(1.420)	(2.818)	(1.591)
TFPgrowth$_{j,t-1}$	2.124**	4.583**	2.454**	2.068	0.979	1.410	1.539*	1.147	3.204***
	(1.075)	(1.868)	(1.065)	(1.742)	(2.047)	(1.501)	(0.859)	(1.646)	(0.930)
Openness$_{i,t-1}$	-0.0225	-0.181***	0.0979***	-0.111	-0.125	-0.0135	-0.0351	-0.282***	0.0803**
	(0.0350)	(0.0693)	(0.0370)	(0.0696)	(0.0792)	(0.0783)	(0.0313)	(0.0685)	(0.0349)
Openness$_{j,t-1}$	0.000914	0.00601	-0.00185	0.0198	0.0233	0.00152	-0.00289	0.0104	0.00691
	(0.0109)	(0.0235)	(0.00968)	(0.0169)	(0.0195)	(0.0131)	(0.0111)	(0.0187)	(0.00854)
Debt/GDP$_{i,t-1}$	0.128***	0.246***	0.0842**	0.279***	-0.0374	0.346***	0.0817*	0.104	-0.00488
	(0.0392)	(0.0632)	(0.0401)	(0.0976)	(0.102)	(0.0841)	(0.0462)	(0.0719)	(0.0506)
Debt/GDP$_{j,t-1}$	0.00869	0.00245	0.0834	0.0296	0.0531	-0.00519	-0.0323	-0.122**	0.0896**
	(0.0374)	(0.0862)	(0.0530)	(0.0774)	(0.0889)	(0.0618)	(0.0366)	(0.0611)	(0.0450)
Inflation$_{i,t-1}$	-0.224	0.593	0.280	-1.705*	-0.581	2.425**	0.375	1.445	0.287
	(0.690)	(1.197)	(0.735)	(1.023)	(1.128)	(1.141)	(0.713)	(1.319)	(0.829)
Inflation$_{j,t-1}$	0.188	0.451	0.135	0.262	0.128	0.0454	-0.00224	0.234	0.0474
	(0.181)	(0.341)	(0.158)	(0.239)	(0.253)	(0.201)	(0.180)	(0.334)	(0.149)
Uncertainty$_{i,t-1}$	-0.364*	-0.186	-0.574***	-0.151	0.865**	-0.0258	0.0443	0.265	-0.800***
	(0.196)	(0.338)	(0.215)	(0.352)	(0.404)	(0.393)	(0.187)	(0.363)	(0.198)
Uncertainty$_{j,t-1}$	-0.0957	-0.199	0.124	0.0914	0.0813	0.0574	-0.0266	-0.164	0.133
	(0.0977)	(0.194)	(0.101)	(0.140)	(0.149)	(0.127)	(0.0963)	(0.182)	(0.0856)
Observations	9822	8447	8477	7206	6432	6014	7658	6725	6774
R^2	0.112	0.093	0.088	0.091	0.099	0.089	0.142	0.118	0.112

Note: The dependent variable is the growth rate of exchange rate-adjusted cross-border liabilities. All estimations include dyad fixed effects and year fixed effects. All independent variables are lagged by one year. Standard errors are clustered at the reporting-counterpartycountry levels. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.

Table A.2: Net inflows by sector and financing instrument

	All Instruments, Net Inflows to j			Debt Securities, Net Inflows to j			Loans and Deposits, Net Inflows to j		
	All Sectors	Banks	Non-Banks	All Sectors	Banks	Non-Banks	All Sectors	Banks	Non-Banks
Credit/GDP$_{i,t-1}$	0.0872*	-0.0277	0.0779	-0.0790	0.0139	-0.0738	0.0274	0.0454	-0.0420
	(0.0455)	(0.0717)	(0.0547)	(0.117)	(0.134)	(0.105)	(0.0414)	(0.0721)	(0.0441)
Credit/GDP$_{j,t-1}$	-0.158***	-0.301***	-0.0730	-0.490***	-0.384***	-0.348***	-0.0810*	-0.239***	0.0261
	(0.0477)	(0.0823)	(0.0580)	(0.113)	(0.134)	(0.132)	(0.0417)	(0.0730)	(0.0509)
TFPgrowth$_{i,t-1}$	-0.283	-0.972	10.81***	25.86***	17.38***	19.48***	-3.237*	1.217	0.838
	(2.813)	(4.276)	(3.472)	(5.186)	(5.683)	(5.054)	(1.963)	(3.843)	(2.126)
TFPgrowth$_{j,t-1}$	2.401	2.821	0.718	3.265	11.68***	-1.616	2.328*	4.044	2.025
	(1.632)	(2.744)	(1.679)	(3.530)	(4.242)	(3.437)	(1.300)	(2.671)	(1.357)
Openness$_{i,t-1}$	0.104**	0.110	0.0589	0.106	0.0698	0.0610	0.111***	0.195**	0.0929**
	(0.0425)	(0.0849)	(0.0475)	(0.0962)	(0.126)	(0.121)	(0.0392)	(0.0919)	(0.0470)
Openness$_{j,t-1}$	-0.00852	0.00458	-0.00754	-0.0346	0.0388	0.0247	-0.0149	-0.0150	-0.0205
	(0.0157)	(0.0327)	(0.0166)	(0.0411)	(0.0494)	(0.0308)	(0.0152)	(0.0278)	(0.0166)
Debt/GDP$_{i,t-1}$	-0.0169	-0.0373	0.00227	-0.135	-0.104	-0.0535	-0.0502	-0.0247	-0.00547
	(0.0526)	(0.0884)	(0.0566)	(0.165)	(0.165)	(0.154)	(0.0583)	(0.105)	(0.0737)
Debt/GDP$_{j,t-1}$	-0.0805	-0.0778	-0.175**	-0.0797	0.00469	-0.207	-0.00480	0.0848	-0.0296
	(0.0503)	(0.108)	(0.0762)	(0.161)	(0.159)	(0.137)	(0.0465)	(0.0875)	(0.0571)
Inflation$_{i,t-1}$	0.331	-0.543	-0.438	2.752	3.392	-4.428*	-0.527	-1.185	-0.587
	(0.870)	(1.500)	(1.008)	(2.037)	(2.316)	(2.342)	(0.917)	(1.766)	(1.178)
Inflation$_{j,t-1}$	-0.278	-0.704	0.0361	-0.208	-0.00169	0.228	0.163	-0.913**	0.317
	(0.247)	(0.449)	(0.248)	(0.454)	(0.678)	(0.477)	(0.222)	(0.434)	(0.225)
Uncertainty$_{i,t-1}$	-0.432*	-0.302	-0.00610	0.771	0.186	0.639	-0.674***	-1.060	0.479
	(0.262)	(0.472)	(0.317)	(0.681)	(0.855)	(0.855)	(0.253)	(0.650)	(0.320)
Uncertainty$_{j,t-1}$	-0.0653	-0.0714	-0.320**	-0.237	-0.585	0.0202	-0.234*	-0.0900	-0.301**
	(0.126)	(0.256)	(0.132)	(0.285)	(0.385)	(0.265)	(0.123)	(0.256)	(0.117)
Observations	9668	8202	8235	7040	6173	5807	7478	6422	6485
R^2	0.080	0.070	0.072	0.089	0.087	0.065	0.090	0.085	0.088

Note: The dependent variable is the growth rate of exchange rate-adjusted cross-border claims net of cross-border liabilities (net inflows). All estimations include dyad fixed effects and year fixed effects. All independent variables are lagged by one year. Standard errors are clustered at the reporting-counterpartycountry levels. Robust standard errors in parentheses. ***, ** and * denote respectively 1%, 5% and 10% significant levels.

APPENDIX B

Table B.1: Variable definitions and sources

Variable	Definition	Source
Total Factor Productivity growth	Growth rate of TFP. TFP is constructed following development accounting literature and assuming a Cobb-Douglas production function	By the author using Penn World Table, version 9 data
Gross inflows	Exchange rate adjusted growth in the total liabilities reported by banks in the country	BIS Locational Banking Statistics (LBS)
Gross outflows	Exchange rate adjusted growth in the total assets reported by banks in the country	BIS Locational Banking Statistics (LBS)
Net flows	Gross inflows minus gross outflows	BIS Locational Banking Statistics (LBS)
Debt/GDP	Ratio of government debt to GDP.	IMF, World Economic Outlook
Uncertainty	World Uncertainty Index (WUI). Computed using the frequency of the word uncertainty or its variants in the Economist Intelligence Unit (EIU) country reports. The higher the index, the higher the uncertainty.	Ahir et al. (2018)
Private sector credit/ GDP	Total credit to the private sector relative to GDP, excluding all other types of credit, such as credit to the government, public sector, and state-owned companies.	World Bank's Global Financial Development Database (Čihák et al., 2012)
Liquid liabilies/GDP	Liquid liabilities of the financial system (% GDP).	World Bank's Global Financial Development Database (Čihák et al., 2012)
Domestic credit/GDP	Domestic credit to private sector refers to financial resources provided to the private sector (% GDP).	World Bank's Global Financial Development Database (Čihák et al., 2012)

Continues on next page

Table B.1 – Continued from previous page

Variable	Definition	Source
Bank credit/GDP	Total assets held by deposit money banks as a share of sum of deposit money bank and Central Bank claims on domestic non-financial real sector (% GDP).	World Bank's Global Financial Development Database (Čihák et al., 2012)
Capital account openness	Chinn and Ito index. It measures the openness in capital account transactions.	Chinn and Ito (2008)

APPENDIX C

LIST OF COUNTRIES

BIS Reporting Countries

Australia; Austria; Belgium; Brazil; Canada; Switzerland; Chile; Germany; Denmark; Spain; Finland; France; United Kingdom; Greece; Ireland; Italy; Japan; South Korea; Luxembourg; Mexico; Netherlands; Sweden; United States; South Africa;

BIS Counterparty Countries

Afghanistan; Angola; Albania; United Arab Emirates; Argentina; Armenia; Australia; Austria; Azerbaijan; Burundi; Belgium; Benin; Burkina Faso; Bangladesh; Bulgaria; Bosnia and Herzegovina; Belarus; Belize; Bolivia; Brazil; Brunei; Bhutan; Botswana; Central African Republic; Canada; Switzerland; Chile; China; Cote d'Ivoire; Cameroon; Congo Democratic Republic; Congo; Colombia; Comoros; Cape Verde; Costa Rica; Cyprus; Czech Republic; Germany; Djibouti; Dominica; Denmark; Dominican Republic; Algeria; Ecuador; Egypt; Eritrea; Spain; Estonia; Ethiopia; Finland; Fiji; France; Micronesia; Gabon; United Kingdom; Georgia; Ghana; Guinea; Gambia; Guinea-Bissau; Equatorial Guinea; Greece; Grenada; Guatemala; Guyana; Honduras; Croatia; Haiti; Hungary; Indonesia; India; Ireland; Iran; Iraq; Iceland; Israel; Italy; Jamaica; Jordan; Japan; Kazakhstan; Kenya; Kyrgyz Republic; Cambodia; South Korea; Kuwait; Laos; Libya; St. Lucia; Sri Lanka; Lesotho; Lithuania; Luxembourg; Latvia; Morocco; Moldova; Madagascar; Maldives; Mexico; Macedonia, FYR; Mali; Malta; Myanmar; Mongolia; Mozambique; Mauritania; Malawi; Malaysia; Namibia; Niger; Nigeria; Nicaragua; Netherlands; Norway; Nepal; New Zealand; Oman; Pakistan; Palestinian Territory; Peru; Philippines; Papua New Guinea; Poland; Portugal; Paraguay; Qatar;

Romania; Russia; Rwanda; Saudi Arabia; Sudan; Senegal; Solomon Islands; Sierra Leone; El Salvador; San Marino; Sao Tome and Principe; Suriname; Slovakia; Slovenia; Sweden; Swaziland; Seychelles; Syria; Chad; Togo; Thailand; Tajikistan; Tonga; Trinidad and Tobago; Tunisia; Turkey; Tanzania; Uganda; Ukraine; Uruguay; United States; St. Vincent and the Grenadines; Venezuela; Vietnam; Yemen; South Africa; Zambia; Zimbabwe;

CONCLUSION

Cette thèse analyse l'importance du développement financier domestique dans la relation entre les capitaux étrangers et la croissance économique. Structurée sur trois articles, l'étude a permis de mettre en exergue l'importance de la prise en compte des conditions financières des pays afin de mieux comprendre les déterminants des flux de capitaux, mais aussi d'expliquer le phénomène de circulation en contre sens des capitaux des pays à fort taux de croissance économique vers les pays à faible taux de croissance. En particulier, le premier article propose un modèle théorique avec une friction sur le marché de crédit domestique pour prédire la corrélation négative entre capitaux étrangers et la croissance de la productivité. Le deuxième article analyse empiriquement les effets de divers types de capitaux étrangers sur la croissance économique, en utilisant le niveau de développement financier domestique comme variable seuil. Le troisième article analyse l'effet du développement financier des pays sources et de destination sur les flux bilatéraux d'un type de capital particulier, les prêts bancaires.

De cette thèse se dégagent trois principaux résultats. Le premier a trait à l'importance des contraintes de financement domestiques pour expliquer la relation négative entre les capitaux étrangers et la croissance de la productivité. En effet, nous montrons dans cette thèse que la contrainte de crédit est l'élément clé qui empêche la productivité de certains pays de croître rapidement et de rattraper celle de la frontière technologique mondiale. Ce résultat est similaire à celui de Aghion et al. (2005). Nous montrons également que la divergence des pays générée par un marché financier moins développé est à l'origine de la corrélation négative entre les flux de capitaux extérieurs et la croissance de la productivité pour ces pays. Lorsque le niveau de développement financier permet de rattraper la frontière technologique, cette corrélation est positive. Cependant, comme le montrent Gourinchas and Jeanne (2013); Alfaro et al. (2014) la corrélation négative est attribuable aux capitaux publics plutôt qu'aux capitaux privés. Notre modèle ne tient pas compte de cette distinction. Une modélisation adéquate des décisions des gouvernements locaux (accumulation de réserves, aides publiques, endettement du gouvernement sur le marché international, ...) dans un modèle similaire à celui développé dans cette thèse permettrait d'avoir de meilleures prédictions, et donc de donner une explication supplémentaire à l'«allocation puzzle».

Le second résultat est lié au débat sur les effets des capitaux étrangers sur la croissance économique. Suivant les résultats de notre premier article, nous montrons empiriquement que la prise en compte du niveau de développement financier dans l'analyse de la relation entre les flux de capitaux et la croissance économique est capitale. Elle permet aussi de comprendre pourquoi les capitaux extérieurs ne favorisent pas la croissance dans certains pays, malgré leur volonté politique à s'ouvrir plus aux échanges internationaux. En particulier, notre résultat identifie les capitaux qui sont bénéfiques ou nocifs aux économies, en fonction du développement de leur marché financier. Ce résultat peut éclairer les décideurs politiques dans leur volonté de contrôler les entrées de capitaux ou d'accumuler plus de réserve. Par exemple, l'accumulation excessive de réserves pour des pays avec un marché financier moins développé nuit à la croissance; cela constitue un gaspillage de ressources qui pourrait servir à développer des projets productifs. Il est donc recommandable pour ces pays un niveau optimal d'accumulation de réserves. Aussi, les aides ne sont pas nécessairement bénéfiques pour la croissance économique, étant donné qu'elles sont plus souvent guidées par des motifs politiques et non nécessairement des motifs de développement. Une meilleure allocation de ces ressources pourrait aider les pays hôtes à réaliser une croissance plus soutenue.

Le troisième résultat de cette thèse fait référence aux emprunts bancaires transfrontaliers en fonction des marchés financiers autant domestiques qu'étrangers. Très souvent, seul le niveau de développement financier du pays hôte est considéré dans les études sur les flux de capitaux. Dans cette thèse, nous montrons l'importance de tenir compte aussi du développement financier du pays source. En particulier, nous montrons qu'en plus d'influencer différemment les flux bancaires selon la nature de l'emprunteur et l'instrument de financement, le marché financier du pays source peut-être un complément au manque de financement dans le pays hôte. Dans le cas des flux bilatéraux d'IDE, ces deux marchés fonctionnent plutôt comme des substituts (Donaubauer et al., 2019). Notre résultat suggère des politiques conjointes et coordonnées entre les pays visant à développer les marchés financiers en vue d'accroitre les flux bancaires bilatéraux. Des politiques individuelles pourraient dans ce cas biaiser les résultats escomptés. À l'opposé, ces politiques individuelles devraient attirer plus d'IDE, sans tenir compte de l'amélioration des marchés financiers des pays sources.

En plus de ces résultats principaux, cette thèse comporte différents résultats qui pourraient être utiles, tant pour les chercheurs que pour les décideurs politiques. Elle fournit des éléments qui peuvent aider à améliorer les modèles théoriques existants afin de mieux expliquer les flux de capitaux, mais aussi les décideurs politiques et économiques dans leurs politiques de développement et d'intégration financière et économique.

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