Essays on Foreign Direct Investment, Economic Vulnerability and Uncertainty

Romain Razafindravaosolonirina

UNIVERSITÉ DE LA RÉUNION
UFR DE DROIT ET D'ÉCONOMIE

Année 2018

THÈSE

Pour l'obtention du grade de
Docteur en Sciences Economiques

Présentée et soutenue publiquement par

Romain Justinien RAZAFINDRAVAOSOLONIRINA

Essays on Foreign Direct Investment, Economic Vulnerability and Uncertainty

Sous la direction de Dominique LEPELLEY (Pr. Université de La Réunion)
et de Jeannot RAMIARAMANANA (Pr. Université d'Antananarivo
&UCM)

JURY :

Jean-François HOARAU	Professeur à l'Université de La Réunion
Dominique LEPELLEY	Professeur à l'Université de La Réunion
Jeannot RAMIARAMANANA	Professeur à l'Université d'Antananarivo
Serge REY	Professeur à l'Université de Pau (rapporteur)
Michaël GOUJON	Mcf HDR à l'Université de Clermont Auvergne (rapporteur)

L'Université de La Réunion n'entend donner aucune approbation ni improbation aux opinions émises dans cette thèse. Ces opinions doivent être considérées comme propres à leur auteur.

Remerciements

Partant de ma petite île natale pour une grande aventure à l'issue incertaine, je vois enfin le bout et je profite de cette occasion pour remercier les contributeurs, de près ou de loin, à cette longue aventure.

En premier lieu, je tiens à remercier mes directeurs de thèse Dominique LEPELLEY et Jeannot RAMIARAMANANA pour leur confiance, leur investissement, leur soutien et surtout leur patience. Un merci particulier pour Dominique LEPELLEY qui a su dans la dernière ligne droite me motiver et sans qui très certainement je n'aurais jamais fini cette thèse.

Je souhaiterais exprimer ma reconnaissance profonde aux Professeurs Serge REY et Michael GOUJON de me faire honneur en acceptant d'être les rapporteurs de mes travaux. De même, j'exprime tous mes remerciements au Professeur Jean François HOARAU d'avoir bien voulu être membre de mon jury de thèse.

Un grand merci à l'équipe d'enseignants-chercheurs du CEMOI de l'Université de La Réunion qui m'ont donné le goût de la matière tout au long de mes études universitaires. Je les remercie pour leur gentillesse, leur écoute et leurs conseils avisés. Il est important de souligner ici le soutient financier du laboratoire, de l'école doctorale et de la région Réunion qui a permis de diffuser et d'enrichir les différents travaux comportant cette thèse.

Mes remerciements vont également aux membres de l'UMR LISA et de l'UFR Droit-Economie-Gestion de l'Université de Corse au sein de laquelle j'ai effectué mes deux années d'ATER. Un remerciement à Sandrine, Antoine et Sauveur, mes chargés de cours, qui non seulement m'ont accueilli comme faisant partie intégrante de l'équipe mais aussi permis de mettre plein pieds dans la vie en corse.

Mes remerciements vont aussi à mes amis de La Réunion, de Corse et d'ailleurs, qui, avec cette question sadique et angoissante « et sinon... tu la soutiens quand cette thèse ? », m'ont permis de ne jamais dévier de mon objectif. Un merci particulier à Claire, sans qui je me serais perdu un peu en pleine campagne corse. Merci à Julie, Laura, Yuheng, Aïcha, Laura, et surtout Santiana.

Merci à mes amis et surtout co-auteurs, Idriss et Laurent, qui même en dehors du cadre

du travail m'ont permis de rencontrer de gens formidables. J'accorde ici une case particulière à Malala, qui a de nombreuses reprises m'a sortie de pleins de soucis. Merci d'avoir cru en moi et de m'avoir remotivé quand il le fallait.

Mes remerciements vont également aux membres de ma famille (de la Réunion et surtout de Madagascar) pour leurs encouragements et leur intérêt. Merci d'avoir cru en moi.

Merci à Ariane, ma fille, qui même dans les moments difficiles, m'a permis de mettre en perspective ce que je devais faire pour qu'elle puisse être fière de son papa. Merci Andréanne, ma compagne. J'espère, malgré ces difficiles dernières semaines, que tous nos efforts paieront.

Table des matières

Remerciements **V**

Table des matières **X**

Introduction Générale **1**

0.1 Quelques notions clés 5

0.1.1 IDE et classification 5

0.1.2 Vulnérabilité Economique 7

0.1.3 L'incertitude et l'activité économique 9

0.2 Choix de modélisation 10

0.2.1 Les modèles de Gravité 10

0.2.2 La modélisation VAR 13

0.3 Les apports de la thèse 14

1 Assessing the link between economic vulnerability and FDI **17**

1.1 Introduction 18

1.2 Definitions and Gravity Framework 20

1.2.1 Definition of Country's economic vulnerability 20

1.2.2 Modeling scheme : A gravity model for FDI 25

1.3 Data and Modelling 27

1.3.1 Data source 27

1.3.2 Estimated model 28

1.3.3 Multilateral resistance and consequences 29

1.4 Results 30

1.4.1 Risky environment and FDI level 30

1.4.2 Subindexes 30

1.4.3 Exposure index disagregation 33

1.4.4 FDI and sub indexes 36

1.4.5 Alternative controls 36
1.5 Conclusion 38
1.A Data sources 42
1.B Basic relationships 45
1.C List of countries 46
1.D EVI components 48

2 FDI, Economic vulnerability and Economic Integration : a gravitational approach 49
2.1 Introduction 50
2.2 Literature review 52
2.3 Model specifications and estimation 54
2.3.1 FDI and BIT link : An empirical approach 55
2.3.2 Model specifications 56
2.3.3 Data 58
2.4 Results 59
2.4.1 Direct effects : Phase-in effect 59
2.4.2 Interaction effects 62
2.4.3 Complementary effect of Economic integration and BIT 64
2.4.4 Economic integration and vulnerability level 68
2.4.5 Dilution effect 70
2.5 Robustness 72
2.5.1 Heckman selection model 72
2.5.2 Reverse causality 72
2.6 Conclusion 73
2.A EVI Components 75
2.B Descriptive statistics and data description 75
2.B.1 data description 75
2.B.2 descriptive statistics 76

3 FDI and Aid analysis : structural economic vulnerabilities mitigation ? 77
3.1 Introduction 78
3.2 Aid allocation : A donors view 80
3.3 Two way of modeling 81
3.3.1 A model of FDI Risk and Aid : A solow type model 81
3.3.2 A model of FDI Risk and Aid : Theoretical specification 84
3.3.3 A possible joint determination 86

3.4 Data and Empirical model . . . 87
3.4.1 Model specifications . . . 87
3.4.2 Data . . . 89
3.5 Results . . . 91
3.5.1 Bilateral Aid . . . 91
3.5.2 Interaction . . . 93
3.5.3 Aid as a transfer . . . 93
3.5.4 Level of Aid . . . 97
3.6 Additional : Empirical joint determination . . . 102
3.7 Conclusion . . . 105
3.A Data properties and descriptions . . . 108
3.A.1 Descriptive statistics . . . 108
3.A.2 Correlation Matrix . . . 109
3.B Aid in the form of disbursement . . . 110
3.C Aid selection . . . 110

4 Chinese Policy Uncertainty Shocks and the World Macroeconomy : Evidence from STVAR 117
4.1 Introduction . . . 118
4.2 Preliminaries . . . 121
4.2.1 Related literature . . . 121
4.2.2 Choice of countries . . . 122
4.3 Empirical background . . . 124
4.3.1 Data . . . 124
4.3.2 The linear model . . . 125
4.3.3 Beyond the linear model . . . 128
4.4 Non-linear results for “developed” economies . . . 132
4.4.1 Impulse response analysis . . . 132
4.4.2 Forecast Error Variance Decomposition . . . 135
4.5 Non-linear results for Brazil, Korea and Russia . . . 138
4.5.1 Impulse response analysis . . . 138
4.5.2 Forecast Error Variance Decomposition . . . 140
4.6 Robustness check . . . 142
4.7 Concluding remarks . . . 146
4.A Data sources . . . 147
4.B The impact of Chinese uncertainty shocks on the Chinese economy . . . 149

4.C Gamma calibration 150

Conclusion Générale **151**

List of Figures **155**

Liste des Tables **158**

Introduction Générale

Dans un système de plus en plus mondialisé et interconnecté, il apparaît de plus en plus nécessaire de comprendre comment se détermine le choix d'investissement dans un pays. Cette remarque, pas nouvelle au niveau des sciences économiques, a connu une attention particulière sous l'impulsion notamment de deux facteurs : la mondialisation des échanges et la compréhension du développement. En effet, la nécessité de trouver de nouveaux marchés pour produire, s'implanter et s'étendre constituent l'une des préoccupations principales de la science économique. Depuis les balbutiements de l'économie internationale avec la théorie des échanges et des avantages comparatifs à la *Ricardo* jusqu'aux développement récents des modèles d'économie géographique à la Helpman, Melitz, and Rubinstein (2008) ou Redding and Venables (2003) sur l'importance des frictions à l'échange sur la répartitions des échanges internationaux ; il apparaît important de comprendre quelles sont les forces qui agissent dans la détermination de la localisation des firmes.

De plus, la fonction d'investissement étant une fonction primordiale à la croissance (Romer (1990), Durlauf, Kourtellos, and Minkin (2001)), l'analyse de la différence d'attractivité des pays, apparaît importante pour comprendre les mécanismes sous-jacents de la répartition du capital au niveau mondial. Cette analyse est d'autant plus importante que la littérature met en exergue les gains nets issus de la mondialisation [1].

Cependant, force est de constater que mondialisation ne veut pas dire développement pour tous. La répartition des échanges internationaux reste inégalitaire, avec une dynamique à deux vitesses : un volume important d'échanges et de flux de capitaux au niveau des pays du Nord associé à une faiblesse avérée au niveau des pays considérés comme du "Sud" [2]. Une simple visualisation de la répartition des investissements directs (IDE) permet de rendre compte de cette répartition des investissements (cf. Fig 1). Bien que le commerce Sud-Sud soit au cœur de la nouvelle géographie du commerce international, boosté par l'émergence des

1. Une étude du phénomène est présentée dans *Handbook of International Economics* avec une analyse à la fois théorique et empirique sur les différents tenants et aboutissants de la répartition des échanges internationaux.

2. On exclut bien évidemment ici les pays émergents.

pays BRICS (Brésil, Russie, Inde, Chine, Afrique du Sud) [3], au niveau de l'investissement, la dynamique au niveau des pays classés PMA (Pays les moins avancés) reste encore à revoir. En effet, le stock d'investissements étrangers dans ces pays dépasse à peine 1% en 2017. Ce constat est d'autant plus alarmant si l'on compare avec le stock au niveau des pays développés de 64,5%. Plus important, si l'on regarde la structure des investissements, les régions en développement restent cantonnés à la production de bien à faibles valeurs ajoutées alors qu'une spécialisation forte en économie de la connaissance est faite au niveau des pays du Nord. Sans verser dans l'analyse du rattrapage économique, ce constat est primordial si l'on admet que le développement doit passer par l'industrialisation.

En outre, le besoin d'entrer dans ce qu'on appelle aujourd'hui les "chaînes de valeurs" reste une issue d'actualité certaine. En effet, avec les Sustainables Development Goals (SDG) [4], il semble clair au niveau de l'agenda des Nations Unies que l'intégration des pays aux différents marchés est une issue privilégiée pour l'atteinte d'un développement économique. Cependant, si l'effort doit être salué pour l'initiative des SDGs, le niveau d'intégration des PMA au niveau des chaînes de valeurs reste à déplorer. Seules 9% des valeurs ajoutées à l'export sont ainsi attribués aux PMA au niveau mondial selon les chiffres issus du United Nations Conference on Trade and Development (2018)).

C'est notamment avec cette double contrainte de mondialisation et de développement qu'il apparaît nécessaire de comprendre pourquoi certains pays/zones géographiques attirent les investisseurs et d'autres non.

Avec la diversification des accords économiques, on est en droit de se poser les questions suivantes : i) quels sont les freins à la montée en force de l'investissement extérieur dans les pays faiblement dotés, ii) les accords économiques permettent-ils (ou non) de sortir de cette "trappe à faibles investissements" ; iii) les autres formes de financements permettent-elles de réduire les freins à l'arrivée des investissements et enfin iv) comment d'autres formes de risque peuvent-elles influencer la santé générale d'une économie ?

Une des notions importantes que l'on va définir dans ce chapitre préliminaire est l'approche de la vulnérabilité des pays. Il apparaît, et ce n'est plus un débat au niveau de la littérature, que deux choses expliquent le niveau de développement des pays : les avantages de première nature [5] et les institutions. L'idée dans cette approche est de pouvoir mesurer

3. Le taux de croissance du commerce au niveau des BRICS est de 12% en moyenne sur la période 1995-2015.

4. Anciennement Millenium Development Goals (MDG), les objectifs du millénaire pour le développement fixent une série d'objectifs à atteindre pour un développement stable et pérenne au niveau mondial.

5. Il s'agit d'avantages liés à la géographie des pays (dotations factorielles, climats, frontières naturelles, etc.) que l'on pourrait associer à la théorie des dotations factorielles d'Hecksher et Ohlin. Cette notion est largement utilisée en économie géographique.

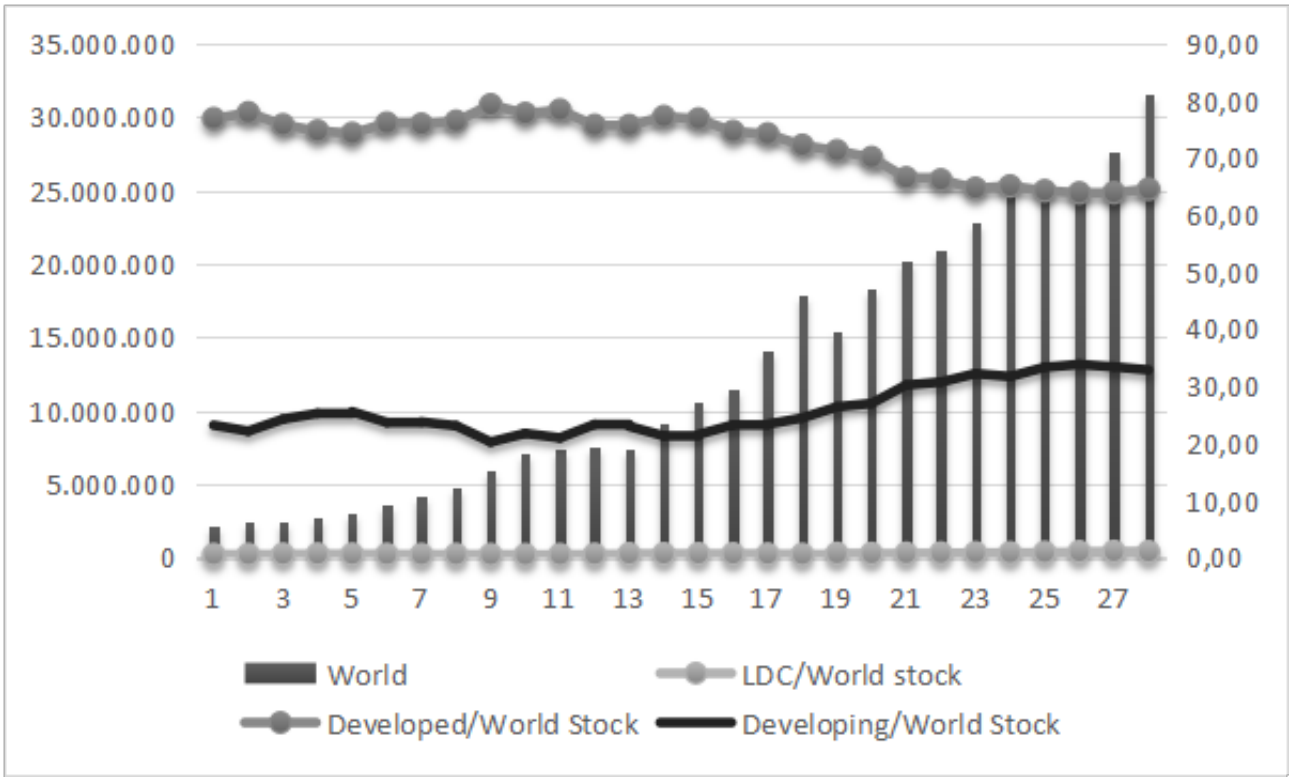


FIGURE 1 – Evolution du stock d'investissements
Source : UNCTAD, FDI/MNE database www.unctad.org/fdistatistics.

les deux sources structurelles possibles des blocages à l'essor des pays par l'investissement direct. Les avantages en première nature (ou plus spécifiquement les inégalités de première nature) étant définis comme des facteurs déterministes liés à la géographie des territoires, cette approche suggère ainsi une facilité (difficulté) naturelle de certains territoires à atteindre un certain niveau de développement. De cette vision, on justifie ainsi une approche du développement et de l'aide au développement comme une nécessité afin de compenser ces difficultés (qui semblent insurmontables) liées à la localisation d'un territoire donné.

L'approche par les institutions paraît un peu plus subtile, dans la mesure où les formes d'institutions mènent à l'explication et à l'évolution des territoires. L'approche de Acemoglu, Robinson, Aghion, and Hersant (2015) est un exemple intéressant de l'approche par les institutions justifiant, à travers le prisme des institutions, les échecs et réussites des Etats avec le degré d'inclusivité des institutions existantes. De cette seconde approche, l'on est en droit de se dire que l'adoption d'une institution inclusive est garante de la réussite d'une économie. Cependant, cette analyse sur la primauté des institutions ne permet pas d'expliquer les phénomènes sous-jacents du développement, surtout dans un monde de plus en plus complexe [6].

6. Rodrik et Sachs offrent dans *Finances & Development (2003)* un débat sur la primauté ou non des

Au vu de ces éléments, l'approche par la vulnérabilité économique des pays essaie d'expliquer les mécanismes liés aux avantages de première nature.

Notre approche dans cette thèse, qui est une analyse en plusieurs papiers, consiste à apporter un éclairage supplémentaire, à savoir, prendre en compte les facteurs/blocages déjà décelés au niveau de la littérature sous forme d'indices et de les appliquer à l'analyse des modèles de gravité [7] pour voir i) comment les mesures de la vulnérabilité impactent et sont impactées par toute forme d'intégration, d'aide et/ou de partenariat économique et ii) quels sont les effets escomptés au niveau de l'investissement.

Une question connexe est l'importance de facteurs conjoncturels qui peuvent influencer la dynamique de l'investissement. S'il est indéniable, à travers l'analyse de la résilience, avec des approches comme celles de Briguglio, Kisanga, and Secretariat (2004), qu'une esquisse peut se faire sur les principaux facteurs influençant le niveau d'investissements (Blonigen and Piger, 2014), il reste cependant un flou sur la relation entre investissements et incertitude, malgré l'apport important (théorique) de Dixit and Pindyck (1994). En effet, cette question est redevenue centrale au niveau de la littérature avec la dynamique actuelle des relations internationales et le développement récent de techniques économétriques permettant de prendre en compte l'incertitude. Nous nous situons dans la lignée des nouvelles recherches sur le lien entre les variables macroéconomiques et l'incertitude [8]. L'incertitude étant définie comme un composante imprévisible, plus large que le risque (qui peut être évalué), son évaluation apparaît délicate. Ainsi, la littérature propose plusieurs solutions possibles pour l'évaluation de l'incertitude. La définition de l'incertitude comme une variable de second moment permet de la lier à la variance d'une variable macroéconomique. Par conséquent, l'incertitude est souvent associée à la volatilité et on la relie souvent à l'évolution d'indicateurs de volatilité comme l'indicateur VIX (Bloom, 2009). Une alternative se trouve dans le développement récent de l'analyse de données textuelles, ou "text mining", avec comme point de départ le papier de Baker, Bloom, and Davis (2016). Les résultats étant assez proches, et les deux indicateurs étant censés capturer différentes formes d'incertitude, ces analyses, ainsi que celles de Bloom (2014) ou de Jurado, Ludvigson, and Ng (2015) mettent en évidence l'influence majeure de l'incertitude sur les variables macroéconomiques, suggérant en général un déclin des activités économiques face à un choc d'incertitude. Un résultat majeur est celui du comportement de l'investissement, confirmant l'hypothèse de "real option value" et un comportement de "wait-and-see". Ainsi les périodes d'incertitudes sont souvent associées à des périodes de

institutions.

7. Le choix du modèle de gravité comme cadre d'analyse est justifié dans la sous-section 0.2.1.

8. Dans l'analyse du niveau de la relation entre investissement et incertitude, on fait un glissement vers l'analyse de la santé économique globale, capturant les grands agrégats macroéconomiques des pays étudiés.

baisse notable du niveau d'investissement et de consommation dans les pays étudiés.

Une critique peut cependant être émise sur ces analyses de l'incertitude. La majorité des analyses faites se focalisent sur l'impact des chocs d'incertitudes sur le cas américain. La différence institutionnelle entre les pays, comme précédemment cité, peut conduire à revoir l'impact des chocs d'incertitudes appliqué à d'autres pays (Colombo (2013)). Une seconde critique découle de la première : si les analyses sur l'impact des chocs d'incertitudes se focalisent sur les possibles transmissions des chocs d'incertitudes sur les principaux partenaires des Etats-Unis, la transmission des chocs d'incertitude d'origine différente est rarement étudiée dans la littérature actuelle [9].

Nous décidons ainsi d'apporter notre contribution sur l'analyse de l'incertitude et d'utiliser les indicateurs d'incertitudes issus d'une analyse textuelle selon Baker, Bloom, and Davis (2016). L'émergence des pays en transition comme la Chine, combinée à une forte montée de l'incertitude des politiques économiques face aux différents événements conjoncturels de ces dernières années, nous amène à nous poser des questions sur les conséquences possibles d'une fluctuation de l'incertitude de la politique économique sur l'activité économique en général.

0.1 Quelques notions clés

Dans cette section, afin de cadrer notre analyse, nous procédons à une définition simple des différentes thématiques et termes ce que l'on entend étudier dans cette thèse.

0.1.1 IDE et classification

Selon l'OCDE, un IDE est défini comme un investissement transfrontalier, fait par une entité résidente dans une économie (pays hôte) dans un objectif d'obtenir des intérêts à long terme dans une entreprise résidant dans une autre économie [10]. Ces intérêts à long terme impliquent l'existence d'une relation de long terme entre l'investisseur direct et l'entreprise en question et un degré d'influence significatif de l'investisseur direct dans la conduite des affaires de l'entreprise. Un prise de participation d'au moins 10% du pouvoir de vote, représentant l'influence de l'investisseur, fait partie des critères de base utilisés [11].

En raison du caractère de long terme de la relation, un IDE est souvent relié à des coûts importants et irrécupérables. Cela implique que le choix d'investir à l'extérieur est une

9. La disponibilité des données est dans la majeure partie des cas une des raisons principales de ce focus sur le cas américain.

10. Définition qui est très proche du Balance of Payment Manuel 5 (BPM5) du Fond Monétaire International.

11. En comparaison, les investissements en portefeuille sont faits dans le but d'acquérir des actions pour un objectif de court terme, sans vouloir ni acquisition ni contrôle.

décision importante pour une firme, vu les risques liés à la nature même de l'investissement. Ceci peut s'illustrer par le fait que lorsqu'une firme met en place une filiale à l'extérieur, cette firme fait face à des risques d'expropriation du pays hôte ou, au moins, à des changements imprévisibles de règles et de régulations (Asiedu, Jin, and Nandwa (2009), Bandyopadhyay and Younas (2014) etc.).

Parlant de typologie et de classification des IDE, la littérature récente met en lumière différentes typologies. D'un côté, on a une approche classique où une firme peut décider soit de directement investir en construisant de nouvelles infrastructures en IDE de création ; soit d'acquérir une part au sein d'une entité existante par une opération qu'on appelle *"Merger and Acquisition"* ou Fusion acquisition. De l'autre, une firme peut décider de répliquer dans un autre pays ses propres activités, ce qui ici est appelé IDE horizontal ; soit décider de répartir sa chaîne de production sur différents sites en utilisant les avantages que les pays hôtes offrent (taxation, opportunité en matière de salaire....). Ce mode de production est vu comme une forme verticale des IDE.

Si la différenciation entre les différentes fins de l'investissement étranger ne semble pas poser pas de problèmes typologiques, il est cependant difficile de déterminer le comportement des investisseurs. Pour se faire, une autre approche permet d'analyser, à travers le désir des investisseurs, la décision d'investissement. Le paradigme Ownership Location and Internationalisation (OLI) de Dunning (2001) offre un cadre d'analyse compact. Ainsi, si l'objectif de la firme est de trouver des ressources pour produire, l'implantation des IDE (de création) est plutôt de "ressource seeking". Si par contre l'intention principale de l'investissement est de couvrir un nouveau marché, on peut dire que ce type d'investissement est "market seeking". Finalement, si l'objectif d'un investissement est de minimiser les coûts et de trouver des moyens plus efficients (en terme de main d'œuvre), l'investissement pour l'"efficiency" seeking émerge.

Plus concrètement, les larges coûts irréversibles liés aux IDE déterminent le privilège donné à l'apparition d'une forme d'IDE plutôt qu'une autre. Ainsi, si des coûts importants sont constatés pour entrer au niveau d'un marché, la solution de "tariff jumping" est privilégiée. Dans ce cadre, il est plus intéressant de s'implanter directement dans un pays pour bénéficier de la proximité du marché, au lieu d'importer. Il devient évident dans ce cas que le rapport à la distance et les coûts doivent privilégier l'apparition d'IDE horizontal. En effet, l'arbitrage entre Export et Investissement mais surtout des coûts fixes liés à l'export contre les coûts d'implantation dans un nouveau marché détermine la forme d'investissement (Baltagi, Egger, and Pfaffermayr (2007)). Empiriquement, ce rapport donne lieu à une influence positive de la distance (Egger and Pfaffermayr, 2004a).

En outre, la volonté d'une entreprise de réexporter les biens produits privilégie l'apparition

des IDE du type vertical. Cependant dans ce cadre, les firmes font face à des coûts de monitoring importants qui sont évidement à comparer avec les coûts de la réexportations. En somme, l'analyse stratégique de l'implantation des firmes multinationales laisse apparaître une politique mixte d'investissement dans les pays, mélangeant en même temps la production faite d'une manière verticale et horizontale en acquérant des entreprises dans des pays (fusion acquisition) ou en construisant une nouvelle filiale dans un autre pays (IDE de construction). La détermination de la forme d'investissement dépend surtout des coûts relatifs à la présence dans un nouveau marché. Les modèles de gravité que l'on va détailler dans la section 0.2.1 vont apporter un éclairage plus précis sur ces choix de localisation.

0.1.2 Vulnérabilité Economique

Si l'on prend la définition de ce que l'on entend par vulnérabilité, d'une manière simple, il s'agit selon Guillaumont (2009) du "risque que rencontre un pays de voir son développement entravé par des chocs externes et naturels auxquels il fait face". Cette définition implique cependant ce que l'on a déjà détaillé auparavant, à savoir en premier lieu l'acceptation que l'exposition d'un pays soit considérée comme handicap (relié à l'avantage de première nature) et en second lieu une nécessité d'identification et de mesure de ces handicaps.

En effet, l'idée d'accepter la vulnérabilité des pays comme handicaps à la croissance et au développement n'est pas une idée neutre de sens. Ainsi un pays est vulnérable parce qu'il est exposé, malgré lui, à des aléas structurels qui ne dépendent ni de sa volonté de se développer, ni des possibles faiblesses des institutions en place pour atteindre ces objectifs de développement. De cette idée découle l'approche de l'aide au développement. Puisque le sous développement n'est pas perçu comme un stade du développement mais comme une fatalité pour les pays, il a été nécessaire de mettre en place des politiques visant à sortir les pays de la "trappe à pauvreté". Ainsi, les pays vulnérables sont les pays particulièrement exposés à des chocs de l'extérieur du fait de leur positionnement géographique, de la structure de leur marché (déséconomies d'échelle, faible diversification de la production, etc.), du degré d'ouverture vers le commerce extérieur, etc. Ici, il y a un clivage sur ce que l'on intègre dans les causes de la vulnérabilité. En effet, si l'on recense tous les candidats potentiels justifiant la vulnérabilité des pays, il devient vite problématique de savoir quelles sont le réelles sources d'instabilité dans les pays. Cependant, les idées qui entourent les indicateurs de vulnérabilité englobe trois notions définies dans Guillaumont (2009), à savoir : la taille des chocs, l'exposition aux chocs et la résilience des pays face à ces chocs. Il est important de noter à ce point que l'une des principales préoccupations qui entoure la vulnérabilité est l'instabilité qu'elle fait peser sur l'activité économique des pays. Ici, la notion d'instabilité de la croissance prend tout son sens, dans la mesure où ces instabilités sont génératrices

d'incertitude pouvant nuire à la dynamique de l'investissement.

Afin d'intégrer ces différents volets, il est devenu nécessaire de s'intéresser à leur quantification. De cette idée sont nés les différents indicateurs de vulnérabilité. Comme le concept de vulnérabilité économique est une notion à multiple facettes, il serait prétentieux de se dire que la quantification de ce concept est parfaite. Si la littérature offre un panel assez riche de différentes mesures et de méthodologies pour la prise en compte de ces handicaps (notamment avec Briguglio, Kisanga, and Secretariat (2004), Angeon and Bates (2015) ou même Blancard and Hoarau (2016) etc.), une capacité de mesure simple de ce phénomène a souvent été privilégiée pour permettre un comparatif entre les pays, aboutissant notamment à la mesure actuelle de l'Indice de Vulnérabilité Economique.

Tout naturellement, l'indice de Vulnérabilité économique du Committee for Development Policy des Nations Unies (IVE-CDP) fût privilégié pour quantifier la vulnérabilité des pays. Cet indice essaye donc de prendre en compte les différents volets de la vulnérabilité cités auparavant en les regroupant en deux grands sous-indices : l'exposition aux chocs et la nature/magnitude des chocs. Le degré d'exposition aux chocs vise à prendre en compte notamment la structure du marché, le niveau de développement des moyens de production, la dépendance de la production à la production d'un seul bien, le degré d'isolement et la petitesse du marché [12]. La partie magnitude et nature des chocs vise quant à elle à identifier l'origine des différents chocs afin d'identifier la sensibilité des pays à ces différents chocs. Elle comprend ainsi l'occurrence de désastres naturelles, l'instabilité de la production et l'instabilité des exportations.

Si l'on est en droit de se poser des questions sur le caractère arbitraire de l'inclusion de certains indices dans la mesure de la vulnérabilité structurelle d'un pays [13], il est cependant à remarquer que l'utilisation de cet indice dans la catégorisation des pays ayant besoin d'une l'Aide Publique au développement rend son rôle primordiale et incontournable dans l'analyse des handicaps à la croissance [14]. En outre, malgré les possibles faiblesses de cet indice pour la prise en compte de cas particuliers comme le cas des Petits Economies Insulaires en développement (PEID) (Blancard and Hoarau, 2016), ou même la simplicité du système de pondération [15] ; force est de constater que cet indice reste une bonne base pour l'analyse de la vulnérabilité des pays.

En somme, c'est autour de cette notion d'entrave au développement et des risques liés à l'investissement dans les pays vulnérables que nos travaux vont se construire.

12. La version de 2011 de l'IVE intègre une partie environnementale en intégrant le risque climatique.
13. Briguglio, Kisanga, and Secretariat (2004) par exemple décide d'être parcimonieux dans le choix des indicateurs pour ne pas créer d'amalgame dans la définition de la vulnérabilité. Quant à Angeon and Bates (2015), ils suggèrent l'utilisation d'une autre mesure de la vulnérabilité.
14. l'autre indice pris en compte pour la catégorisation étant l'indice de développement humain (IDH).
15. Guillaumont (2009) suggère l'utilisation d'une agrégation basé sur un système semi-géométrique.

0.1.3 L'incertitude et l'activité économique

La notion de vulnérabilité vu auparavant suggère l'incertitude sur les perspectives de croissance des pays concernés. Il est donc primordial de faire un petit détour par la notion d'incertitude dans cette partie de l'analyse.

Il est bien connu que l'incertitude sur l'occurrence d'événements futurs a des répercussions sur les habitudes de consommations (au niveau micro) mais aussi sur la santé de l'économie en général (surtout au niveau de l'investissement). L'idée d'incertitude est une idée connue de tous, cependant sa définition ainsi que sa quantification ont toujours été problématiques. En effet, l'activité économique semble suivre des cycles avec plusieurs facteurs pouvant bouleverser ces cycles. Ces chocs ou événements ponctuels peuvent avoir de multiples conséquences (positives ou négatives). Des exemples que l'on pourrait citer sont la crise de 1929, les chocs pétroliers des années 1970, les attaques terroristes de 2001 et plus récemment la crise financière de 2010. Si ces événements semblent être exogènes, il apparaît important de les quantifier afin d'en mesurer les conséquences. C'est ce qu'a toujours fait l'économiste avec la notion de risque.

Si l'on sait maintenant quantifier d'une manière assez précise les différents composantes d'un risque macroéconomique (le risque de défaut par exemple), la quantification de l'incertitude a toujours fait débat au sein de la communauté économique. En effet, la part d'inconnu qu'intègre l'incertitude rend sa quantification difficile. Même si théoriquement les travaux de Dixit and Pindyck (1994) montrent qu'il est possible d'évaluer, de quantifier cette notion, les travaux empiriques ont mis du temps à prendre leur envols. C'est avec les crises financières de 2008 à 2010 que cette notion (l'incertitude) est devenue centrale dans le débat économique. En effet, la *Grande Dépression* de 2008 a fait resurgir au niveau du marché américain une grande montée de l'incertitude donnant ainsi un regain d'intérêt à sa quantification.

Ainsi, l'incertitude est souvent associée à la volatilité de la production. L'on approxime donc souvent l'incertitude par la volatilité du PIB. Une montée de l'incertitude correspond dans cette définition à un augmentation des variations au niveau de l'écart-type de la variable observée. D'autres mesures de l'incertitude viennent s'ajouter à cette notion de volatilité de la production. L'influence certaine des marchés financiers sur l'investissement et l'activité économique a conduit les chercheurs comme Bloom (2009) à privilégier comme proxy de la variable capturant l'incertitude les indices de volatilité de marché financier (le VIX aux Etats Unis). Arguant des différentes origines de l'incertitude, les chercheurs tels que Baker, Bloom, and Davis (2016) ou Jurado, Ludvigson, and Ng (2015) ont récemment démontré que plusieurs formes d'incertitudes peuvent être décelées et quantifiées. Ainsi, pour le cas spécifique de l'incertitude de la politique économique, Baker, Bloom, and Davis (2016) suggèrent l'uti-

lisation d'indices d'incertitude basés sur du "text mining" et l'analyse des journaux.

Si des débats existent encore sur la définition de l'incertitude, les effets des chocs d'incertitudes sont cependant perceptibles au niveau de la santé de l'économie. Un choc d'incertitude entraîne notamment une contraction de la demande en bien et services, une augmentation du chômage (les entreprises arrêtant d'embaucher pour faire face à ce choc) et surtout une contraction de l'investissement. La réaction des investisseurs correspond à ce que l'on appelle "wait and see" [16].

Des zones d'ombres subsistent cependant dans l'analyse de l'incertitude et des chocs liés à l'incertitude : i) comment se comporte une économie si l'on prend en compte les cycles économiques cités auparavant, ii) est-ce que les chocs d'incertitudes ont un effet de contagion transfrontalier. En effet, la majorité des études se concentre sur la santé générale de l'économie, sans distinction entre les phases de récessions et d'expansions. En outre, si la transmission des chocs d'incertitude n'est plus à démontrer pour le cas des États Unis vers ses pays partenaires, l'évidence est moindre sur les effets de contagions venant d'autres origines. C'est ce que nous essayons d'aborder dans la dernière partie de la thèse.

0.2 Choix de modélisation

Il apparaît nécessaire dans cette section de justifier nos choix de modélisations afin d'avoir un aperçu de ce qu'on attend dans les différents chapitres.

0.2.1 Les modèles de Gravité

Dans l'analyse des différents mécanismes permettant la détermination des flux internationaux, nous décidons de nous tourner vers un des modèles les plus robustes dans la littérature actuelle en économie internationale. La compréhension des relations bilatérales entre les pays et la nature gravitaire des flux bilatéraux (comme le commerce, les investissements directs et la migration) nous conduisent à privilégier ce type de modélisation. Au départ, largement critiqué par sa nature entièrement empirique, ce modèle a su montrer une incroyable robustesse en terme de résultats, en s'accommodant de beaucoup de questions restées sans réponses au sein de la littérature. La première version de ce modèle, appelée aussi version "naïve", vient d'une simple constatation de la relation entre la taille des économies (des économies semblables s'attirent) et la distance qui les sépare (relation inversement proportionnelle). Ainsi, en ne se focalisant que sur une relation simple, ces modèles de première génération n'ont aucun fondement économique.

16. que l'on traduit par "attentisme" en français

Les premières justifications théoriques de la relation gravitaire viennent avec les travaux d'Anderson and Van Wincoop (2001),Baier and Bergstrand (2009) qui justifient les modèles de gravité comme conséquences des théories néoclassiques de libre-échange, en supposant une fonction de production à la Armington. Ces modèles, étant à la base assez restrictifs (*Tinbergen, 1962*), offrent cependant une justification plus concrète et empirique du célèbre modèle d'économie géographique de Krugman (1979) en justifiant l'idée de concurrence monopolistique tendant à la spécialisation des pays/firmes dans la production des biens.

Les modèles postérieurs aux modèles dits de "gravité naïfs", avec l'arrivée de la notion de "résistance multilatérale", offrent un spectre plus important dans l'analyse gravitaire. En effet, Anderson and Van Wincoop (2001) ont montré, avec un modèle plus élaboré et des fondements microéconomiques, la dépendance des relations bilatérales aux relations multilatérales. Ces modèles de gravité dits "structurels" rendent les estimations de la relation gravitaire entre pays plus réalistes. Plus important, la notion de résistance multilatérale introduit les frictions liées aux échanges avec partenaires commerciaux. Ces frictions passent surtout par l'intégration de prix relatifs et le volume total des flux bilatéraux dans l'analyse de ces modèles. Ici, le commerce n'est plus une relation bilatérale, ne dépendant que des seuls partenaires, dans l'ajustement faces aux différentes politiques commerciales ; elle constitue aussi un ensemble prenant à la fois en compte toutes les relations existantes au niveau commercial et les frictions à l'échange. La non prise en compte de ces effets tend à une surestimation de l'intensité des relations commerciales entre les pays partenaires.

La prise en compte de l'hétérogénéité des firmes constitue une des dernières avancées significatives récente dans les modèles de gravité. Les modèles de gravité initiés par Eaton and Kortum (2002) permettent en effet de rendre compte du niveau de différence technologique et expliquent la différence de production et de spécialisation dans la production d'un bien. Ceci étant, cette analyse, avec celles de Helpman, Melitz, and Rubinstein (2008) (HMR -après) et de Chaney (2008), permettent d'expliquer la marge extensive (l'arrivée de nouveaux acteurs sur le marché) et intensive (une intensification des volumes de commerce sans forcément une extension en nombre des acteurs) des firmes dans l'analyse du commerce international. L'idée repose ici surtout sur des concepts d'économie géographique où le commerce permet non seulement une intensification des échanges mais aussi une diversification des acteurs.

Si les modèles précités auparavant, notamment le modèle HMR, s'intéressent exclusivement au commerce dans un cadre d'équilibre partiel, il est important de noter qu'une dérivation des modèle de gravité peut aussi rendre compte des effets du commerce sur gains et pertes à l'échange au niveau infra-national. Il s'agit ici d'une approche en équilibre général où l'on tend à analyser les résultats des relations commerciales sur la richesse et l'emploi (Anderson, Larch, and Yotov, 2018). L'analyse de Head and Mayer (2013) et de Anderson, Larch,

and Yotov (2018) apportent un fondement assez intéressant pour intégrer les différentes exigences techniques liées à la réalisation des modèles de gravité et à l'estimation des différents paramètres permettant de donner un sens aux estimations. Ainsi, il est possible, à travers la création et l'utilisation de flux à partir de modèles de gravité dits structurels, d'évaluer les conséquences d'une politique modifiant les coûts à l'échange et d'imaginer ex-ante les différents scénarios modifiant l'environnement du commerce international.

Par conséquent, ce cadre à la fois théorique et empirique, avec la facilité de fonder des relations gravitaires dans un cadre bilatéral, a conduit à se poser des questions sur la possibilité de trouver et de fonder d'autres cadres gravitaire avec d'autres flux bilatéraux, comme notamment les Investissements directs étrangers (IDE) [17].

D'une part, le lien étroit entre la détermination des flux de commerce et d'IDE semble suggérer une liaison de type gravitaire dans la détermination des flux d'IDE. D'autre part, ayant bénéficié directement des avancées au niveau de la modélisation gravitaire pour le commerce international, les modélisations économétriques au niveau de l'analyse des IDE jouissent, dès leurs premières applications, d'une assez grande stabilité en terme de résultats. En effet, bien que tardivement étudiée au niveau des modèles de gravité, on s'aperçoit depuis quelques années que la localisation des firmes multinationales suit les mêmes caractéristiques gravitaires que celles qui sont recensées au niveau du commerce international. Les travaux initiateurs de Brainard (1997), Bénassy-Quéré, Coupet, and Mayer (2007) et Head and Ries (2008) ont ainsi permis de mettre en évidence l'importance des variables gravitaires dans le choix de localisation des investissements, au niveau bilatéral. Plus précisément, les papiers de Head and Ries (2008) et de Brainard (1997) constituent une des premières approches théoriques de la nature gravitaire que peuvent suggérer les flux d'IDE. Ils justifient ainsi une relation gravitaire proche de celle trouvée au niveau du commerce international avec un focus sur les fusions-acquisitions, cités auparavant. Les travaux de Bénassy-Quéré, Coupet, and Mayer (2007) quant à eux se focalisent sur une justification de l'intensité des flux d'investissements par la différence institutionnelle entre les pays partenaires.

Ces premières modélisations ont conduit à l'élaboration de cadres plus formalisés de la modélisation en IDE. L'apport de Kleinert and Toubal (2010) est sans doute le plus fondamental dans la caractérisation de la nature gravitaire des IDE bilatéraux. Les auteurs développent trois modèles standards au niveau du commerce international : les modèles de concurrence monopolistique avec hétérogénéité des firmes comme dans Helpman, Melitz, and Yeaple (2004) et Melitz (2003) ; les modèles dits de proximité-concentration à la Redding and Venables (2003) qui prédisent une concentration des firmes dépendant des coûts fixes et

17. Il est à remarquer ici que l'on voit l'application des modèles de gravité dans différents champs de la science économique, notamment dans l'étude des flux migratoires.

de la distance entre les firmes ; et les modèles incluant différents stades de production à la Markusen and Venables (1999). Ceux-ci, à des variations près, aboutissent tous à la même conclusion : la relation gravitaire des flux d'IDE. Ils mettent en évidence les différents modes d'entrée des firmes à travers le temps, la distance et l'existence conjointe des deux formes d'IDE au niveau des économies. Blanchard, Gaigné, and Mathieu (2008), pour leur part, arrivent à la même conclusion en considérant un modèle théorique avec deux types de coûts irréversibles : des frais spécifiques à l'implantation des firmes et des frais spécifiques à la firme exportatrices. L'analyse des équations de profits des firmes aboutissent ainsi à l'apparition des différentes formes d'investissements, dépendant tous de la taille de la population et de coûts augmentant avec la distance.

D'autre part, malgré les différentes analyses empiriques se focalisant sur les IDE [18], on ne peut ignorer la nécessité évidente d'apporter une analyse sur les différentes formes d'IDE pour intégrer les différentes théories constituant la littérature fondamentale des IDE [19], rendant ainsi uniforme l'analyse théorique ainsi qu'empirique. Dans un second temps, l'analyse féconde de l'application de ces modèles semble souvent limitée au cadre des pays développés et en transition. Cela est souvent justifiable par la disponibilité et la fiabilité des données au niveau de ces pays, mais aussi par l'importance des flux au niveau de ces zones géographiques, à raison de 60% au niveau des pays avancés comparé à 1% pour les pays les moins avancés (PMA) (cf Fig 1).

0.2.2 La modélisation VAR

Dans la continuité de l'analyse, nous nous tournons vers l'analyse des phénomènes pouvant modifier la santé économique des pays. Pour ce faire, il apparaît que le modèle de gravité va être limité dans la mesure où il ne permet que d'analyser les flux bilatéraux. Le désir de capturer l'incertitude de politique économique et son influence sur les variables macroéconomiques des pays nous amène à nous tourner vers une autre type de modélisation : la modélisation de séries temporelles. Si l'évaluation des modèles de gravité se fait ex-post, l'analyse par les séries temporelles nous permettent de simuler comment les chocs d'incertitudes se propagent sur une horizon temporel défini. Les modèles de séries temporelles étant des modèles largement utilisés en macroéconomie, il apparaît logique de les appliquer dans notre cas.

Le modèle Vector Autoregressive (VAR) est la forme multivariée des modèles du type

18. Blonigen and Piger (2014) offre un large panel des différentes analyses et déterminants des IDE et permet d'avoir une vision globale et concrète des différentes analyses entreprises dans ce domaine.

19. Par littérature fondamentale, nous entendons ici, la théorie de localisation des firmes à la Dunning (2001), la théorie du cycle de vie à la Vernon (1992) ou même Grossman, Helpman, and Szeidl (2006).

Autoregressive (AR). Dans ces modèles, les variables dépendantes sont les valeurs actuelles des variables indépendantes, aboutissant à ce que l'on appelle un processus autoregressif. La possibilité d'implémentation de chocs pour simuler la réaction de l'économie est le principal avantage de ce type de modélisation. Ainsi, des fonctions de réponses sont généralement émises pour voir la réaction de l'économie face à différent type de chocs.

Cet outil efficace pour la simulation des variations des agrégats macroéconomique, directement via les datas, a souvent été critiqué par son manque de fondements théorique dans l'approche des différentes variables étudiés. Cependant, l'analyse par les VAR reste un bon enseignement sur les liens entre les différents agrégats.

Nous introduisons deux exigences dans notre analyse sur le modèle Vector Autoregression : i) nous voulons intégrer les chocs d'incertitudes dans le modèle et ii) nous voulons prendre en compte les variations de cycles économiques dans le modèle.

Cependant, nos exigences empiriques ne peuvent être satisfaites dans le cadre d'une modélisation VAR classique. On se tourne donc, dans le dernier papier, vers une modélisation de VAR à changements de régime. Le changement de régime permet de prendre en compte les réactions spécifiques des pays étudiés en différenciant les phases du cycle économique. L'identification du choc d'incertitude passe par l'initialisation d'un choc sur l'écart-type de notre mesure de l'incertitude de politique économique (EPU), issue des recherches de Baker, Bloom, and Davis (2016).

0.3 Les apports de la thèse

L'objet de la thèse est d'étudier le lien entre les différents volets de la vulnérabilité économique, définie selon les termes de Guillaumont, et le niveau d'Investissement Direct Etranger (IDE). Plus précisément, l'objectif des papiers présentés dans la thèse s'articule selon la logique suivante. Tout d'abord, il s'agit de déceler dans le cadre du premier papier les différentes formes de vulnérabilité qui affectent le niveau d'IDE. Dans un second temps, notre analyse se focalise sur le lien avec les traités d'investissements et étudie comment ces traités modifient la relation IDE - Vulnérabilité. En un troisième temps, notre focus concerne l'étroite relation qui existe entre l'aide au développement et les IDE, afin de préciser dans quelles mesures l'Aide et les IDE sont intimement liés. Finalement, nous abordons un spectre plus large en étudiant non plus seulement l'investissement mais aussi l'économie en général, avec un travail sur l'influence de l'incertitude de la politique économique sur les variables macroéconomiques.

Dans le premier chapitre, il s'agit de démontrer le lien étroit entre Vulnérabilité économique et IDE, mais aussi et surtout de montrer comment les modèles de gravité, qui sont

des outils importants de l'analyse des relations bilatérales entre les pays, s'insèrent très facilement dans l'analyse des déterminants des investissements étrangers. Pour ce faire, comme justification, nous nous sommes appuyés sur les apports théoriques de Head and Ries (2008) et de Kleinert and Toubal (2010). Sur le plan empirique, les travaux de Head and Mayer (2013) ainsi que d'Anderson and Van Wincoop (2001) et plus spécifiquement de Silva and Tenreyro (2006) sont pris en compte. Les différentes techniques que nous avons implémentées mettent en évidence l'impact négatif des différentes sources de vulnérabilités liées à l'isolement, la taille du marché et la structure du marché comme facteurs déterminants dans la localisation d'IDE au niveau des pays étudiés. Pour rendre notre analyse plus robuste, nous nous tournons vers les modèles qui prennent en compte une partie de la spécificité des données en économie internationale, notamment les modèles en "pseudo-poisson" avec prise en compte de présence de zéros. La conclusion reste la même, vu sous l'angle de notre analyse : certaines composantes de la vulnérabilité économique des pays affectent plus particulièrement le niveau d'IDE dans les pays.

Dans le second papier, nous entrons plus en détails dans l'analyse des différentes interactions que les traités d'investissements peuvent apporter pour sécuriser les IDE. Pour ce faire, l'essentiel du travail se focalise sur l'apport des traités d'investissements bilatéraux (et, par extension, de l'intégration économique) sur la localisation d'IDE. Plus spécifiquement, si l'effet des traités d'investissements sur le niveau d'investissement est certain et confirme ce que l'on trouve dans la littérature, l'interaction entre les variables de vulnérabilités et les traités d'investissements bilatéraux (TIB) permet de diversifier et de préciser l'analyse. Quand les vulnérabilités liées à la taille des marchés et à l'isolement sont réduites par la signature de TIB, l'indice de mesure de la concentration de la production s'accroît en présence de TIB ; cependant la production est plus stable. Dans une certaine mesure, la prise en compte du degré d'intégration économique offre une vision plus contrastée du lien entre IDE et Intégration économique. Les résultats de cette analyse montrent qu'une entrée plus franche au niveau de l'intégration entre les pays partenaires diminue les coûts à l'exportation et l'implantation sous forme d'IDE (origine de l'arbitrage en Export et IDE). Cet arbitrage disparaît au niveau de l'Union douanière pour l'utilisation de la catégorisation de Baier, Bergstrand, Egger, and McLaughlin (2008). Les résultats de l'étude de l'interaction avec les mesures de la vulnérabilité conduisent à un constat plus contrasté au niveau de l'intégration économique, avec les accords préférentiels tendant à accentuer la vulnérabilité des pays.

Le troisième chapitre de la thèse s'intéresse à un volet supplémentaire de l'analyse des déterminants des IDE : la relation étroite entre Aide au développement et IDE. La littérature actuelle n'est pas encore fixe sur l'intime relation/corrélation entre ces deux variables. Pour cadrer notre analyse, nous nous appuyons sur les travaux de Selaya and Sunesen (2012) et

de Bandyopadhyay and Younas (2014) (qui trouve son origine dans les travaux de Asiedu, Jin, and Nandwa (2009)), afin d'étudier cette relation en tant qu'instrument politique de promotion des IDE mais aussi d'envisager une détermination conjointe du niveau d'aide et d'IDE permettant de réduire les faiblesses liées à la vulnérabilité des pays. Le constat est intéressant : on ne trouve pas, au niveau bilatéral, un effet de substitution entre Aide et IDE ; cependant le niveau cumulé d'aide peut avoir un effet sur le niveau d'IDE. Dans le cadre de l'interaction avec les autres variables, l'aide proposée dans le cadre bilatéral semble insuffisante, voire inopérante, corroborant ainsi les résultats déjà obtenus au sein de la littérature.

Le quatrième papier se focalise sur une problématique plus large, qui fait l'objet d'une littérature grandissante et qui concerne les effets de l'incertitude liée à la politique économique d'un pays sur les variables réelles. Le cadre d'analyse concerne la montée de l'incertitude au niveau de la politique économique chinoise et ses effets sur ses pays partenaires (USA, Eurozone, Japon, Brésil, Russie et Corée du Sud). Nous nous tournons donc vers la modélisation d'un VAR avec transition de régime pour différencier la réaction des variables selon les cycles économiques. Nous obtenons que les économies développées (USA et Zone Euro) sont sensibles aux chocs d'incertitude avec une diminution du niveau de production industriel, de l'inflation, du niveau d'emploi et d'export en périodes de récession, ce qui n'est pas le cas en période d'expansion. Pour les pays en développement, ceux-ci sont sensibles aussi bien en périodes de récession que d'expansion, avec une sensibilité particulière du niveau d'inflation au Brésil ; et une réaction contre-intuitive du chômage en Corée. Ces résultats sont dans la droite ligne de Fernández-Villaverde, Guerrón-Quintana, Rubio-Ramírez, and Uribe (2011), qui soulignent une sensibilité particulière des pays émergents et en développement face aux chocs externes de toute nature. Plus important, les résultats de cette analyse sont en cohérence avec les papiers précédents de la thèse, concernant l'influence de la structure des économies sur la détermination des vulnérabilités face aux chocs externes.

Chapitre 1

Assessing the link between economic vulnerability and FDI

1.1 Introduction

Developing countries participation to the international market is an issue actively debated not only the international relationship but also actively argued in the economic literature. Indeed, when North-South and South-South trade and investment appear crucial to the development of an "international market of goods and services" ; trade analysts and practitioners are in urge to disentangle the relevant patterns of those flows in the South.

Two phenomenas seem to explain this urge. On the one hand, the necessity to find new markets for final goods and intermediary products is becoming vital to the internationalization process. On the other hand, the international agenda to attain the Sustainable Development Goals (SDGs) from developing cooperation via alternative finances and market integration (challenge 17) emphasize the crucial place of developing states to the future of international analysis.

Recent figures complement this framework : the new trend of international flows with a decline in investment (and trade) in the developed world contrasting with the stable growth of the same flows in the developing world. For instance, within major players (i.e. developed countries), between the period of 2000 to 2011, FDI gross level decreased (from 88% to 65% of overall flows). On the contrary, FDI level from the developing countries increased from a peanut to an interesting level (12% to 35%) during the same period (UNCTAD, 2013). The contribution of the South to the world economy amounts now at 16% of the overall flow of FDI and has doubled within only twenty years (Aleksynska and Havrylchyk, 2013).

The first explanation of this changing situation is from the FDI and trade booms in transitional economies driven by the BRICs (Brazil, Russia, India and China) group. Indeed, with a double digit growth rate for China and India, and an enormous market potential, these countries benefit from a large amount of capital inflow (outflow) and trade [1]. More importantly, as stated by Grauwe, Houssa, and Piccillo (2012) and Amighini and Sanfilippo (2014), flows seem to be redirected toward Africa, and extensively to underdeveloped world.

The second explanation comes from the literature of FDI locations. According to Dunning (1979) and his famously known OLI (Ownership, Location and Internalization) paradigm, FDI locations are determined by investors' behavior : whether their are market-seeking, resource-seeking or efficiency-seeking investors. Others, like Mathews (2006), showed how emerging multinationals use some advantages related to a learning process to acquire some place in the international trade or market and to choose their locations. More importantly, recent models in international economics, emphasize the important role of heterogeneity

1. With the recent slowdown in international investment from 2014, this topic is still accurate and important as, for developing countries, international investment is indispensable for sustainable industrial development(United Nations Conference on Trade and Development, 2018).

among firms are important in the selection of firms and the location of investment (Helpman, Melitz, and Rubinstein (2008), Helpman, Melitz, and Yeaple (2004)).

However, if the focus is on detailed information on the repartition of FDI among developing countries, something more interesting could be drawn : some countries attract FDI and others don't (see Figure 1.1 which shows how important is the bilateral investment flow between country partners). More specifically, the Sub Saharan region, the small island developing states and some parts of Latin America seem to be forgotten in this picture.The Figure 1.1 exposes the geographical repartition of FDI among the top 1000 in 2017 and offer a clear picture of this puzzle. How should this pattern be justified other than structural handicaps. Indeed, part of the mentioned region suffer from lack of infrastructure, problems of corruptions, political tensions and weaknesses that may hinder the willingness to invest. By taking into account these facts, authors like Asiedu, Jin, and Nandwa (2009) and Bénassy-Quéré, Coupet, and Mayer (2007) tried to explain the link between FDI locations and risk related to investment. This link is seen on the one hand related to expropriation risk (which is assumed reducing the level of investment) ; and on the other hand related to institutional determinants as done in Desbordes and Vicard (2009) who focus on quality of interstate relations to enforce bilateral investment treaties as determinants of FDI. Some authors focuses on other type of risk like Bandyopadhyay and Younas (2014) with terrorist related risk to explain FDI location. When Blonigen and Piger (2014) offers an overall understanding on the determinants of FDI, not much is known on the other factors related to investment risks deter FDI level.

Trying to link the related literature of FDI and inherent risk, my proposition in this paper is to account a fact that seems to have been forgotten in the current literature [2] : the link between inherent (structural) risk i.e. vulnerability and FDI level. More specifically, I attempt to capture external factors (other than policy driven) that may influence FDI locations. This approach differs to various authors as I suggest an alternative view of capture deterring determinants of FDI via the estimation of a gravity model.

According to some authors, an economic risk has two main components : a vulnerability part and a resilience part (Guillaumont and Chauvet (2001), Briguglio, Kisanga, and Secretariat (2004)). More specifically, a risk is composed with a inherent vulnerability ; and a policy induced part which build the resilience. Therefore, my approach in this paper is simple : by definition, a FDI is a long lasting investment made in a foreign economy ; thus, it should be related to a long lasting phenomenon, the inherent risk related i.e. structural vulnerability [3].

2. Although the fact that the UNDP have done an analysis on FDI in the Least Developed Countries (LDC), that organization focuses only on a descriptive approach. An econometric analysis to infer and assess this link is clearly missing.

3. Remark that I interchange the use of inherent, macroeconomic or structural vulnerability.

I, therefore, suspect that the vulnerability of a country deters the level of FDI. I also hypothesize that FDI level in a vulnerable country depend on the various sources of vulnerability. To assess the source of vulnerability in a country, I follow Guillaumont, McGillivray, and Wagner (2015). In their paper, they divided the EVI components and find that shocks influence more the volume of aid than exposure to external shock. For my case, I am suspecting that exposure to shocks is a driven factor of FDI level as it captures market structure and market size which, in my case, are assumed as fundamental information to firms establishment.

Taking into account the nature of bilateral FDI i.e. as bilateral flow, I decide, as a baseline modeling scheme, to use gravity modeling here adapted to FDI case following Bénassy-Quéré, Coupet, and Mayer (2007), Donaubauer, Glas, Meyer, and Nunnenkamp (2018) among others.

The paper is organized as the following : section 1.2 is related to our data and modeling process ; section 1.4 gives our main results and alternative estimations and section 1.5 concludes.

1.2 Definitions and Gravity Framework

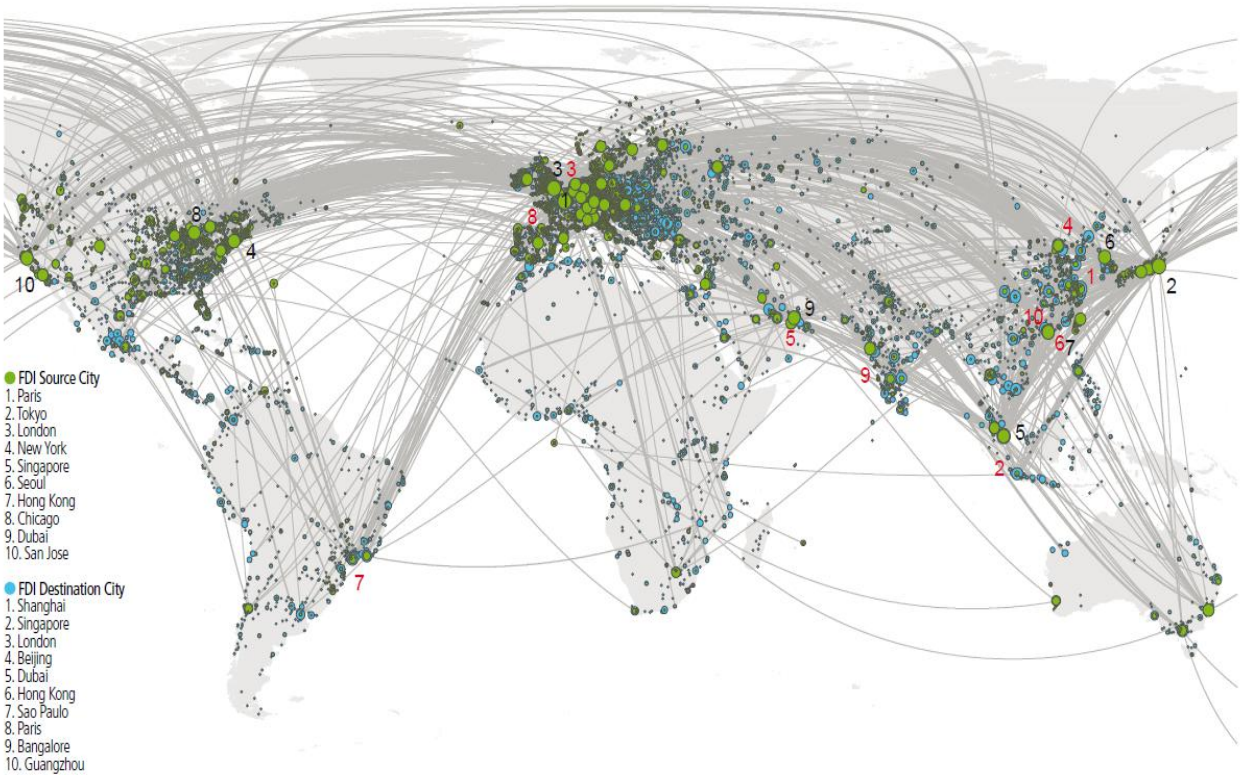
The concept of vulnerability is multidimensional and need to be defined. Due to this nature and the complexity of FDI (vertical or horizontal), this section is dedicated to offer an introductory insight to the rest of the analysis.

1.2.1 Definition of Country's economic vulnerability

To begin with, I have to define the idea of vulnerability to have an idea of how it is combined to FDI analysis. Vulnerability, in the sense of Guillaumont, is the risk for a country to be hit by exogenous shocks (such as natural disasters) or external (as deteriorating terms of trade). It differs from resilience, which is defined as the capability of a country to address itself from a shock (i.e. depending on the existing policy) [4]. Structural vulnerability, as it is defined, is determined by exogenous variables which do not depend on the current policy of a country. When a large literature exist on the concept of structural vulnerability, retaining the main determinants of the topic is a large debate in the literature (some proposition of how to measure the concept could be found in Angeon and Bates (2015), Guillaumont (2009), Briguglio, Kisanga, and Secretariat (2004) or Blancard and Hoarau (2016) among others). However, a consensus had to be addressed, as the necessity to justify and measure

4. could be taken into account as influencing the concept of resilience are the expropriation risk, terrorism, monetary policy and others.

FIGURE 1.1 – Top 1000 destination and source cities of FDI



Source : Wall (2017)

this concept has expanded (Guillaumont, 2009). Necessity driven by the desire to understand and quantify burdens to economic development.

Consequently, accepted conception of economic vulnerability of a country at the structural level has to measure : how countries are exposed to shocks ; and when countries are affected the magnitude of these shocks. Every measure of vulnerability is based mainly around that two concepts and generally based on indexes that take into account two main sub indexes : an exposure index and a shock index.

I focus my analysis on the CDP-EVI from the FERDI database as a retrospective database is available freely [5]. This database has three main advantages. First, it takes into account multiple aspects of vulnerability's source [6]. Second, the retrospective nature of the database offers a justification to the use of a large time frame and a panel data analysis. Finally, the simplicity of the index construction, which is based on an arithmetic average of every subindex, led to an extensive use of the CDP-EVI index compared to alternative measures of the concept [7].

Specifically, Exposure to shocks is composed by an index on the size of the country (population to proxy the smallness of a territory), a remoteness index, structural index (instead of agriculture and forestry activities, merchandise concentration in export). The 2011 version of the index added an index that captures the environment of a country (the population share living in low elevated coastal zone).

The shock sub-index combines natural shocks measurement and measurement of trade shocks. The measure of trade shock is evaluated by analyzing the instability of exports of goods and services. The number of victims of natural disaster leading to loss of shelter and the instability of agricultural production are used as variables for the construction of the natural shock index.

All the index and sub indexes are constructed through a min max process or an inverse of the min max depending on the case [8]. In order to have a synthetic index, sub indexes are weighted following their relative effect on country's economic wealth [9].

5. The database used in this paper is based on Cariolle and Goujon (2013). An updated version of the database is also available in Feindouno and Goujon (2016).

6. As comparison, Briguglio, Kisanga, and Secretariat (2004) offers another index of economic vulnerability with limited components.

7. A semi-geometric weight is also used in Guillaumont (2009) which seems more appropriated for the aggregation method. However, the purpose of this analysis is also to seek further the multiple dimensions, the choice of the weight should not have impact on the final result.

8. Further details can be seen in Guillaumont (2009)

9. Apart from an arithmetic or a semi-geometric weight, endogeneous weights could also be used, as in Blancard and Hoarau (2016).

Exposure to external shock and FDI

The idea behind the exposure to shocks defining a vulnerability is quite straightforward. Indeed, from the literature, unclear events or uncertainty around events occurrence are deterring investment decisions (often resulting to postpone an investment decision (precautionary saving)). From the fundamental work of Dixit and Pindyck (1994) to the recent resurgence of this literature from Baker, Bloom, and Davis (2016), drivers of investment seem to be heavily affected by the exposure of investment to major economic shocks. More interestingly, as stated in Donaubauer, Glas, Meyer, and Nunnenkamp (2018), little is known on how infrastructure instabilities are affecting the level of investment. This comes from the difficulty to find an overall measure of the concept [10]. These authors overcome this difficulty by the construction of an synthetic index of infrastructure. The same remark could be done to the exposure of a countries.

The choice to use the CDP-EVI index could be helpful to explain the relationship with investment. Indeed, by construction, exposure to external shocks could be defined as an index taking into account which is considered as weaknesses of a country : the market size, the market structure and the geographical situation of population. First, the market size (captured here by the population index) is known as an important determinant of FDI, when the principal motives comes from a market seeking behavior. Indeed, for the seek of "tariff jumping" as in Egger and Pfaffermayr (2004a), the market size vulnerability. Instead, the direction of the relationship become ambiguous when the main motives of the firm is to reexport to another country. Clearly, reexporting lessen the need of important population.

Besides, the same analysis could be done with the remoteness subindex. Distance from the international market is an important driver of trade as trade costs are increasing with the distance (Helpman, Melitz, and Yeaple (2004), Redding and Venables (2004). An isolated country is therefore expected to have more difficulties to access to investment as the investment costs increase with the isolation.

Second, countries specialization captured in the market structure index (agriculture and forestry activities, concentration of merchandise in export) could be beneficial to the investment depending on the dominant effect. As explained in Markusen and Venables (1999), relationship among domestic firms and foreign firms could have two effects : a competition effect and a linkage effect (therefore a catalyst to industrialization). The two facets of market structure stated here, could have differentiate effect. On the one hand, an underdeveloped market structure, characterized by an important agriculture and forestry concentration, may be interesting for industries seeking resource endowment (not necessarily for an efficiency

10. I refer here to the measure of the infrastructure in Donaubauer, Meyer, and Nunnenkamp (2016).

seeking purpose). Instead, an important merchandise exportation is a signal to a somehow developed market. Furthermore, a developed market may be interesting for an efficiency seeking (presence of a interesting human capital) and beneficial for a linkage effect. On the other hand, a developed market is also a signal of an important competition with domestic firms. Consequently, knowing the market structure is crucial to foreign investment localization as it reduces information costs and monitoring costs. When highly concentrated market could be beneficial to investment (if specializations are in high value added products), diversification of exported goods is crucial investment when multinationals purpose are to reexport to other markets (Amighini and Sanfilippo (2014), Gamberoni (2007)).

Finally, population situated in the coastal zone may be subject to climate change. Consequently, the uncertainty of outcome from foreign plants is expected to deter the FDI level.

Magnitude of Shocks and FDI

Apart from being exposed to events, another specificity that could burden investment is related to the occurrence and magnitude of events that could hit an economy. Categorized within the idea of Shocks, two important questions should be addressed. First, what nature is the shock and how economies are affected by this shock. By studying the nature of the shock, one can figure out the channel of propagation of the shock and address at what extent economic activities are affected.

When it is quite clear that vulnerabilities due to natural events are crucial to determine the level of investment, important shocks deterring human capabilities to produce (as the homeless due to natural disaster) is clearly a deterrent to foreign investment.

Second, the relationship between instability of agriculture and investment is highly dependent to the nature of the shock. When instabilities in the primary sector is due to distortion on the international market, it may be interesting to serve the local market directly. Indeed, this situation exacerbates the advantages to produce locally rather than exporting. However, when distortions to primary sectors is due to occurrence of natural events, willingness to invest in one market could be burdened by country's situation (this case is especially true for Small Island Developing States (Blancard and Hoarau, 2016).

Finally, export instabilities could be a deterrent signal for FDI when the purpose is to serve other markets by re-exportation. As manifestation of good and services difficulties to export, instabilities of exports could lead to a rise in export costs. This situation is detrimental to FDI when export-platform purpose is the main driver of foreign investment.

Following these definitions, the multiple nature of the variable measured in the EVI makes the analysis of the relation to the FDI level difficult.

My take in this paper, is to expose and highlight such factors are important in determi-

TABLE 1.1 – EVI and FDI : Expected Relationships

Variables	Expected relationship to FDI
Exposure	**Overall Negative relationship**
Population Subindex	Ambiguous sign (depending on FDI purpose)
Remoteness	Expected negative sign
Share of agriculture and forestry	Ambiguous (depending on the FDI purpose)
Export concentration	Ambiguous (depending on the FDI purpose)
Low elevaled coastal zone	Expected to be negative
Shock	**Overall negative relationship**
Natural disaster	Negative expected sign reducing human capabilities to produce
Agriculture instabilities	Ambiguous sign (depending on the origin of the instabilities)
Goods and services export instabilities	Ambiguous sign

ning the level of investment, thus explaining one of the black boxes around the channel of investment locations.

The impact of the different part of country's vulnerability to FDI level was seen inconclusive due to the complex nature of FDI and the multiple dimension of vulnerability affecting country. More interestingly, even smaller is known when considering how could vulnerability impact on the bilateral level of FDI. When Blonigen and Piger (2014) establish robust covariates to include in a bilateral analysis of FDI, the multiple dimensions in the vulnerability analysis seek a more specific investigation.

1.2.2 Modeling scheme : A gravity model for FDI

The gravity model for trade, a workhorse model is based on the Newtownian logic i.e. trade is related to the size and the distance between economies. Initiated by Tinbergen (1962), it is base on a physical logic with variables like GDP or Distance justifying trade volume between nations. Latter, criticize as theoretical, often called the " intellectual orphan" of international trade (Anderson, 2011), its relatively simple assumption and intuitive interpretation made this kind of model very popular among researchers. Theoretical foundations came with Anderson (1979) who uses Armington's hypothesis to show the fact that, on a equilibrium status, all goods are traded and all countries trade. Thus, the richer the country the more it trades. Bergstrand (1989),Deardoff (1998)an Krugman added to this theoretical foundation the factor endowments theory and monopolistic competition. Ottoviano and Melitz (2008) and Helpman et *al* (2008) contributed to that theory by adding up the firm heterogeneity. Head and Mayer (2013) in the *Handbook of International Economics* gives a broad range of how gravity models fits well with advances in the international economics analysis. The actual form of a gravity model for trade can be expressed as :

$$x_{ijt}(m_{ijt}) = \frac{Y_{it}Y_{jt}}{D_{ij}}. \tag{1.1}$$

Here, it is clearly showed that bilateral trade depend on bilateral distance D_{ij} and bilateral country size expressed by Y_{it} and Y_{jt}.

Although gravity models are workhorse in international trade analysis, they have been extended to other bilateral flows as FDI (Kleinert and Toubal, 2010) and migration (Lewer and Van den Berg, 2008).

Here, it appears important to recall some simple justifications to the bilateral analysis of FDI via two framework models : the models presented in Blanchard, Gaigné, and Mathieu (2008) and Kleinert and Toubal (2010).

Blanchard, Gaigné, and Mathieu (2008), for example, consider one product produced by one firm within two economies h and$f$ with different population and technology level. The country's production is subject to two types of "sunk cost" : a specific implementation costs G per unit of production and specific costs to the company F. Consumers are immobile and markets are segmented, three modes of production are available to the firm ; either : a single production site and therefore export to the other country (resulting in transport costs and export barriers) ; an horizontal output (two plants) ; or a implant abroad with re-export to the country h to serve both markets. Within this framework, these authors yields to firm's profit functions which will depend on population size, trade costs and the level of technology. The tradeoff between Export and FDI comes at the comparison of the profit functions [11].

Kleinert and Toubal (2010) on the other hand, assume three different framework to derive gravity like relations to FDI. In every model describe in their paper, the decision to invest is taken when the expected profit is higher than the fix costs associated to implant a new company and the difference between the two countries level of sales. Moreover, fix costs is expressed as function of country's position to introduce a fundamental factor in gravity modeling : costs associated with the distance between countries. By assuming an iceberg transportation costs, these authors prove that the level of FDI depend on production capabilities, absorption capacity and distance related costs. These authors also prove the existence mutual existence of Merger and Acquisition with Greenfield investment.

As one can see, although the approach differs, theoretically speaking, FDI flows have a gravitational characteristics [12].

Despite the fact that gravity modeling are largely used within a bilateral FDI determinant framework, the concept of vulnerability affecting FDI seems to miss in the literature. However, as proven by these theoretical analysis, frictions to investments are important determinant of FDI location. Among these frictions to investments, country specific variables has been considered as enhancing costs to investment. Therefore, Asiedu, Jin, and Nandwa (2009),

11. This issue is more detailed in the Blanchard, Gaigné, and Mathieu (2008)

12. Another derivation of gravity models with a focus on Merger and Acquisitions could be found in Head and Ries (2008) and lead to the same conclusions on the gravitational characteristics of FDI

Bénassy-Quéré, Coupet, and Mayer (2007) or Desbordes and Vicard (2009) proposed various measure of country specific terms as institutional distance or quality of interstate relationship or expropriation risks. Others like Helpman, Melitz, and Yeaple (2004) use fix effects to capture the country specific unobserved components. The difficulty to capture all observable elements as stated in Donaubauer, Glas, Meyer, and Nunnenkamp (2018) led to the extensive use of fix effect. Our attempt here is to use the unified concept of vulnerability to measure at what extent the level of FDI is affected.

1.3 Data and Modelling

1.3.1 Data source

Our interest variable is the level of bilateral FDI from UNTCAD in millions of dollars. I follow Bénassy-Quéré, Coupet, and Mayer (2007), who focus on FDI stock as it reflect country's stock of capital [13]. As FDI stock is less volatile than FDI flow, using stocks rather than flows ensures more stable regression results. Blonigen and Piger (2014) also opted for this variable to capture long term determinants of FDI between nations.

Using proxy variables to capture inherent risk, viewed in term of vulnerability, I am using the retrospective economic vulnerability index published by the FERDI [14]. This index, as mentioned, is disaggregated in the next following sections to account for its various components.

As our analysis is based on gravity models, I've decided to use control variables common to gravity models as colony (ex-colonies trade more with colonizers than the others) and distance D_{ij} (geodesic distance used by Mayer and Zignano (2011) in their gravity models). Monadic control variables are also added in the sense that GDP of importing and exporting countries are crucial variables in gravity model estimation. Therefore, the variables GDP_o for origin country and GDP_d for domestic country is added to control the size. Alternatively, I will add up per capita income in the sense of $GDPpercapita$ and population.

Our focus is on 125 vulnerable country [15] with 34 partner country [16] between 2003-2011. I've chosen this period from the data availability on the bilateral FDI statistics from UNCTAD database [17].

13. Remark that I do not deflate FDI level to avoid the so-called bronze medal mistake
14. http ://www.ferdi.fr/fr.
15. examples are Botswana, Côte d'Ivoire, Cameroon, Congo Rep, Democratic Rep. of Congo, Ethiopia, Gabon, Ghana, Guinea, Gambie, Kenya, Madagascar, Mozambique, Malawi, Niger, Nigeria, Soudan, Sénégal, Togo, Tanzanie, Uganda, South Africa, Zambie, Zimbabwe, etc.
16. France, Italy, Australia, Japan, USA, UK and China among others.
17. https://unctad.org/en/Pages/DIAE/FDI%20Statistics/FDI-Statistics-Bilateral.aspx

1.3.2 Estimated model

As regards to the various theoretical specifications mentioned earlier, an analysis on the determinant of FDI following gravity models follow various estimation process.

Staying within an OLS, I have to log-linearize our gravitational variables by taking his log ,following this specification :

$$lnfdi = C + \beta_1 lnGRAVDATA + \beta_2 RISK + \epsilon ijt \tag{1.2}$$

with $lnFDI$, the natural logarithm of FDI stock. $GRAVDATA$ takes into account gravitational variables from a classic estimation in a gravity model as

$$GRAVDATA = (GDP\_i, GDP\_j, Distance_{ij}, exp(colony_{ij}, commonlanguage, etc.)) \tag{1.3}$$

and

$$RISK = exp(EVI_i) \tag{1.4}$$

As mentioned, the inherent risk is measured by the index of structural risk EVI.

This specification is our baseline estimation for a more theory grounded gravity model. However, some problems arise in gravity model specification. The log-linearized specification should include fix effect and account for heterogeneity among country-pair and time and for possible endogeneity issues. Therefore, I add in the following specification time fix-effect and country-pair fix effect [18](Baier and Bergstrand, 2007). Then, I use robust standard errors as in the Hubber-White estimators to account for heteroskedasticity.

More importantly, the log-linearization process is dropping out all zeros in our dependent. This problem, well known by gravity models practitioners, is a major problem since not all zero in the flows or stocks could be considered as a missing observation. Therefore dropping out these flows may lead to an important loss of information. When proposition from authors like Bénassy-Quéré, Coupet, and Mayer (2007) is to add a small unit before the logarithmic transformation, this approach with less theoretical foundation could be controversial. The alternative comes from Silva and Tenreyro (2006) who account for the multiplicative form by estimating our gravity variable with a pseudo poisson maximum likelihood estimator (PPML estimator) to add up zeros our dependent variable [19].

18. The use of fix-effect would control for relative price with the cost of dropping out some of our control variables. The use of fix-effect is also made to account for possible omission bias.

19. One possible limitation of the use of the PPML estimator is mentioned in Burger, Oort, and Linders (2009) with the excess of zeros. Therefore, the authors use Zero Inflated models to account for possible overdispersion in the data. However, as stated in Silva and Tenreyro (2006), the PPML estimator is quite robust to account for uses related to proportion of zeros.

The PPML version, which is considered robust in presence of zero flows, is used following this equation :

$$FDI = exp(\beta_1 lnGRAVDATA + \beta_2 RISK) + \epsilon_{ijt} \tag{1.5}$$

Variables within our model don't change ; only the dependent variable changes (FDI level for the PPML, LogFDI for the OLS version and the OLS with fix effect).

1.3.3 Multilateral resistance and consequences

Before stepping up to present our results, one interesting findings should be addressed in gravity estimations : the case of multilateral resistance. One major step up in the trade analysis is from Anderson and van Wincoop (2003) (AvW henceforth) proving the necessity to take into account for all interactions of countries in terms of supply and expenditure, when performing a structural gravity modeling.

Formally, this structural form of the gravity model is expressed as :

$$X_{ni} = \frac{Y_i}{\Omega_i} \frac{X_n}{\Phi_n} \phi_{ni} \tag{1.6}$$

where Ω_i and Φ_n represent the so-called "multilateral resistance terms" which could translated into a weighted average of trade barriers (or market access) [20]. Therefore, $\frac{Y_i}{\Omega_i}$ takes into account the relative market access and $\frac{X_n}{\Phi_n}$ relative production capabilities. This means, when taking into account bilateral flows, one have to take into account the influence of the rest of the flows (estimated through the two multilateral resistance terms). This new resolution gives an answer to the McCallum border puzzle and a more accurate estimates to the gravity modeling scheme.

This new feature is taken account through different methods and specifications. However, empirically, fix effects specifications [21] are largely used to take into account these unobserved feature in the bilateral relation between countries [22].

In order to properly account for the multilateral resistance terms, I estimate the following PPML model by controlling fix effects (country-pair fix effect). All the results are summarized in the upcoming Table 1.4.1, Table 1.4.2 and Table 1.4.4.

20. the theory grounded AvW multilateral resistance terms is sligthly different, however the interpretation is much alike the idea related here

21. Another way to take into account multilateral resistance modeling refer to Baier and Bergstrand (2009) (BB henceforth) with the construction of remoteness index ; or Head and Ries (2008) who construct a two step estimation.

22. For the suspicion of collinearity between the constructed remoteness index in BB for a structural gravity model and the EVI remoteness subindex, I decide to try stick on fix effect estimations.

1.4 Results

1.4.1 Risky environment and FDI level

The OLS versions, PPML and fix effect estimations offer the GDP elasticities between 0.7 to 1.8, in line with our theory predicted value. However, the variable GDP_o which focused on the GDP of exporter country is far lower than the expected elasticity. The correction from the use the PPML estimator offers more interesting results.

The distance ($ldist$) is negative. This sign is as predicted and expected. As the gravity modeling suggests, costs related to investment or trade increase with home-host country natural and economic distance. The other gravity control variable have the correct sign. Interestingly the colonial relationship is surprisingly large.

Focusing now on our interested variable, the economic vulnerability index, shows some robustness. Through our different modeling, the EVI shows a negative but insignificant sign. Changes in the EVI index, if I stick to these results, do not change significantly the level of Foreign Direct Investment. By taking into account the multilateral resistance terms, i.e. the relative influence between countries, one can isolate the real impact of this diminution, as the OLS modeling tends to sure-valuate coefficients. Again, Our interest variable is not significant with a country-pair fix effect. Thus, I reiterated the same process to the PPML procedure which brings out the same results.However, this inconclusive result could be mask by the process of construction of the EVI. In fact, as the EVI is a synthetic measure of the vulnerability, the agregration method could influence the final result and mask the influence of the different sources of vulnerabilities. Consequently I decided to disaggregate the index into its first subcomponents and follow on the a full disaggregation of the index.

1.4.2 Subindexes

Previous results show a slight insight of the negative effects of economic vulnerabilities on FDI levels. However, it doesn't appear clearly with this analysis what kind of vulnerability drives these results :

- is that the economic exposure to shocks

- or the magnitude of external shocks

By splitting our vulnerability index, one can begin to identify the main source of vulnerability that affects the level of FDI. Following Guillaumont et *al* (2015), I decide to replace the EVI index by it's own sub index : exposure to shocks and magnitude of shocks.

Our new gravity model is expressed as below :

TABLE 1.2 – FDI and Agregated level of Economic Vulnerability

VARIABLES	OLS Log of FDI	OLS with Fix effects Log of FDI	PPML with fix effects Level of FDI stock
lnGDP_o	0.232***	1.851***	0.548**
	(0.0771)	(0.302)	(0.214)
lnGDP_d	0.643***	0.547***	0.600***
	(0.0556)	(0.144)	(0.0952)
EVI	-0.00932	0.000433	0.00735
	(0.0106)	(0.0126)	(0.0211)
ldistw	-0.236		
	(0.152)		
common official language	0.0138		
	(0.338)		
colony	2.765***		
	(0.337)		
Constant	-16.15***		
	(3.087)		
Country fix effect	No	No	No
Time fix effect	Yes	Yes	Yes
Country-pair fix effect	No	Yes	Yes
Country- time fix effect	No	No	No
Observations	8,872	8,707	10,544
R-squared	0.201	0.927	
Number of dyad			1,523

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

TABLE 1.3 – FDI, Exposure and Magnitude of Shocks

VARIABLES	OLS Log of FDI Stock	OLS with fix effect Log of FDI Stock	PPML with fix effect Level of FDI stock
lnGDP_o	0.241***	1.858***	0.572***
	(0.0769)	(0.302)	(0.213)
lnGDP_d	0.770***	0.541***	0.608***
	(0.0619)	(0.144)	(0.0912)
EXPOSURE	0.0357***	-0.0300	-0.0854***
	(0.0103)	(0.0255)	(0.0190)
SHOCK	-0.0205***	0.00281	0.0137*
	(0.00607)	(0.00654)	(0.00818)
ldistw	-0.483***		
	(0.168)		
comlang_off	-0.0243		
	(0.335)		
colony	2.741***		
	(0.336)		
Constant	-18.08***		
	(3.085)		
Country fix effect	No	No	No
Time fix effect	Yes	Yes	Yes
Country-pair fix effect	No	Yes	Yes
Country- time fix effect	No	No	No
Observations	8,872	8,707	10,544
R-squared	0.212	0.927	
Number of dyad			1,523

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

$$lnfdi = C + \beta_1 lnGRAVDATA + \beta_2 RISK + \epsilon ijt \tag{1.7}$$

with this time as structural risk components our two subindex

$$RISK = (EXPO; SHOCK) \tag{1.8}$$

The PPML formulation is here :

$$FDI = exp(\beta_1 lnGRAVDATA + \beta_2 EXPO + \beta_3 SHOCK) + \epsilon_{ijt} \tag{1.9}$$

Contrarily to the previous analysis, exposure to shocks matters the most in investment

decisions. Three more modeling is performed to check for robustness.

My fix-effect estimation shows an insignificant effect of the exposure index. On the contrary, the shock index falls positive but insignificant too. To correct the possible problems occuring with the use of the OLS estimator and account for zeros I perform, as already done before, the PPML estimation procedure, following Silva and Tenreyro (2006).

Consequently, my PPML estimation confirmed my previous result, but this time, the $SHOCK$ index falls significant and counters the effect of the exposure index. This effect is unexpected and hard to explain.

A small conclusion can be drawn in our EVI analysis. Generally, vulnerabilities are important factors to investment locations and decisions. Exposure to external economic shocks do really matter. This results are in line with Gnangnon (2018) who finds a negative relationship between FDI and exposure of countries.

Consequently, I disaggregate this exposure index which has 5 subindexes (population, localization, and environment, economic structures and remoteness) to show clearly how important sources of vulnerability matter in our FDI analysis.

1.4.3 Exposure index disagregation

The latter section have highlighted the significant role that exposure to external economic shocks have in investment locations. That drives us a more accurate analysis : how these exposure variables (i.e. subindexes) influence investment decisions. Evidently, I have to make changes in our gravity modeling. I replace the exposure subindex to its own components. At this stage of the analysis, I decide not to take into account our shock index. Our estimated model should follow the below equation :

$$lnfdi = C + \beta_1 lnGRAVDATA + \beta_2 EXPO + \epsilon ijt \tag{1.10}$$

where

$$EXPO = (POP; AGRISHARE; XCON; REMOT; LECZ) \tag{1.11}$$

and the PPML version is expressed by :

$$FDI = exp(\beta_1 lnGRAVDATA + \beta_2 EXPO) + \epsilon_{ijt} \tag{1.12}$$

with POP sub index of the number of population, $AGRISHARE$ sub index which expressed the share of agriculture part in the economy, $XCON$ expresses export concentration, $REMOT$ for remoteness and $LECZ$ captures the fact that a country or a region is near a coastal zone.

By subdividing the exposure sub-components to shocks, I find more detailed result and a tendency that I already observed in the EVI analysis literature. The economic size sub index, captured by the population exposure in the EVI, appears significant and has a negative effect on investment locations, following the OLS process of estimation.

Correcting heteroskedasticity and taking into account zero flows within our dependent variable, i.e. the PPML procedure, three subindexes appear significant and show interesting insight : market structure sub indexes and economic size subindex (Table 1.4.3).

The remoteness index is significant, throughout our different estimations. It shows again a difficulty to access to the market. The more isolate the country, the less investment it attracts. The additional control of market size, i.e. population, turns out to be consistent too. This result gives us insight on how FDI level is affected negatively by vulnerability resulting to market size and location.

Surprisingly, patterns of merchandise export do not seem to affect the level of FDI (the sign turns out to be insignificant but negative). This pattern is confirmed by the Share of Agriculture, Forestry and Fisheries index, which captures how important is the primary sector for an economy. The negative sign of this index is indicating the crucial role of market structure in bilateral FDI. More interestingly, FDI level is impeded by an increase the dependence to primary sector. My insights on the level of development of the market seems justified. As already stated in the previous section 1.2, underdeveloped market structure impedes FDI attraction. These results evidently corroborate the findings of Bénassy-Quéré, Coupet, and Mayer (2007) and Donaubauer, Meyer, and Nunnenkamp (2016) on the significant role of these variables, when those authors give a special focus on the role of institutions in determining the market structure. Understanding the structure of export however would be interesting to conclude on the analysis.

Finally, the coastal zone sub-index has an insignificant effect on investment decisions. Even though insignificant, this variable appear to be more inclined to affect more Small Island Developing State (as stated in the section 1.2).

Therefore, Investment decisions, as expected, are following market imperatives : the size and the market structure (here especially the share of Agriculture). As our result, investments in vulnerable markets are still following the same patterns as normal market. More specifically, revealed handicaps from market structures are impeding the growth of bilateral FDI.

A conclusion can be drawn, adding up more detailed thinking and analysis. Exposure to external shocks is crucial in investment locations. Investors are especially interested in market structure and size which is led by a "market seeking" behavior .

TABLE 1.4 – FDI and Exposure to shocks

VARIABLES	OLS lfdi	OLS fix effect lfdi	PPML fix effect Level of FDI stock
lnGDP_o	0.263***	1.812***	0.618***
	(0.0770)	(0.306)	(0.208)
lnGDP_d	0.801***	0.462***	0.454***
	(0.0897)	(0.146)	(0.112)
POP	0.0112	-0.0287	-0.0612***
	(0.00683)	(0.0336)	(0.0206)
REMOT	0.0219***	-0.0237**	-0.0230***
	(0.00501)	(0.0108)	(0.00711)
XCON	-0.00727**	0.00528	-0.000564
	(0.00343)	(0.00430)	(0.00404)
SHARE_AGRI	-0.00449	-0.00430	-0.0399***
	(0.00613)	(0.0115)	(0.0123)
LECZ	0.00491	-0.0455**	0.207
	(0.00372)	(0.0202)	(0.342)
ldistw	-0.878***		
	(0.213)		
common official language	-0.170		
	(0.332)		
colony	2.885***		
	(0.330)		
Constant	-16.73***		
	(3.561)		
Country fix effect	No	No	No
Time fix effect	Yes	Yes	Yes
Country-pair fix effect	No	Yes	Yes
Country- time fix effect	No	No	No
Observations	8,908	8,743	10,601
R-squared	0.224	0.927	
Number of dyad			1,527

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

1.4.4 FDI and sub indexes

To strengthen our analysis, I investigated in depth the EVI index components by adding in our last analysis all the shock sub indexes. As before, different estimation techniques are performed to check for robustness and to compare from previous insight. Table 1.4.4 details the results.

The previous results are confirmed when adding up new indexes in our analysis. Our preliminary conclusion is not rejected, that gives us the opportunity to say that market structure indexes are robust.

A new element upsurges when working with all the EVI sub indexes. The "disaster" index, which captures the number of homeless person due to natural disaster, appears significant in investment decisions. One may think of the urge to reinvest after a natural disaster but this assumption should be verified. Looking deeper to its influence, it seems clearly small compared to other variables.

Moreover, agriculture instability and exports instability appears non significant. Following the previous assumption, export instability is not expected to impact FDI negatively when the purpose of FDI is not to reexport. In addition, the insignificant sign of agriculture instability is quite interesting. The only justification that could be argued is the distortion from agricultural production is not affecting the level of FDI. As pointed out in Chakraborty and Nunnenkamp (2008), output from agricultural sector do not granger cause the boom of FDI.

Our results seem justified and are not in contradiction to previous analysis on the determinants of FDI.

1.4.5 Alternative controls

One could be worried about out gravity costs proxies and another control variables would affect our estimations. The literature gives different controls which could be performed to seek the robustness of the results.

First, as alternative to the GDP measure, population and GDP per capita are introduced as alternative measure to income and market size. The Table 1.6 presents the results from these estimations.

Generally, even though I change the gravity classical controls, the changes in the results are minimal and encourages us in the robustness of the model.

Besides, an additional variable to this measure of GDP is the income dissimilarity, proposed by Cheong, Kwak, and Tang (2015). Concretely, the dissimilarity is constructed by $|\frac{y_{it} - y_{jt}}{y_{it} + y_{jt}}|$, which is bounded from -1 to +1. The idea is similar to the GDP controls as

Table 1.5 – FDI and EVI subcomponents

VARIABLES	OLS Log of FDI	OLS with fix effect Log of FDI	PPML with fix effect Level of FDI stock
lnGDP_o	0.262***	1.822***	0.600***
	(0.0773)	(0.306)	(0.209)
lnGDP_d	0.758***	0.465***	0.543***
	(0.0938)	(0.152)	(0.0995)
POP	0.00728	-0.0296	-0.0669***
	(0.00719)	(0.0336)	(0.0207)
REMOT	0.0237***	-0.0240**	-0.0224***
	(0.00517)	(0.0108)	(0.00632)
XCON	-0.00723*	0.00553	0.000366
	(0.00400)	(0.00430)	(0.00382)
SHARE_AGRI	-0.00221	-0.00588	-0.0356***
	(0.00610)	(0.0114)	(0.0120)
LECZ	0.00456	-0.0457**	0.182
	(0.00373)	(0.0204)	(0.293)
DISASTER	-0.00605*	0.00296	0.00557**
	(0.00329)	(0.00359)	(0.00272)
X_INSTA	-0.000378	0.00173	0.00399
	(0.00444)	(0.00643)	(0.00703)
AGRI_INSTA	-0.00293	-0.000716	0.00439
	(0.00377)	(0.00369)	(0.00466)
ldistw	-0.855***		
	(0.215)		
common official language	-0.155		
	(0.332)		
colony	2.860***		
	(0.328)		
Constant	-15.50***		
	(3.674)		
Country fix effect	No	No	No
Time fix effect	Yes	Yes	Yes
Country-pair fix effect	No	Yes	Yes
Country- time fix effect	No	No	No
Observations	8,871	8,706	10,543
R-squared	0.225	0.927	
Number of dyad			1,523

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

country with the level of development between countries.

The previous results are maintained. Confirming the results in Blanchard, Gaigné, and Mathieu (2008) ; population size, GDP per capita and trade costs proxies are robust determinants of FDI. However, as the proxy of the population reenters in the vulnerability measure, the measure of population, to control the size of a country turns out to be insignificant.

By adding up a dissimilarity of income from Cheong, Kwak, and Tang (2015) (Table 1.7), it appears interesting to highlight how important market similarities as significant covariates of bilateral FDI. However, as pointed in Cheong, Kwak, and Tang (2015), one could not interpret directly the coefficient from this variable as elasticities. As they explain "...statistical significance indicate that size and income dissimilarities between two countries have unambiguously[...]impacts on their bilateral trade flows".

More importantly, all the previous results are maintained with our various specifications of controls. As I focus especially on PPML with fix effects' results (which correct all the possible problems occurring with gravity estimations), my estimations is stable throughout my various specifications. Interestingly, the index of disaster, which in previous estimation tend to be significant but small in size, turns out to be insignificant when I control for countries income dissimilarities, population and GDP per capita.

1.5 Conclusion

In this paper, I studied the probable link between an inherent risk to exogenous economic shock (measured by the vulnerability) with the level of FDI. I chose to estimate, as my principal interest is to analyze determinants of FDI, a gravity model adapted to our case. To assess countries' vulnerability, I chose the vulnerability index from the CDP and disaggregated into its own subindexes.

As suspected, the riskier the economy , the thinner the FDI level. Interestingly, this first result is not revolutionary as it doesn't give an explanation about how can the source of vulnerabilities affect the level of FDI. I address this issue by disaggregating the retrospective EVI index. On the first step, I've desegregated the EVI into his first two sub-component which shows that exposure to external shock can drive the FDI location : the more exposed the country, the riskier the economic environment and the less FDI is attracted. On the second stage, I've disaggregated all the EVI components. These estimations give us more accurate results : index capturing market structures and the size of the economy are crucial to the FDI level ; when export concentration and location to coastal zone seem not playing a major role. Surprisingly, affection on human capital due to disaster sometimes impact positively the level of FDI (in a slight manner) and the other determinants of magnitude of shocks seems

Table 1.6 – Alternative gravity controls

VARIABLES	OLS Log of FDI	OLS fix effect Log of FDI	PPML fix effect Level of FDI stock
lpop_o	0.0554	-4.238**	-0.580
	(0.0798)	(2.105)	(1.301)
lpop_d	0.659***	3.165**	3.042***
	(0.145)	(1.452)	(1.115)
lgdpcap_o	2.120***	1.971***	0.679***
	(0.138)	(0.321)	(0.237)
lgdpcap_d	0.880***	0.603***	0.584***
	(0.108)	(0.165)	(0.104)
POP	0.000346	0.120	0.0651
	(0.0110)	(0.0812)	(0.0618)
REMOT	0.0298***	-0.0169	-0.0201***
	(0.00524)	(0.0108)	(0.00703)
XCON	-0.00945**	0.00515	-0.00244
	(0.00382)	(0.00437)	(0.00385)
SHARE_AGRI	0.00164	-0.00563	-0.0296**
	(0.00628)	(0.0117)	(0.0127)
LECZ	0.00655*	-0.0376	0.210
	(0.00354)	(0.0232)	(0.309)
DISASTER	-0.00305	0.00315	0.00464**
	(0.00336)	(0.00350)	(0.00232)
X_INSTA	-0.00104	0.000569	0.00738
	(0.00397)	(0.00661)	(0.00667)
AGRI_INSTA	0.00195	-0.00157	0.00455
	(0.00374)	(0.00372)	(0.00443)
ldistw	-1.293***		
	(0.217)		
comlang_off	-0.0666		
	(0.330)		
colony	2.776***		
	(0.331)		
Constant	-17.86***		
	(2.318)		
Country fix effect	No	No	No
Time fix effect	Yes	Yes	Yes
Country-pair fix effect	No	Yes	Yes
Country- time fix effect	No	No	No
Observations	8,744	8,579	10,363
R-squared	0.327	0.928	
Number of dyad			1,504

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1.7 – Alternative controls (2)

VARIABLES	OLS Log of FDI	OLS fix effect Log of FDI	PPML fix effect Level of FDI stock
lnGDP_o	0.132*	2.328***	0.252
	(0.0790)	(0.374)	(0.257)
lnGDP_d	1.376***	0.0961	0.892***
	(0.110)	(0.202)	(0.183)
gdpcap_dis	4.254***	-2.654***	1.371**
	(0.370)	(0.872)	(0.693)
POP	0.0499***	-0.0557	-0.0519**
	(0.00825)	(0.0346)	(0.0214)
REMOT	0.0341***	-0.0286***	-0.0173***
	(0.00535)	(0.0108)	(0.00668)
XCON	-0.00575	0.00374	0.00141
	(0.00387)	(0.00441)	(0.00370)
SHARE_AGRI	-0.00265	-0.0136	-0.0267**
	(0.00628)	(0.0115)	(0.0114)
LECZ	0.00906**	-0.0481**	0.0388
	(0.00378)	(0.0197)	(0.167)
DISASTER	-0.0172***	0.00338	0.00433
	(0.00332)	(0.00354)	(0.00264)
X_INSTA	0.0105**	0.00175	0.00192
	(0.00415)	(0.00655)	(0.00692)
AGRI_INSTA	-0.00176	-0.00179	0.00329
	(0.00385)	(0.00372)	(0.00443)
ldistw	-1.138***		
	(0.212)		
comlang_off	-0.173		
	(0.330)		
colony	2.831***		
	(0.319)		
Constant	-29.80***		
	(3.972)		
Country fix effect	No	No	No
Time fix effect	Yes	Yes	Yes
Country-pair fix effect	No	Yes	Yes
Country- time fix effect	No	No	No
Observations	8,744	8,579	10,363
R-squared	0.287	0.928	
Number of dyad			1,504

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

to play a minor role to the bilateral investment level.

When it is interesting to characterize the interplay of host countries' various measure of vulnerability with bilateral investment level, the various dimensions captured in these indexes warn us to take into account these results carefully.

1.A Data sources

TABLE 1.8 – Data sources.

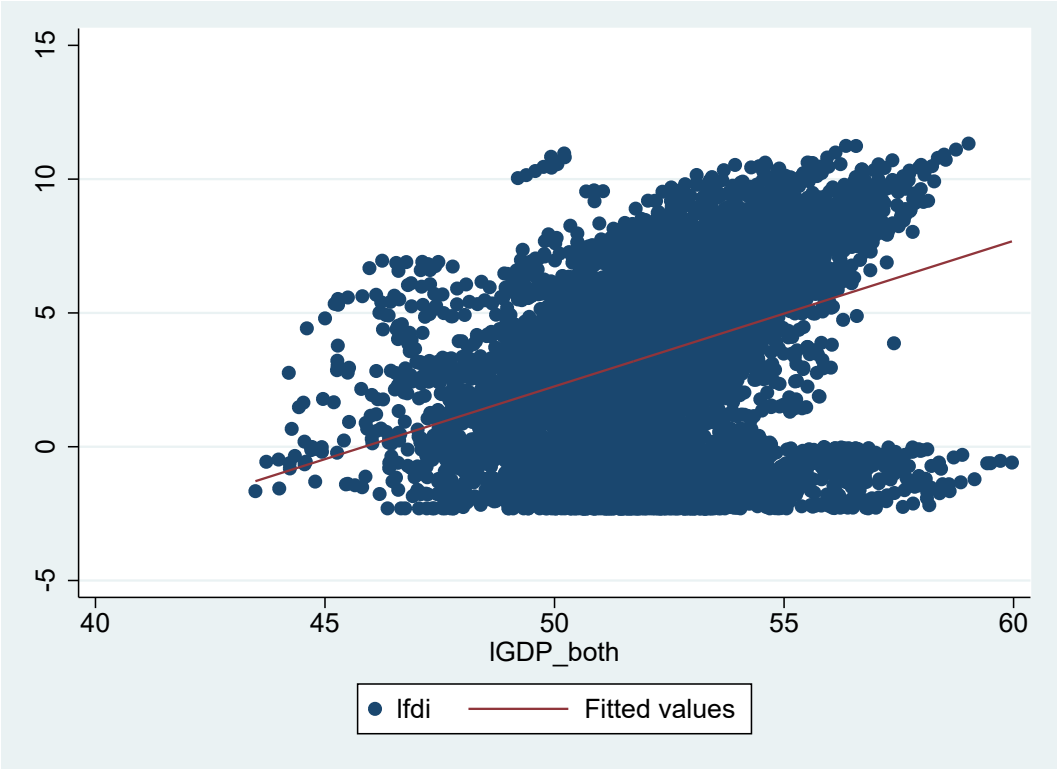
Variable	Description	Source
Interest variables		
FDI_ijt	Stock of FDI in millions of dollar	UNCTAD website
Monadic gravity controls		
GDP_o	GDP of origin country	WDI
GDP_d	GDP of destination country	WDI
GDP_o per cap	GDP per capita of origin country	WDI
GDP_d per cap	GDP per capita of destination country	WDI
Pop_o	Population of origin country	WDI
Pop_d	Population from destination country	WDI
GDP dis	GDP dissimilarity	Cheong, Kwak, and Tang (2015)
Dyadic gravity controls		
Distance_ij	Weighted bilateral distance between countries	CEPII
Colony	Colonial relatioship	CEPII
Common language	Common official language between partner country	CEPII
Country Specific vulnerability variables		
EVI	Economic Vulnerability Index	FERDI
Pop	Vulnerability index related to population	FERDI
Remoteness	Remoteness Subindex	FERDI
XCON	Export concentration	FERDI
Agrishare	Agriculture and Forestry share	FERDI
LECZ	Population in Low elevated coastal zone	FERDI
Disaster	Homeless due to natural disaster	FERDI
Xinsta	Merchandise Export instability	FERDI
Agri insta	Agriculture Instability	FERDI

TABLE 1.9 – Correlation Matrix

Variables	Level of FDI stock	POP	REMOT	XCON	SHARE_AGRI	LECZ	DISASTER	X_INSTA	AGRI_INSTA
Level of FDI stock	1.000								
POP	-0.135	1.000							
REMOT	-0.007	0.220	1.000						
XCON	-0.130	0.246	-0.044	1.000					
SHARE_AGRI	-0.103	-0.151	0.146	0.105	1.000				
LECZ	-0.017	0.367	-0.073	0.018	-0.136	1.000			
DISASTER	-0.029	-0.109	0.396	-0.199	0.324	-0.130	1.000		
X_INSTA	-0.040	0.423	-0.062	0.071	-0.097	0.216	-0.165	1.000	
AGRI_INSTA	-0.114	0.130	-0.054	0.549	0.343	0.119	0.005	0.124	1.000

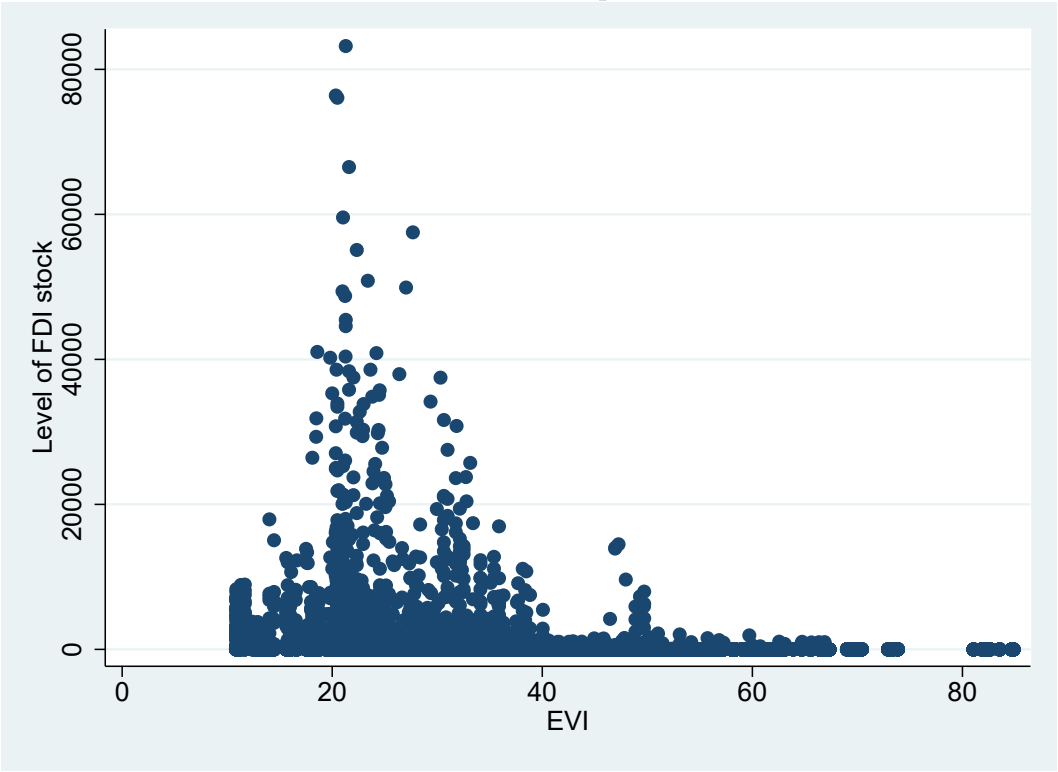
1.B Basic relationships

FIGURE 1.2 – Relationship FDI and GDP



Note : lnGDP_both is generated as a simple product of lnGDP_d and LnGDP_o

FIGURE 1.3 – Relationship FDI and EVI



1.C List of countries

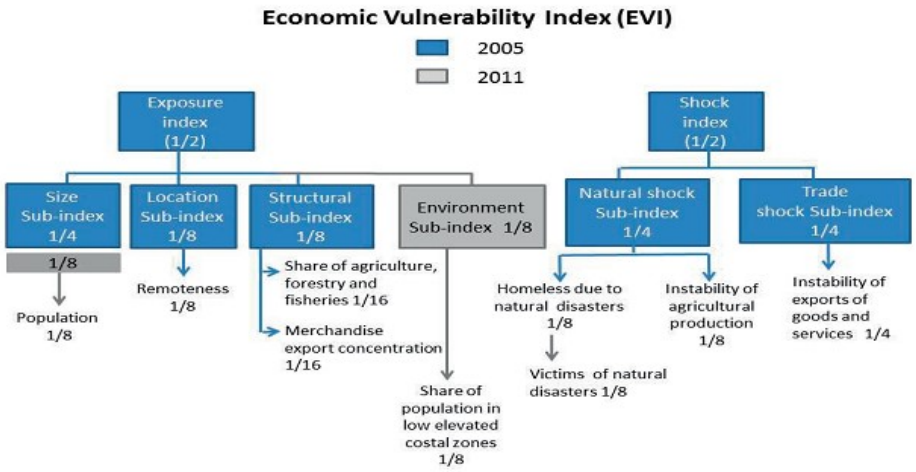
Table 1.10 – List of countries

Partner Country	**Reporting Country**
Australia	Afghanistan, Ecuador, Maldives, Tonga
Austria	Angola, Egypt, Mexico, Trinidad and Tobago
Belgium	United Arab Emirates, Eritrea, Mali, Tunisia
Canada	Argentina, Ethiopia, Mongolia, Turkey
Suisse	Antigua and Barbuda, Fiji, Mozambique, Tuvalu
Chile	Burundi, Gabon, Mauritania, Tanzania. United Republic of
Czech Republic	Benin, Ghana, Mauritius, Uganda
Germany	Burkina Faso, Guinea, Malawi, Uruguay
Danemark	Bangladesh, Gambia, Malaysia, St. Vincent and the Grenadines
Espagne	Bahrain, Guinea-Bissau, Namibia, Viet Nam
Estonia	Bahamas, Equatorial Guinea, Niger, Vanuatu
Finland	Belize, Grenada, Nigeria, Samoa
France	Bolivia, Guatemala, Nicaragua, Yemen
United Kingdom	Brazil, Guyana, Pakistan, South Africa
Greece	Barbados, Honduras, Panama, Zambia
Hungary	Brunei Darussalam, Haiti, Philippines, Zimbabwe
Ireland	Bhutan, Indonesia, Papua New Guine, Cambodia (Kampuchea)
Iceland	Botswana, India, Paraguay, Kiribati
Israel	Central African Republic, Iran.Islamic Republic of, Qatar, Nepal
Italy	Chile, Iraq, Rwanda, Oman
Japan	China, Israel, Saudi Arabia, Solomon Islands
Korean Republic	Cote d'Ivoire, Jamaica, Sudan, Venezuela
Luxembourg	Cameroon, Jordan, Senegal, Peru
Mexico	Congo. the Democratic Republic of the, Kenya, Singapore
Netherland	Congo, St. Kitts and Nevis, Sierra Leone
Norway	Colombia, Korea. Republic of (South Korea), El Salvador
New Zealand	Comoros, Lao People's Democratic Republic, Sao Tome and Principe
Poland	Cape Verde, Lebanon, Suriname
Portugal	Costa Rica, Liberia, Swaziland
Slovaquie	Cuba, Libya, Seychelles
Slovenie	Djibouti, St. Lucia, Syrian Arab Republic
Sweden	Dominica, SriLanka,Chad
Turkey	Dominican Republic, Morocco,Togo,
United States	Algeria,Madagascar,Thailand

1.D EVI components

FIGURE 1.4 – EVI components 2005- 2011 comparison

Figure : Composition of the Economic Vulnerability Index (EVI), 2005-2011 versions compared



Source : Cariolle, Goujon 2013

Chapitre 2

FDI, Economic vulnerability and Economic Integration : a gravitational approach

2.1 Introduction

"FDI remained by far the largest external source of financing for the world's developing economies, accounting for almost half of the $1.4tn in external financial flows to developing economies. But that overall figure was down from more than $2tn in 2010 and well below the level needed to achieve the poverty reduction..." [1]

This quotation from the financial times highlights how important FDI are to countries and how difficult to attract them in the presence of assumed high level of risk. Indeed, Foreign direct investments (FDI henceforth), by definition, are investments made in a country by another one, in order to acquire a long lasting interest. Due to its nature, engaging into FDI assumes large sunk costs, more than traditional investment. This debate reaches another level when taking into account that investments are made in countries with high level of risk. Thus, security has been a central discussion point in investment decisions, especially in transnational investment. In fact, authors like Bandyopadhyay and Younas (2014), Dixit and Pindyck (1994) and Asiedu, Jin, and Nandwa (2009) (among others) pointed out the effect of any sort of risk affecting investment in general and FDI in particular. More importantly, with various risk leading to under-investment, studies showed mutual interest of host countries and investors to secure investments through the use of agreements, in which host governments show their willingness to reduce the source of risk, and ensure investors to have a return for investment (Dixon and Haslam, 2016).

Therefore, concomitantly to the proliferation of FDI in high-risk regions, the number of International Investment Agreements (IIA henceforth) increases from almost zero in the 80's to 3304 in 2016, with a dominance of Bilateral Investment Treaties [2] (BIT henceforth)(Figure 2.1).

However, as the number of BIT explodes between countries, there is a little consensus on the empirical effect of BIT (Sauvant and Sachs, 2009). Tobin and Busch (2010) (among others) for example, find a non positive effect of having BITs. Conversely, Neumayer and Spess (2005) (among others) find a positive effect of BIT among the beneficiaries. Recently, Falvey and Foster-McGregor (2017) try to explain this heterogeneity among results by focusing on policy and institutional distance between host and investor countries.

In addition, in a context of globalization, interactions are noted between BIT and economic integration (Dixon and Haslam (2016) and Bergstrand and Egger (2013)). As economic

1. https://www.ft.com/content/3ab8d4e6-4b09-11e7-919a-1e14ce4af89b
2. In fact, Investment treaties can be divided into three major forms : bilateral investment treaties (BIT), International Investment agreements (IIA) and other investment treaties. I focus on the first form of investment agreements i.e bilateral investment treaties, given the minor place of the other forms in the international framework.

integration may have direct and indirect impact on FDI level, depending on the nature of FDI, the effect of international agreements may be investment enhancing (Medvedev (2006)) or diverting (substitution between FDI and Export, see Kerner (2009), Tobin and Busch (2010)), with a possible decreasing marginal impact of BIT.

Nevertheless, when it is acknowledged that BIT, through dispute settlement process that it provides, is certainly beneficial in reducing expropriation risks (Allee and Peinhardt, 2010) ; little is known on to what extend BIT could be beneficial to other sources of risks. More importantly, is BIT an interesting tool to mitigate structural weaknesses of a country and then overcome burdens binding countries to attract investment ? The idea is to argue on the statement that BIT which fundamentally affects risk related to expropriation, should affect other sources of risk, crucial to the choice of investment location.

My contribution enters in this literature by arguing that not only BITs are associate to an increase in FDI level in a direct manner, but enter indirectly in hindering high-risk countries handicaps (here defined as vulnerabilities). Besides, my analysis is broadened by including the possible interaction between BITs and Economic integration agreements following Sirr, Garvey, and Gallagher (2017).

Eventually, my focus is only on countries that are eligible to the least developed country status, by assessing how BIT could mitigate the level of risk, by deterring countries handicaps to attract investment.

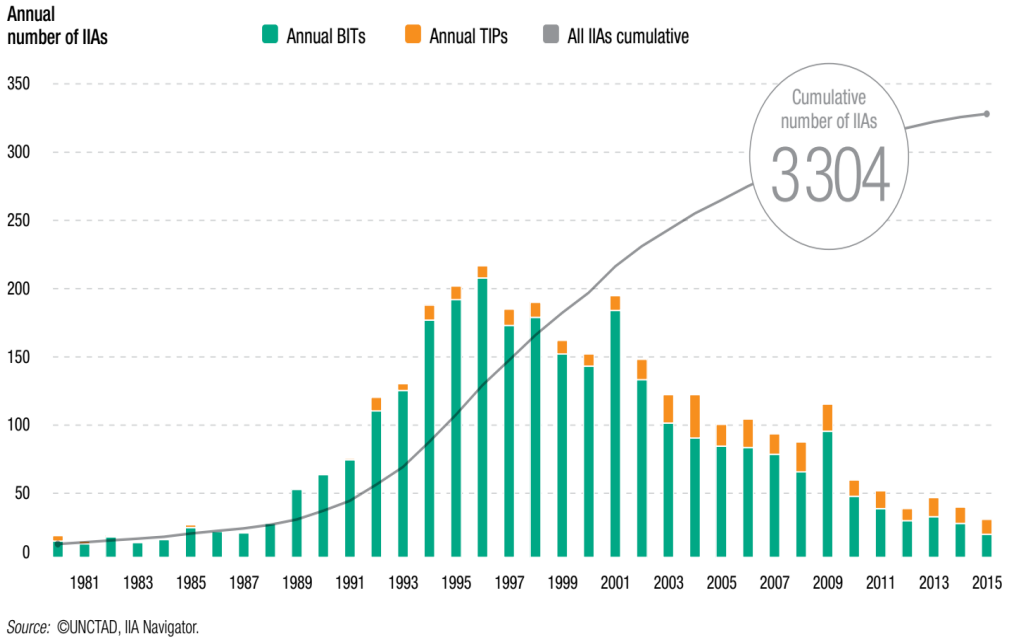
Therefore, BIT, as solutions to secure investment, not only are able to overcome the effect of a poor economic institution (i) (an issue largely treated in the literature) but also have capabilities to mitigate the economic vulnerability (ii) . This double effect may explain the fact that extremely vulnerable countries tend to sign more and more BIT. In addition, presence of trade agreements may interact in favor of BITs (iii) and create a better economic environment in reducing vulnerabilities (iv).

To measure the level of risk in a country, I focus on an alternative literature related to economic vulnerability index (EVI). This choice is driven by the nature of FDI which should be taken as a mid-term or long-term flow (by definition related to sunk cost associated to FDI). As far as I know, it is hard work to find papers focusing only on the special nature of vulnerable countries (in the sense of Guillaumont and Briguglio) apart from Gnangnon (2015). Despite the fact that those countries are putting a lot of effort to engage in those treaties, the related benefits are still unclear(Neumayer and Spess (2005), Egger and Pfaffermayr (2004b)).

The paper is organized as follows. The first section focuses on the link between the concept of economic vulnerability and FDI. The second section is a short literature review on the link between FDI and BIT. Section 3 focuses on the model specification and on data. Then, we

are turning to results through different assumptions mentioned in our first three sections. In section 5, I'm using alternative specification as a robustness check. Section 6 will end up with the conclusion.

FIGURE 2.1 – Number of IIA



2.2 Literature review

There is a large body of literature linking the level of FDI, BIT and different forms of risk, ending up with different results, not really reaching a global consensus. To cope with different nature of risk affecting FDI, two strand of literature emerge. First, at a general view, risk, when looked as institutional weakness, deters FDI. In fact, Bénassy-Quéré, Coupet, and Mayer (2007) (among others) find in gravity models that Institutional risk deters the bilateral level of FDI. Later, Slangen and Beugelsdijk (2010) focus on institutional hazard and its effect on FDI and find a negative impact of cultural and institutional hazard on the choice on investment location. More importantly, its finding highlight the permanent nature of cultural hazard on FDI. Donaubauer, Meyer, and Nunnenkamp (2016) join this analysis proving how important are infrastructure in the determination of FDI location.

Second, conversely to this strand of literature, a large body of literature only focuses on

expropriation risk and/or corruption impacting FDI as in Busse, Königer, and Nunnenkamp (2010). Asiedu, Jin, and Nandwa (2009) for example explore theoretically this link and find that expopriation is a threat to investment and could be mitigated from sufficient incentives to not expropriate. Along their line, Bandyopadhyay and Younas (2014) assess how terrorist risks leads to under-investment.

Despite the seminal work of Dixit and Pindyck (1994), who offer theoretical facts on various forms of risk affecting investment level, the literature exploring other forms of risk is somewhat overlooked. It is even harder to find literature seeking how protective are BIT against other forms of risk.

When now interested in how BIT and Economic agreements are effective to FDI, the results are contrasted.

In fact, Desbordes and Vicard (2009) by using a gravity model find that BITs are strong signals to investors who suffer from diplomatic risk, emphasizing in their paper the crucial influence of interstate relation quality. Colen, Persyn, and Guariso (2016) argue that BIT signature has contrasting effect on economic sectors, boosting FDI in sectors with large sunk costs, and a relatively soften effect on high-skill sectors, confirming previous research with an aggregate level. Chenaf-Nicet and Rougier (2016) find a negative effect of macroeconomic instability related to regional integration of countries and its effect on FDI. Neumayer and Spess (2005), on the other hand, find evidence of a limited BIT protection provisions, through the lens of the substitution to fragile domestic institution quality. Dixon and Haslam (2016) argue that BIT, host countries characteristics, and FDI relation should take into account a deep analysis of not only the phase-in effect of BIT, but also a deep understanding of the components of those treaties. Salacuse and Sullivan (2005) added how political risk can be deterred through the use of BIT. This part of the literature is essentially based on a deep analysis of dispute settlement provisions. Differences are made trough text analysis of treaties law provision. Besides, Busse, Königer, and Nunnenkamp (2010), arguing in the same vein, find differences in the protection offered by BIT, when international law is taken into account to overcome national policy risk (e.g. expropriation risk). Their finding, in the same line as Dixon and Haslam (2016), enforces a central role of dispute settlement provisions.

In contrast to the this strand of literature, Tobin and Rose-Ackerman (2011), suggested a diminishing return of BIT signature, initiating the idea of a threshold effect to the BIT positive impact. Hallward-Driemeier (2003) reinforce this idea that too much BIT may "bite" developing countries initiating discussion on the right effect of FDI.

Falvey and Foster-McGregor (2017) try to reunite this two part by arguing that those differences in results and views of BIT could be the result of institutional distance between partner countries.

Our contribution in this paper is in the same vein as Busse, Königer, and Nunnenkamp (2010), with a focus on the special nature of exogenous shock that could hit a country (by definition the economic vulnerability level). It could also be related to the work of Dicaprio and Santos-Paulino (2011) when studying the impact of free trade agreements to economic vulnerability.

The idea is to integrate other forms of risk which are generally related to development studies. Driven by leading authors (Guillaumont and Briguglio), this literature focuses on the construction of indexes to determine the structural risk to be hit by external shocks which are defined as vulnerabilities. By construction, those kind of indexes aim to capture various forms and sources of vulnerability [3]. More specifically, in contrast to the deterring impact of different level of risks, solutions to secure investment, like BIT, are affecting various sources of vulnerabilities by hindering their general effect, thus offering a better economic environment in the form of a more secured legal framework.

By hypothesis, vulnerability within a country can deter FDI. However, BIT and IIA's can be helpful to FDI, via not only a direct effect (as we can see in Dixon and Haslam (2016) ; Haslam (2007) ; but also via indirect effect : deterring structural vulnerabilities (through different channels).

2.3 Model specifications and estimation

In the view of the literature review and our research questions, we will be proceeding as follows.

First, I will state different hypotheses with regards to different specifications that could be encountered. As we want first to restate the initial issue of BIT, I will commit to test if BITs act as a signal to investors. I will respond to that question by taking into account different steps of engaging in a BIT. Furthermore, as BIT is expected to have a ricochet effect on FDI through structural countries weaknesses, I will assess this focal question by interacting our main variables (BITs) to various measure of vulnerabilities. Besides, I take into account in my analysis the idea of interaction between trade agreements and BIT.

Second, In order to assess empirically our different assumptions, I rely on the workhorse on studying trade and investment policies in a bilateral manner, by focusing on the specification of a gravity model as in Head and Ries (2008), Kimura and Todo (2010), Bénassy-Quéré, Coupet, and Mayer (2007), and more recently Chenaf-Nicet and Rougier (2016).

Finally, I will give a brief discussion on various variables used in my different specifications.

3. For more details about the EVI index, see Cariolle (november 2013), Guillaumont (2009) and Briguglio, Kisanga, and Secretariat (2004)

2.3.1 FDI and BIT link : An empirical approach

One main hypothesis is the fact that Trade Agreements or Investment Treaties may encourage investors to implant their firm within a country trough a "signaling effect". As these agreements pass through different steps and may take a time to be effective, one can easily imagine different signals emitted from those different process. How to capture this "signaling effect" or a "phase in effect" ? Considering this direct effect is a conventional way of treating the link between FDI and Investment treaties, Dixon and Haslam (2016) provide an extended version to this analysis. To broaden the BITs and IIAs (International Investment Agreements) influence, they provide a precious insight on different signaling schemes that various treaties could mean. They divided treaties between signed and ratified, and classified the eventual strength of the treaties. I decided to follow their pattern by using their differentiation technic. I decided to proceed as follows :

- creating a 5 year lag before the signature of the treaty : a proxy of the announcement phase (a phase-in effect). Contrary to trade modeling, this lagging effect is not clearly understood in an FDI analysis (Sirr, Garvey, and Gallagher (2017)). Thus, the choice of a preferred lag follows those applied in trade modeling via 5 years (Baier, Bergstrand, Egger, and McLaughlin (2008)) [4].

- differentiating the fact that signature is different from ratification (following Colen, Persyn, and Guariso (2016) and Dixon and Haslam (2016)).

In order to justify my choice, I focus on Kerner (2009) to explain the strength of signals. He differentiates between a bilateral signature hypothesis (i.e. protecting its own investment) and signaling effect (affecting other countries, as a "spread out effect").

Besides, to assess the indirect effect via structural vulnerability, I decided to create some interaction terms depending on the nature of the treaty (Ex : BIT*EVI, Signed/Ratified BIT/*EVI). It is important to remember that structural vulnerabilities are affecting the level of FDI depending on the source. This remainder leads us to take into account how can investment agreements affect origins of vulnerabilities. However, a stronger signal, expressed by Ratified BIT*EVI, i.e. a well-secured investment, showing a positive sign through EVI means that it is Investment enhancing, as the interaction of this variables is moving in the same way. Naturally, this contribution on the signal effect of the BIT is expressing a lot of phenomena and thus could be counter intuitive. As expected signs from different signals :

- a positive sign from the BIT*EVI means that BIT and EVI are affecting the level of vulnerability. This case is the best, since it would mean that in presence of BIT, EVI is not

4. The literature do not give an insight on the maximum lag to be used. Baier and Bergstrand (2009) used 3 years lag. Yotov and Larch (2016) in the advanced guide for structural gravity modeling tested different lag length. The range for lag length is general between 3 to 6 years.

a negative signal to investment anymore, thus deterring the initial negative effect of EVI without BIT. To broaden my reflexion, I replace the EVI by its subcomponents (Exposure to shocks and Shocks). [5]

- a differentiation between ratified and signed BIT and its consequences on EVI and its subcomponents are expected to be positive, following the previous pattern. As an example : a positive sign from the couple signed BIT* EVI means the willingness to secure investment is well viewed by the investors. One should confirm by looking at the 5 year lag (as a negotiation phase) : to take into account a phase-in effect.

Finally, I am focusing on agreements, to ensure that our estimations are unbiased, computing in our current modeling scheme the direct and indirect effect (PTA/BPTA/CU *BIT) of Trade agreements. Following Baier, Bergstrand, Egger, and McLaughlin (2008), the level of economic integration enters by using the NSF-Kellog classification [6]. Besides, to broaden the analysis, I decide to interact this classification to sources of economic vulnerability.

Finally, I test the hypothesis of congestion and dilution effect of BIT, by the number of BIT and squared number of BIT in our models.

2.3.2 Model specifications

As pointed out at the beginning of this paper, my choice is to implement a gravitational approach. This approach, classic in the literature on bilateral flow, is an important tool when studying the effect of treaties in an international trade view.

The FDI version of gravity estimation is broadly discussed in Kleinert and Toubal (2010) and Head and Ries (2008). My goal is to reach directly the effect of BIT by expressing it differently, so I didn't recall how one could express FDI gravity models theoretically.

I follow different specifications to test my different hypothesis. First, I evaluate the direct effect of BIT by proceeding as follows :

$$FDI_{ijt} = \alpha_1 + \beta_1 GRAVDATA + \beta_2 RISK + \beta_3 BIT_{ij} + a_i + b_t + \epsilon_{ijt} \tag{2.1}$$

where FDI_{ijt} is the measure of foreign direct investment entering in a country [7]. $GRAVDATA$ is a set of control variables related to a classical gravity model. $RISK$ refers to the vulnerability level captured through the Economic vulnerability index. a_i refers to host and home country fix-effects. b_t represents a time fix-effect. BIT_{ij} is a dummy that indicates that two countries have signed or ratified an investment treaty or not. ϵ_{ijt} refers to

5. The aggregation process and weighting procedure may erase sources of vulnerabilities' influences.
6. http ://kellogg.nd.edu/faculty/fellows/bergstrand.shtml
7. Either $lnFDI$ in an ordinary least square ; or $FDIlevel$ in a pseudo-poisson specification

a random error term. In this form, I can desagregate the level of EVI and BIT. To capture the phase-in effect and signaling effect of BIT, I divide my BIT by ratification and signature (on the one hand) to capture the signaling effect. To capture the phase-in effect, I follow Baier, Bergstrand, Egger, and McLaughlin (2008).

Second, another specification is used to account for interaction between variables :

$$FDI_{ijt} = \alpha_1 + \beta_1 GRAVDATA + \beta_2 RISK + \beta_3 BIT_{ij} + \beta_4 (BIT_{ij} * RISK) + a_i + b_t + \epsilon_{ijt} \quad (2.2)$$

Interaction terms between variables are added which aim to capture the indirect effect of BIT on FDI level by mitigation of the level of risk.

Third, I test the interaction between economic integration and BIT signature. I integrate the direct effect of economic integration, following NSF-Kellog classifications, and the possible interaction between BIT on FDI level. This leads us to the following specification :

$$FDI_{ijt} = \alpha_1 + \beta_1 GRAVDATA + \beta_2 RISK + \beta_3 BIT_{ij} + \beta_4 EIA + \beta_5 (BIT_{ij} * EIA) + a_i + b_t + \epsilon_{ijt} \quad (2.3)$$

Fourth, I interact the different sort of agreements, with different sources of vulnerability as the following :

$$FDI_{ijt} = \alpha_1 + \beta_1 GRAVDATA + \beta_2 RISK + \beta_3 BIT_{ij} + \beta_4 EIA + \beta_5 (EIA_{ij} * EVI) + a_i + b_t + \epsilon_{ijt} \quad (2.4)$$

Finally, I intend to capture a threshold effect of the BIT signature. Indeed, I decide to incorporate two forms : A congestion effect related to the increasing number and a diverting effect by discouraging new BIT. It takes two forms :

$$FDI_{ijt} = \alpha_1 + \beta_1 GRAVDATA + \beta_2 RISK + \beta_3 BIT_{ij} + \beta_4 BITsum + \beta_5 BITsum^2 + a_i + b_t + \epsilon_{ijt} \quad (2.5)$$

$$FDI_{ijt} = \alpha_1 + \beta_1 GRAVDATA + \beta_2 RISK + \beta_3 BIT_{ij} + \beta_4 BITsum + \beta_5 (BIT_{ij} * BITsum) + a_i + b_t + \epsilon_{ijt} \quad (2.6)$$

In all these specifications, I use Ordinary Least Square (OLS thereafter) and Fix Effect (FE henceforth) estimations to correct some heterogeneity. However, according to the literature of gravity model, the OLS estimator is biased because suffers from the fact that it droppes zeros in our database. Moreover, it is not structurally correct due to the miss of multilateral resistances as cited by Anderson and Van Wincoop (2001).

Consequently, another specification is added to the analysis, to take into account the existence of zero values and heteroskedasticity, the Pseudo-Poisson Maximum Likelihood (PPML henceforth), as suggested by Silva and Tenreyro (2006). We take into account possible omitted variable and endogeneity by using a country pair fix effect (Silva and Tenreyro (2006), Fally (2015)). Finally, to take into account the multilateral resistance terms, the literature suggests adding country-time fix effects to time fix effect, to perform a structural gravity model as pointed out by Anderson and Van Wincoop (2001). However, I decided to follow Busse, Königer, and Nunnenkamp (2010) and Bergstrand and Egger (2007) and Erdogan (2017), by assuming that the multilateral resistance terms are "moving slowly". Thus, these terms are essentially captured by the time fix effect. This assumption is made due to our limited time span, preserving a large amount of our database.

2.3.3 Data

Our interest variable is the inward bilateral FDI stock taken from the UNCTAD database [8]. The choice of stock instead of flows in our data is driven by Bénassy-Quéré, Coupet, and Mayer (2007) on a relative stability of this data (as the use of bilateral FDI flows is suffering from high volatility). Moreover, it permits to eliminate possible negative flows. Besides, the analysis of a bilateral data, especially FDI, suffers from a large number of zeros. By using a pseudo-poisson specification later in our analysis, we aim to capture these zeros.

As independent variables, it can be divided into 2 categories. The first category of variables is related to classical control variables for a gravity model : GDP, distance, colonial link, language. Those variables are taken from Mayer and Zignago (2011), available on the CEPII website [9]. The second category of variables are variables related to the level of risk and/or vulnerabilities. As stated earlier in the paper, contrary to the classical literature, one hypothesis of my paper is to state that BIT signature should affect the level of vulnerability of a country. Thus, to measure the vulnerability, I use FERDI's Economic Vulnerability Index(EVI) [10]. This variable focuses only on structural vulnerabilities affecting states, which are our interest proxy of risk. By construction, it is possible to divide this index into its sub-components. The first sub-component is exposure to external shock which aims to capture weaknesses of a country facing exogenous shocks. The second sub-component focuses on the nature/magnitude of the shock hitting an economy (natural shock or trade shock). In a disegregate level, the EVI is composed by vulnerability due to population (related to a mar-

8. http ://unctad.org/en/Pages/DIAE/FDI%20Statistics/FDI-Statistics-Bilateral.aspx
9. http ://www.cepii.fr/CEPII/en/
10. See Cariolle (november 2013)for a construction of a retrospective index, and Guillaumont (2009) for the construction of the EVI and variable choice.

ket tightness), remoteness to international market, market structure vulnerabilities (share of agriculture and export concentration), low elevated coastal zone, number of disasters, export instability and agriculture instability. Each components of the EVI is constructed in order to represent constraints of a country to boost its own economy [11].

Turning now to our interest variables : trade and BIT agreements, I have two main sources. My BIT variables come from the UNCTAD data [12]. I differentiate my BIT by a negotiation process, signature, and ratification. The economic integration variables are taken from the NSF-Kellogg database available from Bergstrand personal site [13].

In sum, our database has 125 countries with 34 partner countries from 2003 to 2011.

2.4 Results

Following our previous specification, I assess the direct link between BIT and FDI, adding up a disaggregation between negotiation process, signature, and ratification ; interacting these variables with our measure of risk ; and assess the link between economic integration agreements and possible dilution effect.

2.4.1 Direct effects : Phase-in effect

Table 2.1 compute how FDI react to presence of vulnerabilities and different steps of BIT stage. The first column (1) is the result of our OLS estimation ; the second column(2) restate our FE estimation ; and the column (3) computes our PPML FE estimation.

Our different steps give interesting results. First, the OLS estimator is introduced without any kind of fix effect. This is done just to ensure the rightness of our gravity specification. More specifically, the main message of gravity is retained : The FDI level takes into account the bilateral size of the country and reacts negatively to an increase in distance (geographical distance, language distance). A negative pattern of our proxies of vulnerability is observed on SHOCK index. However, the exposure index is positive. This estimation, assumed to be upwardly biased, is not favored compared to the two others. Second, adjusting our OLS estimation by the use of time and country-pair fix effect allows to take into account problems of heterogeneity and partly take into account the problem of endogeneity in our estimations. This second specification as cited by Head and Mayer (2013) downwardly bias our gravity estimation. Therefore, we rely on our PPML FE estimation, which is the workhorse estimator used in gravity model as it takes into account all possible errors encountered in gravity

11. More details on EVI construction available in Guillaumont (2009)
12. http ://investmentpolicyhub.unctad.org/IIA
13. http://kellogg.nd.edu/faculty/fellows/bergstrand.shtml

TABLE 2.1 – Phase in Effect

VARIABLES	(1) OLS LnFDI	(2) OLS Fix-effects LnFDI	(3) PPML Level of FDI stock
lnGDP_o	0.180**	1.856***	0.552***
	(0.0762)	(0.302)	(0.211)
lnGDP_d	0.727***	0.534***	0.598***
	(0.0640)	(0.144)	(0.0905)
EXPOSURE	0.0490***	-0.0303	-0.0883***
	(0.0107)	(0.0255)	(0.0187)
SHOCK	-0.0155***	0.00283	0.0134*
	(0.00583)	(0.00654)	(0.00771)
L5BITs	0.110	0.0322	-0.0682
	(0.0906)	(0.0628)	(0.0511)
BIT_signed	0.697**	0.144	0.332***
	(0.307)	(0.149)	(0.108)
BIT_force	0.801***	-0.135	-0.0707
	(0.305)	(0.143)	(0.0955)
ldistw	-0.557***		
	(0.169)		
contig	-3.543***		
	(1.051)		
comlang_off	0.912***		
	(0.272)		
Constant	-16.10***		
	(3.045)		
Observations	8,872	8,707	10,544
R-squared	0.237	0.927	
Time FE	No	Yes	Yes
Country-pair FE	No	Yes	Yes
Number of dyad			1,523

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

modeling (zero flows and heteroskedasticity). The results from EXPOSURE and SHOCK index restate our first insight on the negative effects of structural vulnerabilities on the level of FDI. Interestingly, the level of Exposure to risk has a negative effect to FDI, on the contrary SHOCK index is positive. As we expect various measures of vulnerability affecting differently the level of FDI, we will expand our measures when interacting them to our BIT variables.

Turning now to our variable of interest, as expected, BITs influence positively the level of FDI. Through different estimation, BITs, when signed, have a strong effect on FDI level. Looking deeper to the signaling effect, I find that the effect of the signal may differ. The phase-in is important, as it shed light to future protection. By anticipation, investors tend to be overcautious which led to a negative pattern via a direct effect. This result is unexpected, as intuitively, one can think of an increase in FDI level. One possible explanation is the fact that process is costly and may be investment diverting. Even though the sign is negative,results of a phase-in effect are non significant. Conversely to findings on trade e.g Baier, Bergstrand, Egger, and McLaughlin (2008), the phasing-in effect is not confirmed throughout our various specification [14].

More importantly, the signature is the most important phase (if I refer to the PPML fix effect results). Signing BIT increases the bilateral FDI level up to 40,77%. Instead, by anticipation, this signal (signature) is often the outcome of fierce battle to find a commitment. Putting up a legal framework is the final phase. However, our regressions show a non-significant effect of ratification. This could be explained by the fact that, as it was already anticipated during the previous phases and the signature phase, this normal consequence has no additional effect on the FDI level. Those results are in line with Berger, Busse, Nunnenkamp, and Roy (2011), Berger, Busse, Nunnenkamp, and Roy (2013). Besides, as I pointed earlier, one have to wait for a ratification to see a real commitment within legal frameworks. The literature called it as a "binding effect", i.e. strong commitment to secure and protect investment between host countries and investors (Busse, Königer, and Nunnenkamp, 2010). However, due to an anticipating ratification of BIT, engaging a large sunk costs will remain during earlier phases of the investment treaties, thus, crowding out the expected effect. Specifically, ratification should not be necessarily undergo to ensure the security of investment. An initial signal, prior to this ratification, has a significant signal strength to boost investment.

According to the advanced guide to trade policy [15], to account for the full extent of the BIT regime treatment, we have to take into account for the average treatment effect.

14. Our results are robust to a change in time lags : 3, 4, or 6 years lag.

15. "An Advanced Guide to Trade Policy Analysis : The Structural Gravity Model" (2016), co-published by the World Trade Organization and the United Nations Conference on Trade and Development", Yoto Yotov.

Interestingly, the total effect of engaging into a BIT is around 0.25 [16] ; which gives about 47.23 % [17] increase in FDI.

2.4.2 Interaction effects

Turning to indirect effects, I focus on interactions to the overall EVI index. In fact, to broaden my analysis, I choose to present in the present paper an extended version of the interactions with vulnerability variables [18]. By doing so, I follow Neumayer and Spess (2005), when studying interactions to institutional quality, finding some evidences that BIT could, to a certain extent, mitigate poor institutional quality.

Therefore, as additional hypothesis : institutional weaknesses reduction has as main channel interactions between the level of risk (captured by inherent vulnerability) and BIT agreements. As a matter of fact, this is done to capture the marginal effect of BIT on mitigating the level of risk encountered in a country.

Table 2.2 states the results of our interaction terms. Thereafter, we focus on PPML FE estimations to give reliable estimates. Taking into account sources of vulnerability gives more accurate findings. As suggested by our different estimations, BIT signature has the expected effect. First, BIT earlier stages (captured by our phase-in variable) are not sufficient signals, and even enhancing vulnerability due to remoteness. As already mentioned previously, there are no anticipatory effect expected on BIT status. More importantly, an uncertain situation after BIT signature leads to an increase in the remoteness index, thus, increasing exposure to external shock.

On the other hand, signing a BIT has a mitigating effect on the vulnerability level, thus encouraging investment. Indeed, surprisingly, BIT signature is reducing vulnerability due to a location in a low elevated coastal zone and the impact of a disaster. Furthermore, BIT signature seems insignificant in reducing other forms of country's vulnerabilities. Theoretically, it is hard to figure out why BIT, which is directly effective to investment, is non efficient to reduce vulnerabilities. One possible explanation is the structural characteristics of our measure of risk. In fact, one can assume that the effect of BIT on vulnerability may be delayed in time.

Besides, taking into account ratification offers two signals. On the one hand, BIT ratification seems to enhance export concentration and share of the primary sector. These signs are not expected but appear understandable. Indeed, as far as BITs do not integer clauses

16. Calculation comes from a linear combination of phase-in and BIT signature.
17. Its a semi-elasticity measure : $exp(0.25 - 1) * 100$
18. Exposure and nature of the Shock are also crossed to the different stage of BIT commitment process, but as stated previously, a broad extent of our vulnerability index appears to be more informative. However, those results are still available upon request.

TABLE 2.2 – Interactions

	(1) negotiation_expanded	(2) signed_expanded	(3) ratified_expanded
VARIABLES	Level of FDI stock	Level of FDI stock	Level of FDI stock
lnGDP_o	0.576***	0.596***	0.604***
	(0.197)	(0.208)	(0.207)
lnGDP_d	0.519***	0.526***	0.511***
	(0.113)	(0.0982)	(0.0985)
L5.BIT	0.181		
	(0.147)		
BIT_signed		-0.284	
		(0.353)	
BIT_ratified			-0.142
			(0.265)
BIT*POP	0.00141	-0.00940	0.00497
	(0.00170)	(0.00924)	(0.00928)
BIT*REMOT	-0.00530***	-0.000858	-0.00125
	(0.00125)	(0.00509)	(0.00333)
BIT*XCON	-0.00188	-0.00287	-0.0122**
	(0.00246)	(0.00510)	(0.00547)
BIT*SHARE_AGRI	-0.00155	-0.00509	-0.0183**
	(0.00349)	(0.0165)	(0.00930)
BIT*LECZ	0.00134	0.0160*	0.00660
	(0.00188)	(0.00903)	(0.00708)
BIT*DISASTER	0.000506	0.00776*	0.00678*
	(0.00134)	(0.00397)	(0.00398)
BIT*X_INSTA	-0.00170	0.00855	0.00248
	(0.00172)	(0.00653)	(0.00505)
BIT*AGRI_INSTA	0.00318	0.00639	0.0104*
	(0.00358)	(0.00671)	(0.00630)
Observations	10,543	10,543	10,543
Number of dyad	1,523	1,523	1,523

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

to promote export diversification, Investors when investing tend to focus one sector, thus enhancing export concentration. More specifically, if a country has a comparative advantage in the primary sector, BIT ratification tends to increase the weight of this sector. Thus, increasing dependence on the primary sector creates a sort of Dutch disease known especially in natural resource exporter countries. On the other hand, as BITs are ratified, investments in primary sector reduce instability related to agriculture. This result is in line with the previous paragraph : the economy is more concentrated in agriculture, enhancing vulnerability due to agriculture, but reducing instability in that sector as outcomes are assured by agreements. However, contrary to the initial thoughts i.e. BITs enhancing export, the results do not confirm more stability in exports. Moreover, we can not verify this assumption as an increase in stability of export do not necessarily means more export.

Apart from those indexes, the disaster index seems to respond well to BIT signature and ratification. Indeed, BIT signature/ratification tend to reduce vulnerability due to disaster.

To conclude, the protective effect of BIT seems to change, depending on the stage of BIT. In other words, BIT signature is not effective in reducing the exposure to external shocks. However, BIT ratification offers interesting results on agriculture instability, export concentration, and share of the primary sector. This corroborates the previous assumption of delayed effect of BIT signature on economic vulnerabilities. Meanwhile, signature and ratification are mutually important. In fact, signature may prevail directly as investment enhancer ; and ratification works in reducing vulnerability, which by ricochet is beneficial to the final level of investment.

This additional analysis offers contrasting results on the effect of BIT. More specifically, even not directly enhancing FDI, ratifying BIT seems to be effective in vulnerability reduction.

2.4.3 Complementary effect of Economic integration and BIT

As pointed out by Dixon and Haslam (2016), not taking into account the effect of economic integration on FDI level is a potential source of an important bias. Moreover, as pointed out by Baier, Bergstrand, and Clance (2018), the theoretical and empirical effect of different stages of economic integration is heterogeneous and varies depending on level of fixed costs and policies within and between countries. Thus, I decided into integrate in my database the level of economic integration, as suggested by the seminal paper of Baier, Bergstrand, Egger, and McLaughlin (2008). The level of economic integration agreements is indexed from zero (0) to six (6) : zero (0) meaning no integration between economies, one (1) for one side preferential trade agreement, two (2) for a two side preferential trade agreement, three (3) for free trade agreements, four (4) for custom unions, five (5) for common market and six (6)

meaning an economic union between countries. By doing so, I'm following Vijil (2014) who focuses on Aid for Trade effectiveness on various levels of integration. For my case, as I focus my analysis on vulnerable countries, I have just five (5) levels of integration according to my database, with a large amount of one side PTA : no economic integration (0), non-reciprocal trade agreement (1), preferential trade agreement (2), free trade agreement (3) and custom union (4).

As questions of different levels of integration have already been answered in previous literature, this section aims to respond to two questions : Is there a complementarity between trade agreement and investment agreement ; and if there is complementarity between them, is there any joint effect which deters risk that hampered nation's attractiveness ?

Table 2.3 compute the initial thought of EIA effects on FDI. As results, the first estimation process i.e a direct effect of economic integration appears to be an excellent determinant of FDI. An interesting finding, in my database, is the fact that a one-way preferential agreement and a free trade agreement between countries seems to boost the level of FDI. The effect of a two-way preferential agreement seems unclear, and weak. However, a deeper economic integration is not investment-boosting. The signature of a PTA boost investment by 60% (exp(0,476)-1). FTA boost Investment by 54%. However, a reciprocal PTA is boosting by only 23% the level of FDI.

Our interpretation is that investors are market seeking. The existence of a one-way preferential seems an excellent signal of a good relation between countries, protecting the countries engaging in trade agreements, here presupposed a vertical investment (Sirr, Garvey, and Gallagher (2017)). A deeper integration, in the form of a free trade market, not only enhances trade but enhance FDI, enhancing horizontal FDI as trade barriers decrease(Yildiz, 2013).

However, going from a Free Trade Agreement to an Custom Union is not beneficial. As countries enter into an custom union, the effect disappears. I explain this effect as a direct consequence of a deeper integration. The rent from establishing an FDI is decreasing with the level of integration. Those findings are in relation with the negative relation between integration, which is beneficial for trade agreements, and the FDI level (horizontal or vertical FDI). Investors in this case (custom union) don't make a trade-off between FDI and Export. More specifically, a decrease in trade costs induced by custom union renders investing in FDI non attractive compared to export. Therefore, Investors are indifferent to whether export or implant. Yildiz (2013) highlight this fact in a theoretical model, explaining how tariffs (trade barriers) in CU are sufficiently low to overcome the initial burden inducing the choice of FDI. This finding also corroborate the contrasting finding of Blomstrom and Kokko (1997), arguing how regional agreements consequences on FDI is somewhat contrasted depending on the integration level.

Table 2.3 – Overall effect of Economic integration

VARIABLES	(1) OLS LnFDI	(2) OLS Fix effect LnFDI	(3) PPML Fix effect Level of FDI stock
lnGDP_o	0.188**	1.770***	0.529**
	(0.0749)	(0.299)	(0.215)
lnGDP_d	0.762***	0.478***	0.616***
	(0.0618)	(0.144)	(0.0902)
ldistw	-0.339*		
	(0.183)		
contig	-3.747***		
	(0.937)		
comlang_off	0.888***		
	(0.274)		
EXPOSURE	0.0561***	-0.0290	-0.0806***
	(0.0110)	(0.0256)	(0.0189)
SHOCK	-0.0138**	0.00373	0.0154*
	(0.00607)	(0.00649)	(0.00796)
1 for signed BIT	1.449***	0.0609	0.308***
	(0.173)	(0.153)	(0.101)
EIA level of integration = 1	0.476**	0.428	0.476***
	(0.222)	(0.366)	(0.113)
EIA level of integration = 2	1.013***	0.0244	0.231*
	(0.293)	(0.377)	(0.119)
EIA level of integration = 3	0.876***	0.292	0.434***
	(0.285)	(0.360)	(0.0964)
EIA level of integration = 4	2.259***	0.142	0.350
	(0.634)	(1.034)	(0.565)
Constant	-19.86***		
	(3.081)		
Observations	8862	8697	10 529
R-squared	0.241	0.927	
Number of dyad			1 521

Robust standard errors in parentheses
*** p<0.01 ** p<0.05 * p<0.1

TABLE 2.4 – Joint Effect BIT and Economic Integration

VARIABLES	(1) PTA_BIT Level of FDI stock	(2) BPTA_BIT Level of FDI stock	(3) FTA_BIT Level of FDI stock	(4) CU_BIT Level of FDI stock
lnGDP_o	0.583***	0.549**	0.555***	0.578***
	(0.214)	(0.215)	(0.214)	(0.213)
lnGDP_d	0.605***	0.604***	0.617***	0.611***
	(0.0906)	(0.0902)	(0.0918)	(0.0912)
EXPOSURE	-0.0857***	-0.0849***	-0.0860***	-0.0868***
	(0.0189)	(0.0189)	(0.0192)	(0.0191)
SHOCK	0.0140*	0.0145*	0.0141*	0.0137*
	(0.00815)	(0.00800)	(0.00800)	(0.00808)
BIT_signed & EIA	0.0461	-0.123	0.0760	0.0822
	(0.124)	(0.153)	(0.112)	(0.115)
BIT_signed	0.298***	0.323***	0.293**	0.308***
	(0.113)	(0.104)	(0.118)	(0.119)
Observations	10,529	10,529	10,529	10,529
Number of dyad	1,521	1,521	1,521	1,521

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

On the other hand, there is a strategic behavior that may appear in the level of integration. A one hand Preferential trade agreement is beneficial to a country, as it enhances trade, and encourages investors to implant a firm, as it is nearly exclusive and doesn't offer an additional rent. However, a two hand PTA is not beneficial to an investor.

Besides, a Free Trade Agreement is beneficial to trade and FDI, with an expected profit higher than a PTA (one side or two sides). On a horizontal FDI view, it reduces the re-exportation. On a vertical FDI view, it reduces the importation of materials, here in a case of a global value chains optic.

Turning now to our previous question, I focus on the interaction between BIT and the level of integration. As one can see in Table 2.4, I created an interaction term to capture the possible joint effect. The level of economic integration has no effect (joint-effect) on the BIT status. In other words, being in a form of EIA does not marginal boost the effect of signing a BIT. In fact, the sign of our interaction term $BIT * EIA$ appears insignificant in any form of EIA. Despite economic integration seems an important driver of FDI level ; arguments in favor of a joint effect doesn't seem clear in our case. This finding is important when analysing the emergence of nowadays megadeal (e.g. the Trans Pacific Partnership (TPP)). Interestingly, those deals contain trade and investment clauses stated specifically for each purpose.

2.4.4 Economic integration and vulnerability level

So far, I hypothesize that level of economic integration does not have a related effect on the level of economic vulnerability. However, as argued in Gamberoni (2007), economic integration allows a country to be part of a larger market, thus modifying its internal economic structure.

To assess the impact of economic integration agreements to vulnerability level, I decide to interact our different levels of economic integration with various components of vulnerabilities (related to a disaggregate level of the Economic vulnerability index). As expected sign : I expect a positive sign from interactions of the different levels of economic integration as it means a deterring effect to vulnerability. To focus on various sources of vulnerabilities, which are our main interest, I decide to expand the vulnerability index to its own sub indexes. According to Table 2.5, the overall effect is ambiguous, as different forms of economic integration seem to enhance vulnerability in general.

Results are below :

- Concerning the vulnerability related to the size of the market, captured by the POP index : it generally deters the FDI level. Moreover, and surprisingly, contracting a PTA, or being in an FTA or CU do not affect marginally the level of vulnerability and do not deter the vulnerability due to market size. More importantly, being in a bidirectional PTA enhances the level of the POP index, thus enhancing market size vulnerability.

- Export concentration is not marginally affected by various forms of agreements.

- Concerning the remoteness of a country : BPTA decreases vulnerability due to remoteness. However, FTA tends to increase vulnerability marginally.

- Concerning the share of agriculture index : FTA (as an access to a wider market) overcome the vulnerability due to a large agriculture market. A linear combination of the interaction with the main effect of share of agriculture gives a non-significant effect of agricultural share. Indeed, FTA is overcoming the vulnerability to agriculture. However, BPTA tends to increase the level of vulnerability due to large agriculture.

-Low Elevated Costal zone, Disaster, Export instability are affected marginally by PTA with a negative interaction signs. In this case, contracting a PTA increases vulnerability related to those sources.

According to Gamberoni (2007), the effect of trade agreements is not sure, depending on the nature of those agreements. PTA and BPTA if stable tend to have an anti-diversification effect, when it is focused on one sector and stable (as those agreements do not cover all products, countries tend to specialize on products (Persson and Wilhelmsson, 2016)). Dicaprio and Santos-Paulino (2011) conclude that PTA or BPTA may enhance agriculture and export

TABLE 2.5 – Interactions EVI components and Economic integration agreements

	(1)	(2)	(3)	(4)
	PTA_vuln	BPTA_vuln	FTA_vuln	CU_vuln
VARIABLES	Level of FDI stock	Level of FDI stock	Level of FDI stock	Level of FDI stock
lnGDP_o	0.570***	0.577***	0.552***	0.613***
	(0.210)	(0.212)	(0.202)	(0.211)
lnGDP_d	0.549***	0.510***	0.525***	0.572***
	(0.0948)	(0.0944)	(0.0981)	(0.101)
POP	-0.0731***	-0.0679***	-0.0708***	-0.0646***
	(0.0211)	(0.0205)	(0.0211)	(0.0213)
EIA_stage*POP	0.00638	-0.00893**	0.0129	-0.295
	(0.00416)	(0.00351)	(0.00903)	(0.465)
REMOT	-0.0172***	-0.0223***	-0.0149**	-0.0235***
	(0.00625)	(0.00630)	(0.00615)	(0.00624)
EIA_stage*REMOT	-0.00351	0.0103***	-0.0113**	0.0310
	(0.00595)	(0.00362)	(0.00495)	(0.214)
XCON	-0.00471	0.00167	0.00474	0.000444
	(0.00579)	(0.00371)	(0.00366)	(0.00388)
EIA_stage*XCON	0.00735	0.00769	-0.00726	
	(0.00590)	(0.00688)	(0.00581)	
SHARE_AGRI	-0.0345**	-0.0386***	-0.0475***	-0.0301***
	(0.0138)	(0.0123)	(0.0133)	(0.0116)
EIA_stage*SHARE_AGRI	-0.00987	-0.0172***	0.0376***	-0.0149
	(0.00739)	(0.00610)	(0.0134)	(0.119)
LECZ	0.162	0.268	0.269	0.224
	(0.298)	(0.415)	(0.374)	(0.341)
EIA_stage*LECZ	0.00221	-0.0125**	-0.00677	-5.674
	(0.00604)	(0.00596)	(0.00625)	(9.645)
DISASTER	0.00125	0.00607**	0.00482*	0.00594**
	(0.00301)	(0.00258)	(0.00256)	(0.00261)
EIA_stage*DISASTER	0.00359	-0.00535**	-0.00231	0.0303
	(0.00266)	(0.00223)	(0.00261)	(0.0450)
X_INSTA	0.0113*	0.00518	0.00638	0.00288
	(0.00626)	(0.00697)	(0.00707)	(0.00705)
EIA_stage*X_INSTA	-0.00880	-0.00579***	0.00220	0.0232
	(0.00728)	(0.00187)	(0.00360)	(0.0827)
AGRI_INSTA	-0.00382	0.00536	0.0107**	0.00410
	(0.00621)	(0.00463)	(0.00484)	(0.00457)
EIA_stage*AGRI_INSTA	0.0154**	-0.0116	-0.0112	-0.0778
	(0.00757)	(0.00772)	(0.00739)	(0.0530)
Observations	10,528	10,528	10,528	10,528
Number of dyad	1,521	1,521	1,521	1,521

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

instability as it doesn't offer a sufficient protection to the economy in the sense that it could be repealed.

Our results, in the following tables, restate those effects through the lens of FDI. More specifically, as one can see in the Table 2.3, BPTAs enhance export instability, which is in line with Dicaprio and Santos-Paulino (2011).

Moreover, along the lines of Gamberoni (2007), effects we find from trade agreements tend to have an anti-diversification effect (especially preferential trade agreements), thus enhancing the level of vulnerability due to agriculture share. However, being in a free trade agreement (FTA) is beneficial to the economy as it mitigates the overall negative effect of vulnerability, which can transmute into an economic diversification.

Persson and Wilhelmsson (2016) recently confirm our results, on the relative effect of those agreements to export diversification. Dicaprio and Santos-Paulino (2011) also restate this positive effect of FTA on economic vulnerabilities.

On the overall, interactions between sources of vulnerability to FTA are positive. Thus, in general, FTAs deter economic vulnerability, thus enhancing FDI. Finally, as previously unveiled, CU has no beneficial effect on FDI, even by ricochet (interacting CU with various components of structural risk).

2.4.5 Dilution effect

In this section, I focus on the idea that an investment agreement has a dilution effect, as it is seen in Busse, Königer, and Nunnenkamp (2010) and Tobin and Busch (2010). Therefore, I compute the effect of the number of BIT in our regression. To do so, I take into account the number of BITs signed in a country and see if this has an effect on the bilateral FDI level. I compute again the square of the sum of BITs to see if a threshold exists, confirming the existence of dilution effect.

I expect this sign to be negative, as I am supposing that a large increase in the number of BITs reduces the attractiveness of a country, thus a decreasing marginal effect of BIT signature.

Conversely to general findings, there is no evidence of negative external effect (dilution effect) of signing a BIT.

By interacting those variables, an increasing number of BIT doesn't affect the bilateral level of FDI. As one can see in Table 2.6, the initial effect of the signature is significant and doesn't seem to be altered by other BIT.

A mini-conclusion can be drawn here. For a country, it is always beneficial to sign a BIT, as it is investment attracting. There is no clear evidence of a congestion effect. It is quite clear when we see the relative boom of the number of BIT signatures in the early years.

TABLE 2.6 – Dilution and Threshold Effect

VARIABLES	(1) Level of FDI stock	(2) Level of FDI stock	(3) Level of FDI stock
lnGDP_o	0.583***	0.578***	0.588***
	(0.214)	(0.214)	(0.213)
lnGDP_d	0.614***	0.610***	0.585***
	(0.0925)	(0.0911)	(0.0971)
EXPOSURE	-0.0870***	-0.0877***	-0.0863***
	(0.0191)	(0.0190)	(0.0189)
SHOCK	0.0138*	0.0136*	0.0137*
	(0.00814)	(0.00795)	(0.00798)
1 for signed BIT	0.321***	0.482	
	(0.102)	(0.314)	
BIT_weight	0.00654	0.0123	-0.0395
	(0.00965)	(0.0128)	(0.0528)
BITij*BIT_weight		-0.00702	
		(0.0127)	
BIT_squared			0.000868
			(0.00100)
Observations	10,544	10,544	10,544
Number of dyad	1,523	1,523	1,523

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

However, the degree of protection offered by BITs is not yet assessed in this early stage of the research. A limit to this result is the recent growing trend of dispute settlement between countries and partners and the emergence of stricter version of BIT (Neumayer, Nunnenkamp, and Roy, 2016).

2.5 Robustness

2.5.1 Heckman selection model

To test the robustness of our baseline result, I decided to use an alternative estimation to our OLS and PPML. In the literature of gravity models, it is current to use a two-step Heckman selection model, to take into account for zeros in the database, as an alternative to the pseudo-poisson.

For gravity control variables, former results are confirmed, thus confirming the robustness of our gravity specification. A positive sign related to the economic size (captured through GDP) is obtained. The logarithm of the distance is negative. Finally, the language dummy has a positive influence on the FDI level.

Specifically, exposure and magnitude of shocks seem to have different signs, following the OLS specification results. Those results are not suspicious, as pointed out by Arvis and Shepherd (2013), and are following the OLS result since this specification does not deal with heteroscedasticity, an important shortcoming in gravity models. Consequently, I decided to rely on PPML results, as it is actually an estimator in the literature (Silva and Tenreyro (2006)).

These results are available upon requests.

2.5.2 Reverse causality

The final issue that may affect our result is the reverse causality. More specifically, FDI must arrive before establishing BIT. Thus, FDI determines BIT signature. Toward this problem, putting BIT as exogenous may lead to strongly biased estimates.

To deal with a possible reverse causality between FDI and BIT signature or ratification, we choose to follow Bergstrand and Egger (2007), using "a lead in". The idea is to introduce in our estimation 4 year affect BIT ratification to test for "strict exogeneity". If the coefficient is statistically non significant, the reverse causality effect is not an issue.

Table 2.7 gives a summary of the estimates of lead effects in PPML FE. [19]. Following

19. results are from BIT signed between countries, similar results could be found on ratified BIT

Table 2.7 – Reverse causality

	(1) FDI stock
BIT	0.0727
	(0.86)
BIT lead	0.0259
	(0.31)
N	10619

t statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

these results, it is stated that the problem of reverse causality is not apparent, reinforcing our specification. More precisely, introducing a lead in BIT does not change significantly our results.

2.6 Conclusion

The proliferation of BIT has shaped the relation between investor country and the host country. This issue is crucial when we focus on states that suffer from inherent vulnerability. Focusing on this latter, this paper intends to investigate the relation between investment protection and vulnerability.

First, focusing on the protective nature of BIT, we find that not only BIT has a direct effect on FDI level, but the effect also works indirectly by providing a better economic environment, deterring various sources of vulnerability. This finding is in accordance with efforts from high-risk countries to contract more and more BIT.

Second, by differentiating between different phases of BIT, we find that in an earlier phase, BIT signal is not well understood. Despite signature of a BIT is a sufficient signal that may boost bilateral investment treaty, as it can be interpreted as a credible commitment effort from governments, the ratification phase, while being more binding, does not offer an additional incentive to invest.

Third, taking into account interactions with various sources of economic vulnerability, BITs seem to have a various marginal effect. Ratifications seem to a have negative marginal impact on economic concentration and share of agriculture. However, ratified BITs have a positive impact on production instability. Export instability is not affected by BIT status.

Fourth, assessing the complementary effect between BIT and EIA, a deeper economic integration does not seem a higher level of FDI. Non-reciprocal trade agreement and free trade agreement are investment boosting. Other forms of agreement (custom union or reciprocal trade agreement) do not enhance FDI. I justify this finding by the nature of these agreements and its relation : PTA non reciprocal is offering to a country a special regime in a special market, enhancing a one side access to a market and vertical investment as those investments originally sensible to risks ; Free trade agreement lowers tariffs on trade, thus enhances horizontal FDI, offering a larger market. However, we do not find any evidence of complementary effect through the interaction of these two dimensions. Contrary to the recent findings on the effect of too much BIT, there is no clear evidence of a dilution effect that drives out FDI in our case.

Our results are somehow quite restrained to our population focus on economically vulnerable states. A broader analysis differentiating the quality of BIT protection, as in Dixon and Haslam (2016) and Neumayer, Nunnenkamp, and Roy (2016) is needed to fully understand the effect of BIT.

2.A EVI Components

2.B Descriptive statistics and data description

2.B.1 data description

Variable	Description	Source
FDI_num	Inward Foreign direct investment in level	Bilateral FDI UNCTAD
Gravity control		
GDP_d	Host country's GDP	WDI
GDP_o	Investor country's GDP	WDI
DistW	Bilateral distance between pair of countries	CEPII
Lang	Common official language	CEPII
EVI		
POP	Population vulnerability index	Retrospective EVI FERDI
REMOT	Remoteness index	Retrospective EVI FERDI
XCON	Export concentration	Retrospective EVI FERDI
SHARE_AGRI	Agriculture share	Retrospective EVI FERDI
LECZ	Low elevated coastal zone	Retrospective EVI FERDI
DISASTER	Disaster index	Retrospective EVI FERDI
AGRI_INSTA	Agriculture Instability	Retrospective EVI FERDI
X_INSTA	Export instability	Retrospective EVI FERDI
Economic Agreements		
BIT	Bilateral investment treaties	Investment policy hub UNCTAD
EIA	Economic Integration agreements	Bergstrand's database
PTA	Preferential trade agreements	Bergstrand's database
FTA	Free Trade Agreements	Bergstrand's database
CU	Custom Unions	Bergstrand's database

2.B.2 descriptive statistics

Table 2.8 – Summary statistics

Variable	Mean	Std. Dev.	N
FDI_num	374.309	2391.451	25000
POP	43.039	30.229	24991
REMOT	57.134	21.763	24991
XCON	34.543	25.37	24991
SHARE_AGRI	27.066	23.673	24991
LECZ	19.878	24.517	24991
DISASTER	59.742	28.734	24991
AGRI_INSTA	30.873	28.311	24991
X_INSTA	25.002	20.41	24747

Chapitre 3

FDI and Aid analysis : structural economic vulnerabilities mitigation ?

3.1 Introduction

Having access to developing strategies to overcome domestic structure failures are issues well debated in the literature. FDI and aid emerge as preferred solutions as they are offering potential transfer of knowledge and support to economic growth to the host countries [1]. However, as the purposes of those two flows appear different in nature, limited attention were drawn to link the possible intertwined relation between them. As mentioned in Donaubauer, Meyer, and Nunnenkamp (2016), the relation between aid and FDI flow are ambiguous whether theoretically or empirically.

When positive effects of aid are expected as it enhances productive capabilities e.g. infrastructures (Selaya and Sunesen (2012), Donaubauer, Meyer, and Nunnenkamp (2016), Daude and Stein (2007) or Bénassy-Quéré, Coupet, and Mayer (2007)) ; arguments on the competing nature of aid against FDI are also apparent in the literature.

In fact, Harms and Lutz (2006), Economides, Kalyvitis, and Philippopoulos (2008) and Selaya and Sunesen (2012) highlighted the fact that aid may be harmful, crowding out private activity (domestic investment and FDI) into rent seeking behavior.

Most importantly, the view of a non-altruistic behavior of donors (by means economically interested in enhancing economic interests) puts an interesting figure of how donor countries manage those capital flows to a possible joint determination of aid and FDI. Indeed, Alesina and Dollar (2000), in their seminal paper, emphasize how the commercial interest of donor countries affect the allocation decision of Official Development Assistance (ODA henceforth). Berthélemy (2006) and Neumayer (2003) resolve this issue by categorizing the general pattern of givers and find differentiated effect of aid. From this perspective, ODA and FDI seem to follow an interesting pattern, depending on the commercial interest and political incentives of the donor country on the one hand, and the needs of the given countries on the other hand [2]. In fact, with the needs of a country, e.g. financing development structure, often come a counterpart relative to the procurement of goods and services directly related to donors. Besides, as stated in Cardwell and Ghazalian (2018), allocation of aid could be the "result of previous trading activity or an incentive for future activity". This assertion is especially true with Kimura and Todo (2010)'s findings, pointing out the possible "vanguard effect" of aid, in favor of the donor country and crowding out other partner countries. In this case, aid is used as political instrument to gain influences in a targeted economy.

1. other sources of capital flows could be interesting as remittances and portfolio investments. We focus on FDI and aid as soon as their the main source of willingness to invest in capital flows for developing countries. Also, because remittances are sometimes seen as used to another purpose, such as consumption (Nwaogu and Ryan, 2015)

2. The use of tied status of aid could illustrate this behavior.

Then, it becomes difficult to disentangle the purpose of flows [3] ; and becomes a challenging task when it comes with the mix of investment studies. Theoretically, this relation is rarely assessed. For example, Asiedu, Jin, and Nandwa (2009) and Jin and Zeng (2017) show that providing FDI and aid could be beneficial to overcome expropriation risk related to investment and equilibrium between aid and FDI is possible to optimize the relative loss due to country specific risk affecting a country. Selaya and Sunesen (2012) point out, with an empirical and theoretical model, how aid which focuses on physical capital could crowds out FDI ; and how aid building capabilities could be used as an investment enhancer.

As regards to these findings, our work would be in line with the idea of Asiedu, Jin, and Nandwa (2009), Kimura and Todo (2010) and Dabla-Norris, Minoiu, and Zanna (2015), using bilateral aid as in a determinant of FDI, and testing in the second hand the possible interrelation between these variables.

In the margins of these considerations, there also appears a more fundamental question : how these flows react to inherent risk. Fundamentally, the purpose of aid is to cope with handicaps plaguing growth potential of an identified country. Instead, FDI location depend heavily on factors possibly increasing investment costs. Mixing this view as in Akhtaruzzaman, Berg, and Hajzler (2017), Asiedu, Jin, and Nandwa (2009), Bandyopadhyay and Younas (2014), we extend this idea by taking into account another idea of risk : the risk to be hit by external shocks.

Therefore, our analysis takes into account the possible missing link between aid and FDI in a twofold manner. First, we want to prove that aid should mitigate various sources of risk affecting a country. As a measure of risk, we will rely on countries' structural vulnerability to be hit by external shocks. Second, we test the possible joint determination of aid and FDI as in Asiedu, Jin, and Nandwa (2009), which is as far as we know the only paper who deals with that issue. The difference is we introduce as in Dabla-Norris, Minoiu, and Zanna (2015) a bilateral analysis of this link relying on gravity and aid modeling. Working on bilateral data permits to have access to a large amount of data enhancing the precision of our inferences. In order to properly assess this link, we emit the hypothesis of donor's interested in using aid as a political instrument. Thus, we rely on theoretical frameworks of donors' motivation and do not expect necessarily a complementarity between aid and FDI.

Findings in this papers are also twofold. When theoretically, the nature of the relationship between aid and FDI could be assessed, there is no evidence that aid could directly influence the level of FDI. The mitigating effect of aid however seems apparent just within some forms of vulnerabilities.

3. This assumption is relatively done especially for bilateral aid. Multilateral Aid, by nature is less inclined to be affected by this phenomenon.

The paper is organized as the following. In section 2, we review how aid is allocated without avoiding the link between economic vulnerability and aid. Section 3 recall the theoretical frameworks. Section 4 introduce the empirical model and data. Section 5 and 6 test empirically the different hypothesis that we emit. Finally section 7 concludes the paper by recalling our main results and possible policy implications.

3.2 Aid allocation : A donors view

How development aid should be allocated is an issue with multiple facets in the literature. For instance, determination of how aid could be allocated to a country depends on two major imperatives : donors' interests and recipients' needs. Therefore, adjusting the tie to correspond to these imperatives comes at hand of a large debate.

When criteria to allocate multilateral aid are well-suited, bilateral aid allocation seems more policy oriented. Indeed, according to the United Nations, aid should follow three principles : effectiveness (by promoting growth and economic performance) [4], equity (emphasizing on social justice and equal opportunities for everyone), and transparency (i.e. accountable and clear statistics of ODA commitment and disbursement). These principles are at the heart of the multilateral aid agendas. Two strands of literature emerge from this vision.

On the one hand, ranging to the host countries perspective, the literature focused on how effective aid is. Consequently, this strand concentrates every question on growth analysis, the interlink between aid and growth (Collier and Dollar (2002), Nwaogu and Ryan (2015), or Guillaumont and Wagner (2014) among others), or the performance of aid allocation system (Guillaumont, McGillivray, and Wagner (2015), (Amprou, Guillaumont, and Jeanneney, 2007)). A good example could be with Burnside and Dollar (2000), where aid could be considered as an additional income from a country to another through a transfer ; but only effective with conditions. They showed from the use of a growth model that takes into account some institutional and policy distortions, that aid is only effective when a good policy exists to lead growth.

On the other hand, the effectiveness and possible harmful drawbacks of aid is largely discussed in the literature ((Rajan and Subramanian, 2011) or Temple and Van de Sijpe (2017) when the donors' pattern of aid giving is highly questioned. In fact, Alesina and Dollar (2000) pointed out the fact that bilateral aid is more influenced by donors' interest than multilateral aid, which is more driven by the income level, the Population size and the policy. From this departure, a large strand of authors have questioned the behavior. As showed

4. Under this assumption some criteria are necessary : good governance as a core criterion, and economic vulnerability.

by Berthélemy (2006), the majority of Development assistance is under whether altruistic or economic interested behavior. Altruistic donors seem to maximize the collective welfare of the recipient and "egoistic" prefer recipients with lower tariff rate on import (Lalini et *al*, 1997). It is also known, that altruistic behavior , is especially organized through multilateral cooperation (Neumayer, 2003) ; and the economic interested perception is driven through bilateral cooperation to increase political or economic presence.

Finally, when the purpose of aid is to permit a reduction of poverty, doubts on donors motives come with an important idea : is aid only reducing burdens affecting developing countries or is it just to attain a commercial interest. Our idea lies in this category, by casting doubts on the exclusively mitigating effect of bilateral aid on weaknesses of developing countries. Interestingly, one concept that we can use to measure these weaknesses are available in the concept of vulnerability. When researchers find somehow evident a positive response of countries in favor of vulnerability reduction via aid, the donor's interest is rarely assessed in the literature. Assessing carefully this idea could be done via an investigation of the bilateral nature of aid. One important representation is done by Gradeva and Martínez-Zarzoso (2016), assessing the link via aid for trade and the level of export in a country. In the literature of FDI, the paper of Kimura and Todo (2010) is an interesting application of the advantages procured by aid in the bilateral relation. However, these authors focus exclusively on other measure of risk rather than focusing directly the intertwined relation of aid, vulnerability and FDI. In line with Guillaumont and Wagner (2014) (among others), our take is to emphasize this link in front of a gravity modeling, not focusing on the effectiveness of aid , but rather focusing on the link between aid and FDI in front of vulnerability assessment.

3.3 Two way of modeling

An important figure in the recent literature is to determine the nature of the link between FDI, Aid and Risk. In this section, we want to address and recall two seminal paper treating this link. In the first subsection, I recall the model of Selaya and Sunesen (2012), a solow type model. In the second subsection, we turn our focus on the model of Bandyopadhyay and Younas (2014), which address this issue in a different manner but is very useful to introduce our empirical intuitions.

3.3.1 A model of FDI Risk and Aid : A solow type model

In this section, We recall the model of Selaya and Sunesen (2012) which is, as far as we know, one of the recent model who addresses the issue of the related link between FDI, Aid

and risk. As baseline specification, the classical form of a solow growth model is used :

$$y = Ak^{\alpha} \tag{3.1}$$

where y is the output per capita and k the level of capital per capita. A is the exogenous factor which represents the productivity. To justify the use of foreign capital, they considered model is a small open economy, receiving capital from the rest of the world and not controlling the interest rate.

Here, differentiation is made to take into account two forms of aid : aid affecting the factors of productivity (TFP) [5] and aid affecting directly the capital per capita aid_k affecting thus only the level of capital. In fact $aid = aid_k + aid_a$.

Formally, the capital accumulation rule can be expressed as :

$$k = sy + fdi + aid_k - (n + \delta)k \tag{3.2}$$

where sy represents domestic saving, n and δ represents the Population growth level and the capital depreciation factor.

To determine the level of interest rate, we derive the first order condition. In this model, the level of interest rate is affected by a risk premium.

$$r + \sigma = MPK - \delta = \alpha A k^{\alpha - 1} - \delta \tag{3.3}$$

The level of capital per capita is here affected by the level of σ an idiosyncratic risk (as the term of Selaya and Sunesen) [6]. For our case, this idiosyncratic risk could be represented by any form of factor increasing the difference of interest rate between the rest of the world r and the host country's interest rate.

At steady state, accumulation of capital is nullified, giving a solution to the relation between aid and FDI, following this relation :

$$fdi = -sy - aid_k + (n + \delta)k \tag{3.4}$$

More importantly, the level of capital at the steady state could be easily resolved by :

$$k^* = [\frac{\alpha A}{r + \sigma}]^{\frac{1}{1 - \alpha}} \tag{3.5}$$

5. the part of aid affecting the Total factor productivity aid_a enters in the equation of our exogenous factor A as a second components of our innovation factor.

6. The present version is the model with imperfect mobility of capital, detailed in Selaya and Sunesen (2012).

To analyze how fdi is affected by any changes in aid, differentiation is necessary. Therefore, fdi is differentiate according to aid_k and aid_a.

From this model, any changes in the level of aid targeted as a complementary physical capital crowds out the level of investment as $\frac{\partial fdi}{\partial aid_k} = -1$. On the other hand, studying the sign of the differentiated terms of $\frac{dfdi}{daid_a}$ is quite ambiguous. In fact, aid_a affects both y and k. In a formal manner, one has to study this relationship :

$$\frac{\partial fdi}{\partial aid_a} = -s\frac{\partial y}{\partial aid_a} + (n+\delta)\frac{\partial k^*}{\partial aid_a} \tag{3.6}$$

The sign of this relation is ambiguous as sy and k react positively to capability building, conducting to an indeterminate relation of fdi and aid_a sign (depending on s, n and δ).

Therefore, the relationship between aid and fdi is not determined.

Despite those theoretical reserves, according to empirical studies, aid invested in physical capital should deter domestic and foreign investment (acting as substitute to investment and dependence to receiving country). On the contrary, building new capabilities should boost of FDI, in an initial level ; but this effect may enhance the domestic saving and deters the need of foreign capital.

Furthermore, in a country where the risk is considered nonexistent, σ is equal to zero and in a country with high risk, capital is deterred.

One interesting thing is then to investigate how the rise in risk premium affects the level fdi. Formally, one has to investigate the relation $\frac{\partial fdi}{\partial \sigma}$ and the relation $\frac{\partial \sigma}{\partial aid}$.

Within this model, the risk premium doesn't affect the level of aid affected to physical capital. However, changes in the level of risk premium affect aid toward capability building. More importantly, from this view, host country's specific factors which translated into a reevaluation of the risk affecting a country is detrimental to the level of fdi, in the sense that it burdens the rise of capital k and y.

By the chain rule :

$$\frac{\partial fdi}{\partial aid} = \frac{\partial fdi}{\partial \sigma} * \frac{\partial \sigma}{\partial aid_a} = -s\frac{\partial y}{\partial aid_a} + (n+\delta)\frac{\partial k^*}{\partial aid_a} - 1 \tag{3.7}$$

From equation 3.6, let one derive two relations to study the sign of $\frac{\partial \sigma}{\partial aid_a}$. First as derivative :

$$\frac{\partial k}{\partial \sigma} = -(\alpha A)^{1/1-\alpha}[\frac{1/1-\alpha}{(r+\sigma)^{\frac{2-\alpha}{1-\alpha}}}] < 0 \tag{3.8}$$

From the work of Selaya and Sunesen (2012), the relationship to $\partial k/\partial aid_a$ is positive. One

can infer that $\partial\sigma/\partial aid_a$ is negative. More precisely, an increase in aid_a marginally decreases the level of σ.

Second, let's derive :

$$\frac{\partial y}{\partial \sigma} = (Ak^{\alpha})' = -(\frac{\alpha A}{(1-\alpha)(r+\sigma)})^{\frac{1}{1-\alpha}} < 0 \tag{3.9}$$

As we already stated in the relation above that $\partial y/\partial aid_a$ is positive, $\dfrac{\partial \sigma}{\partial aid_a}$ is negative using the chain rule.

As soon as one consider here a solow growth model, with a decreasing marginal return of capital, α should necessarily satisfy this condition $0 < \alpha < 1$.

One important finding that should be retained here is the deterrent effect of risk premium (which encompasses different factors affecting the mobility of the capital between countries) on the level of y and k and the beneficial effect of aid in reducing the level of risk. However, as stated in Selaya and Sunesen (2012), the link between aid_a and fdi is still undetermined, as soon as an increase in the level of capabilities reduces the need of FDI.

Insights from this first model is necessary to understand the complex relationship between the level of FDI and the level of aid. More importantly, it also highlights the need of a empirical insights to build an idea of how the perception of risk could affect the above mentioned relationship.

3.3.2 A model of FDI Risk and Aid : Theoretical specification

In this section, we decide to address the link between FDI, Risk and Aid, in an alternative way. Following Asiedu, Jin, and Nandwa (2009) and Bandyopadhyay and Younas (2014) , we take a model of FDI, Risk and Aid by considering a firm operating in a host country with a profit level expressed by :

$$\pi = (1-\theta)f(k) - rk, 0 < \theta < 1, f' > 0, f" < 0 \tag{3.10}$$

where θ represents the fraction of output lost by the firm due to some risks. The risks here are considered cost faced by firm operations in its host country. Let θ be a sum of

$$\theta = \theta(\gamma, E), \theta_{\gamma} > 0, \theta_E < 0, \theta_{EE} > 0 \tag{3.11}$$

where γ represents factors that alleviate risk and E host government's effort to reduce risk.

For simplicity, we take that form of risk which is easily understandable.

We also assume that the host government receive aid A from foreign nations. The host

government's payoff is

$$V = \delta(1-\theta)f(k) + A - E \tag{3.12}$$

Following Asiedu, Jin, and Nandwa (2009), we assume that aid mitigate risk, and aid take two forms : general aid (considered altruist) and oriented aid [7] related to government counter-risk effort (i.e. to build resilience). This could be represented as :

$$A = \beta + \eta E, \beta > 0, 0 < \eta < 1 \tag{3.13}$$

where β is general Aid and ηE is oriented Aid.

Combined with the host government payoff, we have :

$$V = \delta(1-\theta)f(k) + \beta + (\eta - 1)E \tag{3.14}$$

We now consider a two-stage game, where the host government chooses a level E effort in stage 1 and the foreign firm chooses k in stage 2. Now, to solve the model, we use backward induction.

The first order condition in stage 2 is given by

$$(1-\theta)f'(k) - r = 0 \tag{3.15}$$

the strict concavity of $f(k)$ drives us to accept the second-order condition

$$k = k(\theta), \frac{dk}{d\theta} = k_\theta = \frac{f'}{(1-\theta)f"} < 0 \tag{3.16}$$

This last equation means that the level of risk θ reduces the value of FDI expressed by k. Now, we focus on the aid-recipient country's choice of reducing risk in stage 1. Substituting eq (3.11) and eq (3.16) into eq (3.14) we have :

$$V(E, \delta, \gamma, \beta, \eta) \equiv \delta[1 - \theta(\gamma, E)]fk[\theta(\gamma, E)] + \beta + (\eta - 1)E \tag{3.17}$$

we find the optimal choice of risk reducing effort from :

$$\frac{\partial V}{\partial E} = V_E(E; \gamma, \eta) = \delta\theta_E[(1-\theta)f'k_\theta - f] + \eta - 1 = 0 \tag{3.18}$$

7. We prefer this concept referring to the freedom to adopt a policy (or not) ; and to emphasize the recent resurgence of a more development oriented nature of "tying" status of a category of aid.

where second order condition can be shown to be satisfied. Equation(3.14) defines :

$$E = E(\gamma, \eta) \tag{3.19}$$

Thus, by substituting eqs(3.11) and (3.17) into eq(3.16), we have

$$k = k[\theta\{\gamma, E(\gamma, \eta)\}] = k(\gamma, \eta) \tag{3.20}$$

Now, given eq(3.20), we can see that the level of FDI depends on the exogenous level of γ (inherent risk) and η the risk reducing parameter of aid (oriented aid). Here, we can explore the marginal effect of the existing risk $\frac{dk}{d\gamma}$ and at the same time the marginal effect of the oriented aid affecting the level of risk ($\frac{dk_\gamma}{d\eta}$).

Intuitively, we can support the idea that a shift in the level of risk drives to a diminution of the expected level of FDI. Besides, we suppose that in a presence of oriented aid, the marginal effect of an increase in the risk level will be mitigated and, by ricochet, could enhance the FDI level.

From the two model, we can easily figure out some important facts. First, the overall effect of aid on FDI is not easily determined. Second, the hypothesis of risk reducing nature of aid is partially resolved by the models but need necessarily a more in depth analysis highlighting different categories of risk affecting a country.

When, the majority of the literature on FDI is focused on the detrimental effect of expropriation (Asiedu, Jin, and Nandwa (2009),Hajzler (2014), Selaya and Sunesen (2012)) or institutional distances (Bénassy-Quéré, Coupet, and Mayer (2007), Donaubauer, Meyer, and Nunnenkamp (2016)), the structural nature of some components of risk should be considered to highlight developing countries' situation. Exogenous situations, more precisely, handicaps (export diversification, agriculture concentration, insularity...) are factors that are independent to country's policy and could serve as important. Guillaumont and Chauvet (2001) and Guillaumont (2009) pointed out the effect of aid may differ, depending on the nature of risk (exogenous or policy-induced). In fact, as already stated in the models above, the effect could be mixed with a limited effect of aid when countries suffer from an inappropriate institutions or more effective with a stabilizing impact on country's inherent weaknesses.

3.3.3 A possible joint determination

Up until now, one main hypothesis of the models is the strict exogeneity of the level of Aid. An interesting feature could be introduced in these models by introducing a form of joint determination between aid and FDI. The purpose of this section is to initiate a possible joint

determination between the level of *aid* and *fdi*, by adding the hypothesis of a cautiousness of the donors (i.e. interested in the level of FDI and aid given to a partner country).

An interesting paper on this relationship could be found in the paper of Jin and Zeng (2017), exposing how the interplay between foreign countries and host countries is determined. Not only host countries' degree of impatience (leading to expropriation) are important to aid provision but also to the level of FDI. Other factors are necessary to determine the joint determination of aid and FDI provision as the existence of a commitment technology ensuring a security to the investment [8]. Finally, the level of development of country is necessary to justify the need of aid measure. An insights from this finding could found in Asiedu, Jin, and Nandwa (2009), by the use of a simultaneous equation [9]. These authors found that aid, for a development view, follow a general scheme of poverty reduction. Moreover, and more specifically, macroeconomic instability (measured by inflation for them) is not a significant determinant of bilateral aid (when the contrary is essential to the multilateral regime of Aid). Again this finding enforce our investigation on different measure of potential measure of economic instabilities.

Interestingly, criteria detailed in the paper to find an equilibrium level of FDI and aid has been investigated in Akhtaruzzaman, Berg, and Hajzler (2017) by a focus on how important expropriation is a major concern in determining the final level of FDI.

3.4 Data and Empirical model

3.4.1 Model specifications

Following the line of the analysis on determinants of FDI, our choice is to implement a gravitational approach. This approach, classic in the literature of bilateral flows, is an important tool when studying the effect of policies in an international trade view.

The FDI version of gravity estimation is broadly discussed in Kleinert and Toubal (2010). Some interesting applications of gravity for FDI could be found in Bénassy-Quéré, Coupet, and Mayer (2007), Head and Ries (2008) and Martínez-San Román, Bengoa, and Sánchez-Robles (2016). On the relationship between aid and FDI, one interesting example could, as already stated, in Kimura and Todo (2010).

The basic idea is that countries' bilateral flow are determined by an newtownian logic i.e. similarity in the size of economies and distance related to these economies. It is then

8. One could think of the use of Bilateral investment treaties with Investment dispute settlement disputes clauses, or a regulatory rule as the measure of rule of law

9. alternative to the simultaneous equation is the use of an instrumentation strategy, mostly via the Blundell and Bond (1998)

straightforward to think of frictions affecting this relationship (policy measures and natural trade costs).

Formally, the model is expressed as :

$$X_{ij} = (\frac{Y_i E_j}{Y_w})(\frac{\tau_{ij}}{P_i P_j})^{1-\sigma} \tag{3.21}$$

This structural form of the gravity model, à la *Anderson and vanWincoop*, is more elaborated than stated. Indeed, it takes into account relative prices between countries P_i P_j and costs related to trade (investment) τ_{ij} (various measure of distance : geographical, political, historical, etc.). Interestingly, this structural form emphasize that to properly estimate the variation of the level of flows between countries, one has to take into account the relative frictions to other country partners. Known as "multilateral resistance terms", relative prices are not directly observable.

The empirical estimation of the structural gravity models comes at hand with alternative solutions. One way to resolve the Equation 3.21 is to log-linearize the theoretical specification. However, it comes with an enormous drawbacks of dropping out zeros to the dependent variable, causing a possible important loss of information. The first solution to this add a small number, before the log transformation (as done in Bénassy-Quéré, Coupet, and Mayer (2007)). Latter criticized of being atheoretical, it is just a simple trick to maintain zeros in the database. To partially include the multilateral resistance terms, the easiest way is the use of fix effect Fally (2015) [10].

To conjugate the need of a theoretically adjusted gravity estimation without the loss of information contained in zero flow, an alternative is to estimate the multiplicative form of with a pseudo-poisson maximum likelihood estimator (PPML henceforth). With the justification of Silva and Tenreyro (2006), the only condition to meet is the conditional mean to be proportional to the conditional variance ; and comes with the advantage of being robust to heteroskedasticity. The flexibility of this estimator and the easiness to adjust the different gravity models' need made this estimator the preferred estimator among gravity practitioners.

Accordingly, we implement our FDI analysis (Equation 3.21) and follow various specifications to test our different hypothesis. First, I evaluate the direct effect of aid by proceeding as follows :

$$FDI_{ijt} = \alpha_1 + \beta_1 GRAVDATA + \beta_2 RISK_j + \beta_3 ODA_{ij} + b_t + n_{ij} + \epsilon_{ijt} \tag{3.22}$$

10. An alternative to the use of distance and cost adjusted to multilateral resistances. Authors like Baier and Bergstrand (2009) developed gravity corrected estimands, integrating the need of structurally adjusted gravity. However, this still comes with the drawback of dropping zeros from the database.

where FDI_{ijt} is either $lnFDI$ in an ordinary least square ; or $FDIlevel$ in a pseudo-poisson specification. $GRAVDATA$ is a set of control variables related to a classical gravity model. $RISK$ refers to the vulnerability level captured through the Economic vulnerability index. b_t and n_{ij} refers respectively to time fix-effect and country-pair fix effects. ODA_{ij} is the natural logarithm of bilateral ODA. ϵ_{ijt} refers to a random error term. In this form, we can disaggregate the level of EVI into its own sub-components to capture the various sources of structural vulnerabilities.

Second, another specification is used to account for interaction between variables :

$$FDI_{ijt} = \alpha_1 + \beta_1 GRAVDATA + \beta_2 RISK_j + \beta_3 aid_{ij} + \beta_4 (aid_{ij} * RISK) + a_i + b_t + n_{ij} + \epsilon_{ijt} \tag{3.23}$$

Interaction terms between variables are added to capture the indirect effect of aid on FDI level through risk mitigation. We expect from this relationship to emphasize on the stabilizing impact of aid mentioned in Guillaumont and Wagner (2014).

In all these specifications, we use ordinary least square and fix effect estimations to correct some heterogeneity. Another specification is added to the analysis, to take into account the existence of zero values and heteroscedasticity, the pseudo-poisson maximum likelihood (PPML henceforth), as suggested by Silva and Tenreyro (2006). We take into account possible omitted variable and partially endogenous variables by using a country pair fix effect (Silva and Tenreyro (2006), Fally (2015)). Finally, to take into account the multilateral resistance terms, the literature suggests adding country-time fix effects to time fix effect, to perform a structural gravity model as pointed out by Anderson and Van Wincoop (2001). However, I decided to follow Busse, Königer, and Nunnenkamp (2010) and Bergstrand and Egger (2007) and Erdogan (2017) ; and acknowledge that the multilateral resistance terms are "moving slowly". Thus, these terms are essentially captured by the time fix effect. This assumption is also made due to our limited time span, preserving a large amount of our database.

3.4.2 Data

Our variable of interest is the inward bilateral FDI stock taken from the UNCTAD database [11]. The choice of stock instead of flows in our data is driven by Bénassy-Quéré, Coupet, and Mayer (2007) and Sousa and Lochard (2011) on a relative stability of this data (as the use of bilateral FDI flows is suffering from high volatility). Moreover, it permits to eliminate possible negative flows.

As independent variables, it can be divided into 2 categories. The first category of variables is related to classical control variables for a gravity model : GDP, distance, colonial link,

11. http://unctad.org/en/Pages/DIAE/FDI%20Statistics/FDI-Statistics-Bilateral.aspx

language. These variables are taken from Mayer and Zignago (2011), available on the CEPII website [12]. The GDP of the resource and host country are controlled to measure the market size and correspond to the production Y_i and E_j from the structural equation 3.21. Others gravity controls are proxies of costs related to investment τ_{ij}, usually captured via the geodesic distance, the language distance and the colonial link.

The second set of variables are related to the level of risk [13]. Thus, to measure the vulnerability, I use FERDI's Economic Vulnerability Index (EVI) [14]. This variable (and it's subindexes) focuses only on structural vulnerabilities affecting states, which are our interest proxy of risk [15]. By construction, it is possible to divide this index into its sub-components. The first subcomponent is exposure to external shock which aims to capture weaknesses of a country facing exogenous shocks. The second sub-component focuses on the nature of the shock hitting an economy and its magnitude (natural shock or trade shock).

Turning now to our interest variable, bilateral official development assistance, our main source is the Aiddata project [16], which is as far as we know, one of the most broadly accessible database on development finances data. Within this database, we can have access to various information on the nature of aid (oriented or unoriented, multilateral or bilateral, official or unofficial, etc.). We follow the work of Dabla-Norris, Minoiu, and Zanna (2015) by focusing on aid commitment as we seek to capture how donors behavior may reflect their policy behavior on aid [17]. To maintain the maximum possible ODA commitment, we transform our ODA variable according to Dabla-Norris, Minoiu, and Zanna (2015) with :

$$ODA_{ij} = sign(ODAcommitment_{ij}) * ln(1 + ODAcommitment_{ij}) \tag{3.24}$$

When Selaya and Sunesen (2012), Gradeva and Martínez-Zarzoso (2016) (among others) may use difference in aid purpose to uncover the relative aim of aid ; we decide to not follow them for the following reason. As we have seen theoretically, the interplay between aid and fdi is inconclusive. As one aim of the analysis is to show how impediment of FDI react to aid provision, adding this specified flow would be informative but not fully capture the overall

12. http ://www.cepii.fr/CEPII/en/

13. Alternative measures is used in the literature as country risk level as the *International Country Risk Guide* by the PRS Guide as in Asiedu, Jin, and Nandwa (2009) or Hajzler (2014) (among others).

14. See Cariolle (november 2013) for a construction of a retrospective index, and Guillaumont (2009) for the construction of the EVI and variable choice.

15. alternative methods of this index which uses different weight and aggregation methods are available in the literature, but this index is, as far as we know, the easiest and most practical way to measure vulnerabilities resulting in a large use of this dataset in the literature.

16. http://aiddata.org/ is an open source project based on official and non-official international development from various institutions

17. We also take into account aid disbursement as robustness with no changes in the results. Available in the appendix 3.B.

effect of aid measures [18]. Not specifying use of aid may then be more useful to have a scope of the overall impact than specifying. However, we are aware of possible contradicting impact of aid affecting the economy resulting in a non significant overall impact.

In sum, our database has 125 countries with 34 partner countries with a time span going from 2003 to 2011, as our work is limited by the data availability to developing and highly vulnerable countries. Potentially, we could uncover up to 23 000 observations, however as pointed out in Liu and Tang (2018), the PPML process will drop out all zero outcomes and singleton observations, reducing our database.

3.5 Results

3.5.1 Bilateral Aid

Table 3.1 shows the result of an impact of Aid on FDI. Contrarily to Kimura and Todo (2010), we find that bilateral Aid do not compete with FDI (as aid falls insignificant with OLS fix effect and PPML).

OLS and OLS with country pair and time fix effects, gives similar results. Not all measure of structural vulnerabilities deter the level of FDI. More specifically, Remoteness tend to decrease the level of FDI when we control the relation between countries (with country-pair fix effects). Instead, export concentration may be investment enhancing as FDI in one focused sector tend to develop export concentration. When argument of beneficial effect of diversification in export on FDI could be argued Gamberoni (2007), defying comparative advantages, in the means of diversifying export are heterogeneous among countries related to Lectard and Rougier (2018). More importantly, with OLS and OLS fix effect, we find that Bilateral ODA commitment tend to compete with FDI, crowding out the effect of FDI. However, it is worth noting that OLS and OLS fix effect results, even may be biased, show a negative and significant sign. As our preferred specification is the PPML specification, we will stick on results from this specifications.

Following PPML specification, we find that aid flows in general do not increase the volume of FDI between countries. This finding is in line with Donaubauer, Meyer, and Nunnenkamp (2016), who suggest that only targeted aid are FDI enhancing by providing enough infra-structure, reducing risks on investment. Most importantly, we loose significance from OLS and OLS fix effect part. Moreover, Market structure and Market size measure of vulnerability seem to be robust deterrent of FDI level, thus, confirming our initial thoughts on deterring

18. Controls from spillover effect of aid may be an interesting way to control the other possible propagation effect of aid.

Table 3.1 – Bilateral Aid impact on FDI

VARIABLES	(1) Log of FDI stock	(2) Log of FDI stock	(3) Level of FDI stock
lnGDP_o	0.0298	1.815***	0.612***
	(0.0738)	(0.306)	(0.211)
lnGDP_d	0.978***	0.466***	0.539***
	(0.0904)	(0.152)	(0.0990)
Log of distance	-0.753***		
	(0.207)		
	(1.024)		
language	0.242		
	(0.299)		
colony	2.456***		
	(0.301)		
Population	0.0336***	-0.0298	-0.0683***
	(0.00720)	(0.0336)	(0.0205)
Remoteness	0.0236***	-0.0240**	-0.0224***
	(0.00502)	(0.0109)	(0.00634)
Export Concentration	-0.00232	0.00565	7.93e-05
	(0.00374)	(0.00430)	(0.00383)
Agriculture Share	0.00709	-0.00612	-0.0357***
	(0.00572)	(0.0113)	(0.0119)
Low Elevated Coastal Zone	0.00526	-0.0444**	0.168
	(0.00354)	(0.0205)	(0.277)
Disaster	-0.00928***	0.00297	0.00550**
	(0.00305)	(0.00359)	(0.00270)
Export Instability	0.000205	0.00183	0.00307
	(0.00435)	(0.00643)	(0.00704)
Agriculture Instability	-0.00306	-0.000817	0.00441
	(0.00355)	(0.00369)	(0.00464)
Aid_ij)	0.0802***	0.00240	-0.00242
	(0.00738)	(0.00376)	(0.00232)
Constant	-17.80***		
	(3.353)		
Observations	8,871	8,706	10,544
R-squared	0.298	0.927	
Number of dyad			1,523

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

effect of structural vulnerability.

3.5.2 Interaction

Table 3.2, Table 3.3 and Table 3.4 show the results of our various specifications (OLS, Fix effect OLS and Fix effect PPML respectively).

Interesting findings emerge when we analyze the interactions with our vulnerability indexes.

Almost in all specifications whether in OLS or OLS fix-effect, the presence of aid deters the negative outcome of vulnerabilities to investment. Vulnerability related to Population (which captures the tightness of the market), Market structures (export concentration, agricultural sector share), and finally related to trade shocks (i.e. instability of export and instability of agriculture) are marginally deterred by aid. Those findings are in favor of arguments with a relative necessity of aid. In other words, apart from being an important source of capital flow, aid is capacity building. Translating it the context of our analysis, Aid not only is an additional source of capital but reduces marginally the deterring effects of countries structural vulnerabilities.

On the contrary, in every estimation, the level of Remoteness, Disaster and vulnerability related to low coastal elevated zone location are not deterred. More specifically, bilateral aid in general have hard time to mitigate non economic structures. Besides, as cited by Donaubauer, Meyer, and Nunnenkamp (2016), untargeted aid, are ineffective in terms of risk reduction, raising some points on how could we Aid be targeted to ensure effectiveness.

On the PPML estimation, every interaction term falls insignificant. To this specification, the presence of bilateral aid is not deterring the vulnerability level. This finding is in line with the non-significant direct sign of bilateral Aid in specification. Most importantly, it emerges that Aid determinant of FDI, is ineffective as a policy tool. This is in contrast with the latest study on FDI and Aid relation who finds a vanguard effect of Aid on FDI (Kimura and Todo, 2010). More important, we confirm the relative the inconclusive relationship of aid and FDI.

The interaction between aid and risk even though non significant are all positive apart from agriculture share. Casting doubt on these insignificant result, we decide to follow on an test if a default in consideration of aid could be beneficial and consistent to the following purpose of the analysis.

3.5.3 Aid as a transfer

In this section, we provide an empirical analysis of the effect of considering Aid as transfer on the level of FDI.

TABLE 3.2 – OLS interaction

VARIABLES	(1) Log of FDI stock	(2) Log of FDI stock	(3) Log of FDI stock	(4) Log of FDI stock	(5) Log of FDI stock	(6) Log of FDI stock	(7) Log of FDI stock	(8) Log of FDI stock
lnGDP_o	0.299***	0.292***	0.296***	0.294***	0.293***	0.294***	0.293***	0.295***
	(0.0154)	(0.0149)	(0.0153)	(0.0151)	(0.0149)	(0.0150)	(0.0151)	(0.0152)
lnGDP_d	0.0589***	0.0389**	0.0471**	0.0304	0.0435**	0.0525**	0.0726***	0.0395**
	(0.0212)	(0.0192)	(0.0200)	(0.0193)	(0.0196)	(0.0210)	(0.0211)	(0.0196)
Log of Distance	-0.147***	-0.177***	-0.186***	-0.181***	-0.179***	-0.179***	-0.162***	-0.188***
	(0.0392)	(0.0380)	(0.0391)	(0.0388)	(0.0378)	(0.0371)	(0.0377)	(0.0391)
language	0.131**	0.225***	0.195***	0.215***	0.225***	0.218***	0.188***	0.203***
	(0.0509)	(0.0503)	(0.0517)	(0.0522)	(0.0503)	(0.0496)	(0.0504)	(0.0521)
colony	0.147*	0.150*	0.125	0.116	0.148*	0.156*	0.154*	0.124
	(0.0790)	(0.0858)	(0.0851)	(0.0889)	(0.0845)	(0.0833)	(0.0853)	(0.0862)
Population	-0.0116***	-0.00523***	-0.00440***	-0.00575***	-0.00476***	-0.00462***	-0.00375**	-0.00516***
	(0.00170)	(0.00149)	(0.00152)	(0.00151)	(0.00154)	(0.00155)	(0.00153)	(0.00150)
Remoteness	0.00165*	0.00195	0.00186**	0.00194**	0.00209**	0.00218***	0.00294***	0.00190**
	(0.000871)	(0.00151)	(0.000873)	(0.000869)	(0.000856)	(0.000836)	(0.000874)	(0.000867)
Export Concentration	0.000907	8.90e-05	-0.00424***	-0.000163	0.000120	0.000360	0.000104	0.000663
	(0.000742)	(0.000788)	(0.00133)	(0.000809)	(0.000781)	(0.000782)	(0.000795)	(0.000759)
Agriculture Share	0.00691***	0.00633***	0.00631***	0.000173	0.00647***	0.00653***	0.00713***	0.00630***
	(0.00120)	(0.00116)	(0.00113)	(0.00180)	(0.00116)	(0.00118)	(0.00118)	(0.00113)
Low Elevated Coastal Zone	0.00119*	-0.00116*	-0.000806	-0.00137**	-0.00243**	-0.000860	0.000101	-0.000861
	(0.000710)	(0.000668)	(0.000685)	(0.000683)	(0.00116)	(0.000676)	(0.000710)	(0.000677)
Disaster	0.00684***	0.00689***	0.00684***	0.00735***	0.00687***	0.00941***	0.00607***	0.00702***
	(0.000703)	(0.000671)	(0.000676)	(0.000688)	(0.000666)	(0.00120)	(0.000687)	(0.000683)
Export Instability	-0.00101	-0.00159**	-0.00176**	-0.00204***	-0.00142**	-0.000678	-0.00592***	-0.00175**
	(0.000677)	(0.000695)	(0.000703)	(0.000713)	(0.000701)	(0.000726)	(0.000949)	(0.000710)
Agriculture Instability	-0.00126	2.87e-05	-0.000466	0.000199	3.33e-05	-0.000164	-0.000233	-0.00729***
	(0.000816)	(0.000903)	(0.000882)	(0.000920)	(0.000889)	(0.000888)	(0.000883)	(0.00150)
aid_ijt	-0.118***	-0.0962***	-0.107***	-0.107***	-0.0985***	-0.0794***	-0.109***	-0.107***
	(0.00464)	(0.00631)	(0.00451)	(0.00429)	(0.00383)	(0.00543)	(0.00423)	(0.00421)
aid_ijt *Population	0.000911***							
	(8.85e-05)							
aid_ijt *Remoteness		2.29e-06						
		(9.84e-05)						
aid_ijt *Export Concentration			0.000441***					
			(9.59e-05)					
aid_ijt *Agriculture Share				0.000494***				
				(0.000102)				
aid_ijt *Low Elevated Coastal Zone					0.000144			
					(9.47e-05)			
aid_ijt *Disaster						-0.000275***		
						(8.14e-05)		
aid_ijt *Export Instability							0.000773***	
							(0.000102)	
aid_ijt *Agriculture Instability								0.000571***
								(9.51e-05)
Constant	-7.566***	-6.794***	-6.912***	-6.497***	-6.905***	-7.332***	-7.759***	-6.678***
	(0.772)	(0.707)	(0.728)	(0.714)	(0.713)	(0.767)	(0.758)	(0.721)
Observations	8,871	8,871	8,871	8,871	8,871	8,871	8,871	8,871
R-squared	0.245	0.229	0.233	0.232	0.230	0.231	0.237	0.235

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.3 – Fix-effect OLS

VARIABLES	(1) Log of FDI Stock	(2) Log of FDI Stock	(3) Log of FDI Stock	(4) Log of FDI Stock	(5) Log of FDI Stock	(6) Log of FDI Stock	(7) Log of FDI Stock	(8) Log of FDI Stock
lnGDP_o	2.222***	2.364***	2.295***	2.265***	2.358***	2.355***	2.243***	2.203***
	(0.312)	(0.314)	(0.312)	(0.314)	(0.313)	(0.313)	(0.310)	(0.315)
lnGDP_d	0.614***	0.729***	0.790***	0.778***	0.717***	0.715***	0.668***	0.768***
	(0.172)	(0.174)	(0.175)	(0.174)	(0.174)	(0.174)	(0.173)	(0.175)
Population	0.0185	0.0508	0.0407	0.0519	0.0500	0.0489	0.0307	0.0481
	(0.0353)	(0.0360)	(0.0357)	(0.0361)	(0.0359)	(0.0361)	(0.0358)	(0.0355)
Remoteness	-0.00791	-0.0284**	-0.0216*	-0.0302**	-0.0290**	-0.0281**	-0.0217*	-0.0240*
	(0.0129)	(0.0132)	(0.0130)	(0.0132)	(0.0134)	(0.0132)	(0.0131)	(0.0132)
Export Concentration	0.0103**	0.00998**	-0.00168	0.00685	0.00969**	0.00961**	0.00913*	0.00779
	(0.00483)	(0.00488)	(0.00531)	(0.00492)	(0.00489)	(0.00488)	(0.00489)	(0.00487)
Agriculture Share	0.00128	0.00707	0.0102	-0.0158	0.00741	0.00772	0.00637	0.0107
	(0.0127)	(0.0129)	(0.0129)	(0.0124)	(0.0129)	(0.0129)	(0.0128)	(0.0127)
Low elevated coastal zone	-0.00776	-0.0494*	-0.0409*	-0.0553*	-0.0494*	-0.0491*	-0.0349	-0.0578**
	(0.0241)	(0.0268)	(0.0243)	(0.0316)	(0.0271)	(0.0271)	(0.0246)	(0.0266)
Natural Disaster	0.00709	0.00847*	0.00758*	0.00749*	0.00836*	0.00906**	0.00647	0.00786*
	(0.00442)	(0.00439)	(0.00437)	(0.00438)	(0.00439)	(0.00459)	(0.00435)	(0.00447)
Export Instability	0.00133	0.00502	0.00560	0.00658	0.00463	0.00451	-0.0188**	0.00727
	(0.00741)	(0.00757)	(0.00745)	(0.00752)	(0.00758)	(0.00758)	(0.00847)	(0.00745)
Agriculture Instability	0.00135	0.00283	0.00334	0.00117	0.00291	0.00300	0.00289	-0.0134***
	(0.00407)	(0.00418)	(0.00420)	(0.00410)	(0.00416)	(0.00418)	(0.00414)	(0.00516)
aid_ijt	-0.200***	-0.154***	-0.173***	-0.184***	-0.147***	-0.141***	-0.181***	-0.172***
	(0.00795)	(0.0120)	(0.00759)	(0.00772)	(0.00707)	(0.0108)	(0.00751)	(0.00679)
aid_ijt *Population	0.00206***							
	(0.000199)							
aid_ijt *Remoteness		0.000144						
		(0.000203)						
aid_ijt *Export Concentration			0.00104***					
			(0.000190)					
aid_ijt *Agriculture Share				0.00173***				
				(0.000242)				
aid_ijt *Low elevated coastal zone					4.02e-05			
					(0.000264)			
aid_ijt *Natural Disaster						-8.46e-05		
						(0.000165)		
aid_ijt *Export Instability							0.00189***	
							(0.000267)	
aid_ijt *Agriculture Instability								0.00121***
								(0.000190)
Observations	8,706	8,706	8,706	8,706	8,706	8,706	8,706	8,706
R-squared	0.491	0.464	0.472	0.477	0.464	0.464	0.476	0.474

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

TABLE 3.4 – PPML Fix Effect interactions

VARIABLES	(1) Level of FDI stock	(2) Level of FDI stock	(3) Level of FDI stock	(4) Level of FDI stock	(5) Level of FDI stock	(6) Level of FDI stock	(7) Level of FDI stock	(8) Level of FDI stock
lnGDP_o	0.615***	0.610***	0.612***	0.612***	0.613***	0.613***	0.605***	0.612***
	(0.210)	(0.212)	(0.211)	(0.211)	(0.211)	(0.213)	(0.211)	(0.211)
lnGDP_d	0.528***	0.540***	0.540***	0.537***	0.539***	0.539***	0.529***	0.539***
	(0.100)	(0.0989)	(0.0990)	(0.101)	(0.0991)	(0.100)	(0.0996)	(0.0988)
Population	-0.0701***	-0.0682***	-0.0686***	-0.0685***	-0.0683***	-0.0681***	-0.0700***	-0.0682***
	(0.0205)	(0.0205)	(0.0205)	(0.0205)	(0.0205)	(0.0208)	(0.0205)	(0.0205)
Remoteness	-0.0219***	-0.0223***	-0.0223***	-0.0223***	-0.0226***	-0.0225***	-0.0222***	-0.0224***
	(0.00626)	(0.00622)	(0.00646)	(0.00625)	(0.00645)	(0.00636)	(0.00632)	(0.00632)
Export Concentration	9.17e-05	0.000182	-0.000170	0.000185	8.54e-06	7.82e-05	2.94e-06	6.36e-05
	(0.00378)	(0.00391)	(0.00391)	(0.00400)	(0.00391)	(0.00383)	(0.00380)	(0.00381)
Agriculture Share	-0.0357***	-0.0357***	-0.0355***	-0.0355***	-0.0355***	-0.0359***	-0.0349***	-0.0357***
	(0.0119)	(0.0119)	(0.0119)	(0.0118)	(0.0119)	(0.0121)	(0.0119)	(0.0119)
Low Elevated Coastal Zone	0.151	0.166	0.166	0.163	0.168	0.169	0.149	0.168
	(0.255)	(0.275)	(0.275)	(0.270)	(0.277)	(0.279)	(0.259)	(0.276)
Disaster	0.00576**	0.00553**	0.00551**	0.00550**	0.00549**	0.00541*	0.00544**	0.00550**
	(0.00275)	(0.00276)	(0.00270)	(0.00270)	(0.00271)	(0.00285)	(0.00269)	(0.00270)
Export Instability	0.00296	0.00309	0.00318	0.00298	0.00308	0.00308	0.00113	0.00309
	(0.00704)	(0.00701)	(0.00705)	(0.00700)	(0.00704)	(0.00704)	(0.00771)	(0.00702)
Agriculture Instability	0.00433	0.00435	0.00444	0.00445	0.00439	0.00444	0.00415	0.00438
	(0.00461)	(0.00455)	(0.00463)	(0.00470)	(0.00465)	(0.00460)	(0.00467)	(0.00507)
BIT	0.0849	0.0852	0.0867	0.0857	0.0875	0.0876	0.0872	0.0871
	(0.0790)	(0.0791)	(0.0792)	(0.0794)	(0.0789)	(0.0796)	(0.0785)	(0.0790)
aid_ij)	-0.00310	-0.00304	-0.00258	-0.00209	-0.00267	-0.00277	-0.00366	-0.00244
	(0.00246)	(0.00353)	(0.00252)	(0.00293)	(0.00278)	(0.00354)	(0.00263)	(0.00249)
aid_ij * Population	7.14e-05							
	(7.25e-05)							
aid_ij * Remoteness		1.19e-05						
		(5.76e-05)						
aid_ij * Export Concentration			1.49e-05					
			(5.78e-05)					
aid_ij * Agriculture Share				-2.39e-05				
				(0.000111)				
aid_ij * LECZ					1.37e-05			
					(7.11e-05)			
aid_ij * Disaster						5.30e-06		
						(4.61e-05)		
aid_ij *Export Instability							8.63e-05	
							(6.29e-05)	
aid_ij *Agriculture Instability								2.38e-06
								(8.31e-05)
Observations	10,544	10,544	10,544	10,544	10,544	10,544	10,544	10,544
Number of dyad	1,523	1,523	1,523	1,523	1,523	1,523	1,523	1,523

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

More specifically, we follow the critics of *Martinez-zarzozo 2017*, who criticized the mis-pecification of the use of level aid in a gravity model. They argued that considering aid as a transfer is more consistent theoretically, in a micro-founded model à la Anderson and van-Wincoop. In order to take into account this critique, we made some transformation within our ODA variables. More importantly, by doing so, we want to see the possible development motives in bilateral ODA.

To account for a possible bilateral aid as a transfer, we construct a variable corrected to the GDP level, which is easily expressed formally by $\frac{aid_{ijt}}{gdp_j}$. This aims at capturing aid as a tool to support growth. Transforming our bilateral variable gives the results in Table 3.5. According to our usual specification, we use three different specifications : an OLS as a baseline, an OLS fix-effect model to account for possible omitted variables and important time trend, and a PPML fix-effects specification to take into account heteroskedasticity in our database.

In the OLS, the results are suggesting a positive effect of the level of aid transfer on the bilateral level of FDI. Moreover, when considering the political effect i.e. the effect of an increase of aid share in the GDP, the more aid is entering in the economy, the more this country attracts investment. These arguments are in favor of a complementary effect of aid on FDI level. However, all the coefficient even positive are non significant. As a remainder, the OLS specification is suspected to be biased toward a gravity model .

Turning to our fix effect estimation, the PPML estimates are on the contrary non-significant and negative to our measure of aid as transfer.

The non significance of bilateral aid in this relationship validates the cast on the nature of aid and FDI relationship. When we suppose that bilateral aid may contain a development purpose, by considering it as proportional to GDP, the result are non significant. As this process do not change fundamentally our results, we decide to stick with the first results.

3.5.4 Level of Aid

The second change is to take into account the cumulative sum of bilateral Aid. This specification aim to take into account if the volume of Aid that a country affect the bilateral level of FDI in general.

In the recent model, all our specification is significant for aid in level. The idea of aid as level is to focus on the general level of Development aid in overall, that may affect the level of bilateral FDI. We therefore construct a variable which is the sum of bilateral aid in a host country by year.

Table 3.6 highlight the fact that aid in level have substitution impact on FDI. A rise in

TABLE 3.5 – Aid as transfer

	(1) OLS_ODA_transfer	(2) OLS_fix_effect_ODA_transfer	(3) PPML_fix_effect_ODA_transfer
VARIABLES	Log of FDI stock	Log of FDI stock	Level of FDI stock
lnGDP_o	0.268***	1.817***	0.600***
	(0.0781)	(0.306)	(0.209)
lnGDP_d	0.762***	0.478***	0.542***
	(0.0991)	(0.152)	(0.100)
Population	0.00607	-0.0295	-0.0670***
	(0.00763)	(0.0335)	(0.0207)
Remoteness	0.0261***	-0.0234**	-0.0224***
	(0.00525)	(0.0108)	(0.00628)
Export Concentration	-0.00553	0.00537	0.000411
	(0.00412)	(0.00430)	(0.00386)
Agriculture Share	-0.00382	-0.00594	-0.0357***
	(0.00589)	(0.0114)	(0.0120)
Low Elevated Coastal Zone	0.00714*	-0.0457**	0.179
	(0.00386)	(0.0204)	(0.286)
Disaster	-0.00570*	0.00289	0.00556**
	(0.00334)	(0.00358)	(0.00270)
Export Instability	-0.000946	0.00132	0.00399
	(0.00459)	(0.00644)	(0.00703)
Agriculture Instability	-0.00285	-0.000923	0.00442
	(0.00381)	(0.00369)	(0.00472)
aid/GDP	0.136	0.0655	-0.00746
	(0.115)	(0.0434)	(0.0407)
distance	-1.107***		
	(0.224)		
language	0.803***		
	(0.295)		
Constant	-13.70***		
	(3.899)		
Observations	8,871	8,706	10,543
R-squared	0.205	0.927	
Number of dyad			1,523

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.6 – Aid Commitment in Level

VARIABLES	(1) Log of FDI Stock	(2) Log of FDI Stock	(3) Level of FDI Stock
lnGDP_o	0.0313***	1.877***	0.615***
	(0.00336)	(0.333)	(0.210)
lnGDP_d	0.110***	0.872***	0.532***
	(0.00992)	(0.189)	(0.0993)
Population	0.00720***	0.0721**	-0.0682***
	(0.000654)	(0.0358)	(0.0203)
Remoteness	-0.000318	-0.0253*	-0.0219***
	(0.000215)	(0.0151)	(0.00625)
Export Concentration	0.00130***	0.0107**	-0.000319
	(0.000357)	(0.00521)	(0.00371)
Agriculture Share	0.00474***	0.00600	-0.0366***
	(0.000523)	(0.0133)	(0.0119)
Low Elevated Coastal Zone	-8.16e-05	0.0212	0.152
	(0.000139)	(0.0241)	(0.262)
Disaster	0.00144***	0.00595	0.00525**
	(0.000257)	(0.00498)	(0.00263)
Export Instability	-0.000100	0.00792	0.00161
	(0.000201)	(0.00810)	(0.00722)
Agriculture Instability	-0.00101**	0.00238	0.00462
	(0.000488)	(0.00429)	(0.00459)
aid cumulative	-0.114***	-0.0810***	-0.00473**
	(0.00373)	(0.00514)	(0.00220)
distance	-0.0168**		
	(0.00851)		
contiguity	-0.00418		
	(0.0276)		
language	-0.0158*		
	(0.00814)		
Constant	-3.741***		
	(0.323)		
Observations	8,871	8,706	10,543
R-squared	0.310	0.351	
Number of dyad			1,523

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

TABLE 3.7 – OLS interaction aid in level

VARIABLES	(1) Log of FDI Stock	(2) Log of FDI Stock	(3) Log of FDI Stock	(4) Log of FDI Stock	(5) Log of FDI Stock	(6) Log of FDI Stock	(7) Log of FDI Stock	(8) Log of FDI Stock
lnGDP_o	0.0314***	0.0312***	0.0316***	0.0308***	0.0314***	0.0318***	0.0319***	0.0309***
	(0.00333)	(0.00335)	(0.00336)	(0.00334)	(0.00336)	(0.00335)	(0.00333)	(0.00338)
lnGDP_d	0.103***	0.109***	0.112***	0.108***	0.110***	0.108***	0.107***	0.110***
	(0.00989)	(0.00986)	(0.00992)	(0.00989)	(0.00994)	(0.0100)	(0.00990)	(0.00993)
distance	-0.0224***	-0.0155*	-0.0197**	-0.0160*	-0.0157*	-0.0177**	-0.0172**	-0.0189**
	(0.00826)	(0.00829)	(0.00848)	(0.00847)	(0.00850)	(0.00848)	(0.00841)	(0.00861)
contig	-0.0129	-0.00364	-0.00910	-0.00146	-0.00244	-0.00441	-0.00498	-0.00886
	(0.0263)	(0.0278)	(0.0282)	(0.0273)	(0.0277)	(0.0285)	(0.0264)	(0.0264)
comlang_off	-0.0158**	-0.0155*	-0.0153*	-0.0158*	-0.0158*	-0.0163**	-0.0158*	-0.0134
	(0.00781)	(0.00808)	(0.00820)	(0.00809)	(0.00819)	(0.00833)	(0.00812)	(0.00847)
Population	0.00669***	0.00719***	0.00732***	0.00714***	0.00721***	0.00701***	0.00694***	0.00727***
	(0.000651)	(0.000650)	(0.000653)	(0.000652)	(0.000654)	(0.000660)	(0.000653)	(0.000654)
Remoteness	-0.000130	-0.000374*	-0.000122	-0.000322	-0.000377*	-0.000301	-0.000211	-0.000368*
	(0.000210)	(0.000210)	(0.000213)	(0.000214)	(0.000209)	(0.000214)	(0.000214)	(0.000220)
Export Concentration	0.00133***	0.00123***	0.00113***	0.00124***	0.00131***	0.00128***	0.00144***	0.00150***
	(0.000335)	(0.000351)	(0.000354)	(0.000356)	(0.000354)	(0.000360)	(0.000353)	(0.000360)
Agriculture Share	0.00434***	0.00472***	0.00468***	0.00474***	0.00476***	0.00471***	0.00473***	0.00476***
	(0.000507)	(0.000520)	(0.000525)	(0.000518)	(0.000522)	(0.000521)	(0.000521)	(0.000525)
Low Elevated Coastal Zone	-3.49e-06	-7.00e-05	-9.56e-05	-8.06e-05	-8.73e-05	-0.000103	-7.64e-06	-0.000150
	(0.000132)	(0.000139)	(0.000131)	(0.000139)	(0.000139)	(0.000151)	(0.000134)	(0.000141)
Disaster	0.00151***	0.00144***	0.00146***	0.00137***	0.00146***	0.00145***	0.00129***	0.00146***
	(0.000245)	(0.000255)	(0.000257)	(0.000256)	(0.000252)	(0.000257)	(0.000251)	(0.000256)
Export Instability	-0.000232	-0.000116	-7.32e-05	-0.000108	-9.74e-05	-2.10e-05	-0.000361*	-0.000183
	(0.000199)	(0.000199)	(0.000202)	(0.000202)	(0.000200)	(0.000201)	(0.000197)	(0.000208)
Agriculture Instability	-0.00110**	-0.000960**	-0.000840*	-0.00105**	-0.00106**	-0.00102**	-0.00126***	-0.00138***
	(0.000469)	(0.000486)	(0.000488)	(0.000487)	(0.000484)	(0.000492)	(0.000486)	(0.000492)
aid cumulative	-0.151***	-0.104***	-0.131***	-0.125***	-0.119***	-0.0819***	-0.135***	-0.128***
	(0.00558)	(0.00892)	(0.00551)	(0.00539)	(0.00497)	(0.00730)	(0.00503)	(0.00491)
aid cumulative*Population	0.00154***							
	(0.000146)							
aid cumulative*Remoteness		-0.000188						
		(0.000154)						
aid cumulative*Export Concentration			0.000707***					
			(0.000152)					
aid cumulative*Agriculture Share				0.000558***				
				(0.000180)				
Aid cumulative*Low Elevated Coastal Zone					0.000292			
					(0.000187)			
Aid cumulative*Disaster						-0.000554***		
						(0.000118)		
aid cumulative*Export Instability							0.00118***	
							(0.000156)	
aid cumulative*Agriculture Instability								0.000827***
								(0.000166)
Constant	-3.526***	-3.741***	-3.799***	-3.698***	-3.752***	-3.703***	-3.673***	-3.722***
	(0.322)	(0.322)	(0.323)	(0.322)	(0.323)	(0.325)	(0.322)	(0.324)
Observations	8,871	8,871	8,871	8,871	8,871	8,871	8,871	8,871
R-squared	0.339	0.311	0.317	0.313	0.311	0.316	0.323	0.317

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

the level of Aid tend to reduce the level of FDI. More precisely, a 1 % increase in the level of Aid tend to diminish the level of FDI by 0.4 %, according to the PPML specification.

This effect is expected and confirms major concerns in the literature. Conversely to findings, applying this specification give a less important pattern of substitution effect between FDI and aid commitment, even though it is significant. This recast the possible dutch disease nature of aid, reducing the level of private investment.

We follow on by interacting the cumulative level of aid and our vulnerability measures.

Turning our attention to interactions in this specification to measure how changes in the level of aid affect the level of vulnerabilities, the same pattern as the previous analysis is followed by our variables. The OLS and Fix effect specification in Table 3.7 and Table 3.8 are robust with relatively small changes between coefficient. More specifically, an increase in the level of aid tend to reduce the measure of the market (in term of size), to reduce the level of export concentration and the dependence to agriculture which means a reduction in the level of vulnerability related to market structure. On the other part, the trade vulnerability

TABLE 3.8 – OLS Fix effect with Aid level

VARIABLES	(1) Log of FDI Stock	(2) Log of FDI Stock	(3) Log of FDI Stock	(4) Log of FDI Stock	(5) Log of FDI Stock	(6) Log of FDI Stock	(7) Log of FDI Stock	(8) Log of FDI Stock
lnGDP_o	1.789***	1.873***	1.837***	1.825***	1.881***	1.897***	1.874***	1.815***
	(0.329)	(0.333)	(0.330)	(0.333)	(0.333)	(0.330)	(0.329)	(0.331)
lnGDP_d	0.598***	0.860***	0.947***	0.929***	0.854***	0.804***	0.760***	0.967***
	(0.185)	(0.189)	(0.189)	(0.189)	(0.190)	(0.189)	(0.188)	(0.188)
Remoteness	-0.000441	-0.0270*	-0.0164	-0.0259*	-0.0299*	-0.0221	-0.0239	-0.0204
	(0.0149)	(0.0152)	(0.0150)	(0.0151)	(0.0153)	(0.0148)	(0.0151)	(0.0150)
Export Concentration	0.0104**	0.0104**	0.00863*	0.00846*	0.0105**	0.00947*	0.0109**	0.00821
	(0.00503)	(0.00517)	(0.00518)	(0.00514)	(0.00516)	(0.00521)	(0.00514)	(0.00511)
Agriculture Share	0.000206	0.00608	0.00614	0.00352	0.00742	0.0105	0.00725	0.00674
	(0.0130)	(0.0133)	(0.0133)	(0.0130)	(0.0132)	(0.0133)	(0.0133)	(0.0131)
Low Elevated Coastal Zone	-0.0344	0.0226	0.00897	0.0270	0.0228	0.0264	0.00985	0.0165
	(0.0249)	(0.0241)	(0.0239)	(0.0238)	(0.0241)	(0.0240)	(0.0245)	(0.0237)
Disaster	0.00982**	0.00594	0.00624	0.00496	0.00662	0.00642	0.00479	0.00557
	(0.00478)	(0.00498)	(0.00500)	(0.00497)	(0.00488)	(0.00492)	(0.00488)	(0.00491)
Export Instability	0.000243	0.00756	0.00784	0.00881	0.00766	0.00644	0.00149	0.00897
	(0.00799)	(0.00811)	(0.00804)	(0.00806)	(0.00809)	(0.00809)	(0.00810)	(0.00797)
Agriculture Instability	0.000926	0.00255	0.00358	0.000763	0.00210	0.00319	0.00125	0.000967
	(0.00420)	(0.00432)	(0.00432)	(0.00427)	(0.00427)	(0.00434)	(0.00428)	(0.00429)
aid cumulative	-0.116***	-0.0774***	-0.0980***	-0.0910***	-0.0863***	-0.0619***	-0.107***	-0.0948***
	(0.00684)	(0.00915)	(0.00664)	(0.00588)	(0.00639)	(0.00736)	(0.00691)	(0.00593)
Population	0.0137	0.0713**	0.0517	0.0775**	0.0688*	0.0489	0.0115	0.0541
	(0.0347)	(0.0358)	(0.0355)	(0.0357)	(0.0358)	(0.0365)	(0.0377)	(0.0354)
aid cumulative*Population	0.00150***							
	(0.000144)							
aid cumulative*Remoteness		-7.63e-05						
		(0.000155)						
aid cumulative*Export Concentration			0.000659***					
			(0.000149)					
aid cumulative*Agriculture Share				0.000664***				
				(0.000176)				
aid cumulative*Low Elevated Coastal Zone					0.000273			
					(0.000183)			
aid cumulative*Disaster						-0.000435***		
						(0.000127)		
aid cumulative*Export Instability							0.00107***	
							(0.000161)	
aid cumulative*Agriculture Instability								0.000836***
								(0.000161)
Observations	8,706	8,706	8,706	8,706	8,706	8,706	8,706	8,706
R-squared	0.376	0.351	0.357	0.354	0.352	0.354	0.360	0.358

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

indicator related to a possible weakness to an external shock are mainly reduced in the form of reduction of instability to export and agriculture. However, surprisingly, the level of natural Disaster is not mitigated by the increase in the level of aid. This is a puzzle as we expected an growing level of aid according to the level of disaster. All thing summed up, our initial thoughts on mitigation effect of Aid to inherent risk level may prevail : reducing economic handicaps restraining FDI level.

Table 3.9 recall the result of our PPML specification. Almost all the results from the former PPML analysis are maintained. More precisely, interacting bilateral Aid with various issues of vulnerabilities has non significant results on the FDI outcome.

However, contrary to the previous specifications, instability related to exportation appears to be mitigated by changes in the level of bilateral Aid. This effect, even small, is worth noting. First, it enforces the initial hypothesis of a vulnerability reducing impact of Aid ; and by ricochet occurs to a rise in the investment level. This effect recalling a channel through Aid may be effective ; and rejoin previous findings on the primordial role of infrastructure and institutional development (Bénassy-Quéré, Coupet, and Mayer (2007) and Donaubauer, Meyer, and Nunnenkamp (2016)). Second, findings on the relative effect of bilateral Aid as an export instability reducer justify the recent increase of "Aid of Trade". Martínez-Zarzoso,

Table 3.9 – PPML Aid in level

VARIABLES	(1) Level of FDI Stock	(2) Level of FDI Stock	(3) Level of FDI Stock	(4) Level of FDI Stock	(5) Level of FDI Stock	(6) Level of FDI Stock	(7) Level of FDI Stock
lnGDP_o	0.621***	0.615***	0.612***	0.615***	0.612***	0.620***	0.617***
	(0.209)	(0.210)	(0.209)	(0.210)	(0.211)	(0.207)	(0.210)
lnGDP_d	0.516***	0.530***	0.519***	0.531***	0.527***	0.506***	0.523***
	(0.101)	(0.0995)	(0.101)	(0.0992)	(0.101)	(0.0991)	(0.0995)
Population	-0.0720***	-0.0675***	-0.0700***	-0.0681***	-0.0696***	-0.0785***	-0.0663***
	(0.0202)	(0.0205)	(0.0201)	(0.0203)	(0.0203)	(0.0198)	(0.0205)
Remoteness	-0.0215***	-0.0221***	-0.0212***	-0.0219***	-0.0214***	-0.0226***	-0.0222***
	(0.00624)	(0.00639)	(0.00624)	(0.00624)	(0.00659)	(0.00609)	(0.00630)
Export Concentration	-0.000360	-0.000264	0.000364	-0.000310	-0.000342	-4.12e-05	0.000224
	(0.00365)	(0.00372)	(0.00387)	(0.00375)	(0.00372)	(0.00367)	(0.00379)
Agriculture Share	-0.0363***	-0.0369***	-0.0371***	-0.0367***	-0.0360***	-0.0339***	-0.0377***
	(0.0117)	(0.0119)	(0.0119)	(0.0117)	(0.0118)	(0.0113)	(0.0119)
Low Elevated Coastal Zone	0.116	0.155	0.114	0.153	0.143	0.0736	0.152
	(0.224)	(0.265)	(0.222)	(0.262)	(0.246)	(0.188)	(0.263)
Disaster	0.00575**	0.00522**	0.00531**	0.00525**	0.00532**	0.00524**	0.00523**
	(0.00276)	(0.00261)	(0.00260)	(0.00263)	(0.00266)	(0.00261)	(0.00259)
Export Instability	0.00151	0.00150	0.00101	0.00161	0.00152	-0.000307	0.00114
	(0.00717)	(0.00721)	(0.00711)	(0.00722)	(0.00721)	(0.00727)	(0.00722)
Agriculture Instability	0.00447	0.00457	0.00492	0.00462	0.00445	0.00365	0.00462
	(0.00454)	(0.00456)	(0.00464)	(0.00458)	(0.00452)	(0.00454)	(0.00453)
aid cumulative	-0.00556**	-0.00457**	-0.00340	-0.00470**	-0.00358	-0.00738***	-0.00396*
	(0.00225)	(0.00230)	(0.00268)	(0.00233)	(0.00402)	(0.00241)	(0.00229)
aid cumulative x Population	7.23e-05						
	(7.65e-05)						
aid cumulative x Export Concentration		-1.33e-05					
		(4.59e-05)					
aid cumulative x share_agri			-0.000116				
			(9.69e-05)				
aid cumulative x Low Elevated Coastal Zone				-1.76e-06			
				(4.99e-05)			
aid cumulative x Disaster1					-1.96e-05		
					(4.95e-05)		
aid cumulative x Export Instability						0.000126*	
						(7.58e-05)	
aid cumulative x Agriculture Instability							-8.25e-05
							(6.84e-05)
Observations	10,543	10,543	10,543	10,543	10,543	10,543	10,543
Number of dyad	1,523	1,523	1,523	1,523	1,523	1,523	1,523

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Nowak-Lehmann, Parra, and Klasen (2014) and Pettersson and Johansson (2013) gives an intersting talk about how could Aid for trade be effective as a policy instrument for trade. More importantly, this finding in accordance with the stabilizing effect of Aid mentioned by Guillaumont and Chauvet (2001) and Guillaumont (2009).

We are not aware of any study evaluating Aid for trade effects on FDI. Our results encourage us to investigate this channel in following researches.

3.6 Additional : Empirical joint determination

Linking the theoretical model of joint determination of FDI and aid, it appears clear and necessary that changes in FDI and aid levels is heavily relied to the concept of governance and governance choice, which structures the outcome of our related FDI and aid link. As stated in Jin and Zeng (2017), who find that degree of impatience and technology diffusion (level of development, in a broader view) determine the choice to invest and the level of aid, the likelihood determination of the .

From an empirical point of view, it is not straightforward to mirror the theoretical part to variables which could be proxied and capture our insights. Interesting views to capture

this phenomenon could be linked to empirical studies like Asiedu, Jin, and Nandwa (2009) and more recently Menard and Gary (2018).

Fortunately, according to the literature, possible proxy to capture governments' behavior toward aid could be heavily related to the governance in the destination country of aid, as soon as aid could be wasted for another purpose, depending on the type of governance. Therefore, adding information concerning governance may encompass our empirical problem and theoretical view. Hopefully, some indicators of governance is easily accessible from the World Governance Index drawn from Kaufmann, Kraay, and Mastruzzi (2010) which may be useful to understand the aid pattern and FDI (to a broader extent).

However, as these indicators not affect all aspect of risk, we decide to put a particular attention to the choice of our governance index measure.

To capture the idea behind every index, we try to assess how the authors (i.e. Kaufmann, Kraay, and Mastruzzi (2010)) define and build their indexes. Those indexes are based on 3 main ideas : how government is chosen and monitored, how effective is the governance in terms of policy implementation and finally how the structures and interactions is respected. As for this view, two definitions appear : how the process of governance is chosen (i.e. related to the way that the power ends up in the hand of a category of people or person) and how effective policies are. By definition, to capture the process of "election", the political stability and absence of violence is captured within the WGI index. This index aims at emphasizing the absence of political tensions that drives the nature of governance. We firmly believe that the first variable which could be affected by political stability is aid commitment. This variable could be related to the discount factor given in the Jin and Zeng (2017) model which means the more the country is impatient, the more the country is unstable temptation to rely on expropriation.

One additional variable that could affect the level of aid, without much attention to the FDI is the government effectiveness. Referring to the initial thought of joint determination, effectiveness of a policy or an economy is captured by a factor that drives the optimal level of investment, putting an attention to the difference between a degree of impatient and effectiveness. Empirically, we rely on the government effectiveness index. Government effectiveness is defined as a credibility of a government to attain it's own policy.

Thinking about the relative importance of our indicators, we decided to assess how our main variables could be affected by our set of additional controls. As results, the correlation matrix in Table 3.10 indicates the least correlation to the FDI level and the highest correlation to the aid commitment level comes from the political stability. On the other hand, government efficiency seems to have show an interesting pattern with both FDI and Aid commitment. We added to our measure of political concern of aid then a measure of voice accountability,

TABLE 3.10 – Correlation matrix FDI, Bilateral Aid Commitment and WGI

	fdi	aid	gee	vae	pve	cce	rqe	rle
fdi	1							
aid	0.1252	1						
gee	0.1435	-0.1366	1					
vae	0.0400	-0.0981	0.5427	1				
pve	0.0174	-0.2420	0.5324	0.4606	1			
cce	0.0938	-0.1971	0.8750	0.5770	0.6734	1		
rqe	0.1212	-0.1182	0.8800	0.5848	0.4643	0.7726	1	
rle	0.0841	-0.1931	0.8769	0.6401	0.7050	0.8927	0.8154	1

Note : GEE for Government effectiveness, VAE for voice accountability, PVE for Political Stability and Absence of violence, CCE for Corruption control, RQE for Regulatory quality, RLE to Rule of Law.

a measure of governement effectiveness and a measure of political stability and absence of violence.

To assess a possible joint determination of FDI and Aid, we rely on the work of Donaubauer, Meyer, and Nunnenkamp (2016) Asiedu, Jin, and Nandwa (2009), by using a three stage least square specification.

Empirically, this specification has some advantages, by estimating simultaneously the level of aid and FDI and reduce the possible endogeneity bias coming from our analysis. However, we are not aware of PPML simultaneous gravity modelling, apart from Mitze, Alecke, and Untiedt (2011) and Menard and Gary (2018). As the validity of the fix effect decomposition method used in Mitze, Alecke, and Untiedt (2011) is severely criticized in (Greene, 2011), we decide to stick on classical three stage least square, this method comes at the drawbacks of missing the opportunity to integrate zero trade flows within it. Therefore, the only comparison to be made could be related to the OLS specification.

Our gravity model of aid is somehow a little different to the FDI or trade gravity models. As justified in Guillaumont and Wagner (2014), bilateral aid is often viewed less development oriented than multilateral aid. This characteristics, which corresponds to a commercial or political interest, could be captured from the use of gravity estimand. Therefore, we added in the following equation, a measure of classical controls of gravity estimation. To control for heterogeneity, we add sets of time and country indicators.

The aid equation is therefore :

$$\begin{cases} FDI_{ijt} = \beta_0 + \beta_1 GRAVDATA + \beta_2 RISK_j + \beta_3 Aid_{ij} + b_t + \epsilon_{ijt} \\ Aid_{ijt} = \beta_4 + \beta_5 GRAVDATA + \beta_6 WGI_{jt} + b_t + \epsilon_{ijt} \end{cases} \tag{3.25}$$

To perform the simultaneous equation 3sls, even controversial in the gravity modelling, a slight change is made within our dependent variables. Following Menard and Gary (2018),

we add a small one to FDI_{ijt} and Aid_{ijt}. ONe important remark here, this process comes at the cost with no control of heteroskedacity as we perform a log linearized model.

Following the previous remark, we proceed with cautions interpreting the result from Table 3.11. Interestingly, gravity controls signs are respected and seems following the same pattern cited in the previous section. Remark that we also introduce population to control for the effect of population on our aid estimation.

However, the signs of our various measure of vulnerability are almost not respected as regards to the PPML.

Concerning our interest variables, in the presence of aid, the level of FDI seems to be boosted positively. On the ODA part, strangely, the presence of FDI is positive, justifying the idea of complementary. ODA reacts negatively to government effectiveness, whereas voice accountability really matters.

As the model is non robust, the following specification is to be taken with caution. Unfortunately, when the idea of joint determination appear interesting theoretically, the empirical part is non robust according to our estimations. We prefer not to interpret deeply the results.

3.7 Conclusion

This article investigate the link between FDI and Aid by associating the relation to a possible reduction of structural economic vulnerabilities. We first recall the theoretical relation between Aid and FDI unveiling how Aid could affect investment enhancing by reduction risk. We empirically assess this link by using a gravity model to assess how bilateral aid could affect the level of bilateral FDI in 125 countries from 2003-2011. In overall, bilateral aid effect on the level of foreign investment is negative (and sometimes inconclusive). Most notably, a change in specifications may affect the level of bilateral FDI. Using a sum of bilateral aid affects negatively the level of FDI, when the proof of a competing nature is non conclusive. This finding is in line with the theory of substitution between aid and FDI in countries receiving a large amount of aid. Moreover, marginally, the effect of increasing bilateral aid may deter various forms of vulnerabilities. More specifically, the role of aid is particularly interesting on Export instability. This finding reinforce the recent grow of aid for trade measures and the positive relative use of this form of aid as a trade enhancer. This reinforce the stabilizing effect of Aid mentioned in Guillaumont and Wagner (2014). In our case, this mitigation effect on export instability appears to be foreign investment enhancer at the same time. Finally, we test the possible joint determination of Aid and FDI, by using a simultaneous equation, however, we proceed with caution interpreting the results as we couldn't perform proper specifications of gravity modelling (further investigations should be

TABLE 3.11 – Estimation results : Joint Estimation

VARIABLES	lfdi	Aid
lfdi		0.279**
		(0.109)
Aid	0.169***	
	(0.00514)	
POP	0.0389***	
	(0.00133)	
REMOT	0.0176***	
	(0.000770)	
XCON	-0.00933***	
	(0.000501)	
SHARE_AGRI	0.00396***	
	(0.000869)	
DISASTER	-0.00201***	
	(0.000518)	
LECZ	0.00706***	
	(0.000541)	
X_INSTA	0.00246***	
	(0.000618)	
lnGDP_o	0.114***	
	(0.0156)	
lnGDP_d	0.908***	
	(0.0171)	
ldistw	-0.571***	-1.059***
	(0.0318)	(0.0881)
col45	2.501***	2.062***
	(0.0954)	(0.427)
Comlang	-0.440***	1.299***
	(0.0426)	(0.124)
lgdpcap_d		-1.191***
		(0.0716)
lgdpcap_o		5.872***
		(0.147)
lpop_o		1.852***
		(0.0548)
lpop_d		0.871***
		(0.0640)
vae		0.920***
		(0.0658)
pve		-0.0220
		(0.0537)
gee		-0.406***
		(0.0802)
Constant	-21.31***	-39.38***
	(0.543)	(1.698)
Observations	23,145	23,145
R-squared	0.401	0.529

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

made to unveil the robustness of our results). In general ensuring our previous results using different gravity models specifications may be necessary.

3.A Data properties and descriptions

3.A.1 Descriptive statistics

TABLE 3.12 – Summary statistics

Variable	Mean	Std. Dev.	N
Level of FDI stock (Millions of dollars)	374.309	2391.451	25000
bi_ODA	89.7469	12305.746	25001
Population	43.039	30.229	24991
Remoteness	57.134	21.763	24991
Export Concentration	34.543	25.37	24991
Agriculture Share	27.066	23.673	24991
Low Elevated Coastal Zone	19.878	24.517	24991
Disaster	59.742	28.734	24991
Export Instability	25.002	20.41	24747
Agriculture Instability	30.873	28.311	24991
lnGDP_o	25.999	1.552	25001
lnGDP_d	22.86	2.296	25001
distance	8.914	0.514	25001
contig	0.003	0.052	25001
comlang_off	0.087	0.282	25001

3.A.2 Correlation Matrix

(1)

	Level of FDI Stock	bi_ODA	Population	Remoteness	Export Concentration	Agriculture Share	Low Elevated Coastal Zone	Disaster	Export Instability	Agriculture Instability	lnGDP_o	lnGDP_d	distance	contig	comlang_off
Level of FDI Stock	1														
bi_ODA	0.118***	1													
Population	-0.135***	-0.0734***	1												
Remoteness	-0.00736	-0.0144*	0.220***	1											
Export Concentration	-0.130***	-0.0280***	0.246***	-0.0438***	1										
Agriculture Share	-0.103***	0.0219***	-0.151***	0.146***	0.105***	1									
Low Elevated Coastal Zone	-0.0167**	-0.0129*	0.367***	-0.0731***	0.0182**	-0.136***	1								
Disaster	-0.0292***	0.0232***	-0.109***	0.396***	-0.199***	0.324***	-0.130***	1							
Export Instability	-0.0404***	-0.0285***	0.423***	-0.0621***	0.0707***	-0.0965***	0.216***	-0.165***	1						
Agriculture Instability	-0.114***	-0.00892	0.130***	-0.0541***	0.549***	0.343***	0.119***	0.00480	0.124***	1					
lnGDP_o	0.156***	0.130***	-0.0517***	-0.0144*	-0.0497***	-0.0452***	0.00227	-0.0199**	-0.0275***	-0.0584***	1				
lnGDP_d	0.229***	0.0577***	-0.801***	-0.312***	-0.263***	-0.353***	-0.249***	-0.166***	-0.332***	-0.349***	0.0901***	1			
distance	-0.0478***	-0.00569	0.143***	0.522***	-0.0713***	-0.0223***	0.0379***	0.234***	-0.0654***	-0.109***	0.00198	-0.112***	1		
contig	0.0115	0.00543	-0.0305***	-0.0133*	0.00178	-0.0224***	0.000481	-0.0107	-0.0107	0.0173**	0.0148*	0.0307***	-0.172***	1	
comlang_off	0.0748***	0.0449***	0.0809***	0.0730***	-0.00537	0.0147*	-0.0314***	0.0336***	0.0667***	-0.0330***	0.194***	-0.0819***	0.0567***	0.0334***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3.B Aid in the form of disbursement

Aid disbursement as transfer According to our OLS estimates 3.13, Aid as transfer is relatively significant. Considering that I am capturing the bilateral effect of Aid as transfer, this result is accordance of our commitment analysis on the OLS.

Results from our Fix effect estimates are non significant.

As mentioned previously, the OLS estimator is strongly biased in a gravity model estimation.

Thus, I run the PPML estimator to take into account for heteroskedasticity and zeros in our database. Running the PPML estimation is sucking out all the effectiveness of our Aid variable as transfer.

Aid Disbursement in level Similarly to the level of commitment, the level of aid disbursement (Table 3.14) is playing a substitution role toward FDI. More specifically, the more Aid a country receive bilaterally, the less FDI the country receive.

This result is related to our PPML estimations.

3.C Aid selection

The Tables 3.15 and 3.16 takes into account the possible selection on aid reception. This is made to relax the idea of transformation of our aid variable. Qualitatively, the results from the section baseline results hold. Apart from the OLS, the reception of aid deters the level of investment. More importantly, the results falls significant controlling for fix effects. The interaction with the aid dummy remain qualitatively the same as done before.

TABLE 3.13 – Aid disbursement as transfer

	(1) OLS_ODA_factor	(2) OLS_fix_effect_ODA_factor	(3) PPML_fix_effect_ODA_factor
VARIABLES	LnFDI	LnFDI	Level of FDI stock
lnGDP_o	0.273***	1.822***	0.600***
	(0.0780)	(0.306)	(0.209)
lnGDP_d	0.753***	0.464***	0.541***
	(0.0953)	(0.152)	(0.0996)
Population	0.00446	-0.0296	-0.0669***
	(0.00727)	(0.0336)	(0.0207)
Remoteness	0.0264***	-0.0240**	-0.0225***
	(0.00524)	(0.0109)	(0.00633)
Export Concentration	-0.00575	0.00554	0.000474
	(0.00412)	(0.00433)	(0.00385)
Agriculture Share	-0.00678	-0.00584	-0.0357***
	(0.00579)	(0.0114)	(0.0119)
Low Elevated Coastal Zone	0.00750*	-0.0456**	0.182
	(0.00386)	(0.0204)	(0.293)
Disaster	-0.00551*	0.00298	0.00557**
	(0.00334)	(0.00360)	(0.00271)
Export Instability	-0.00124	0.00173	0.00393
	(0.00457)	(0.00643)	(0.00704)
Agriculture Instability	-0.00355	-0.000711	0.00441
	(0.00381)	(0.00370)	(0.00467)
ODA_factor	5.298***	-0.0450	-0.320
	(1.714)	(0.694)	(0.376)
distance	-1.116***		
	(0.224)		
contig	-4.196***		
	(1.225)		
comlang_off	0.799***		
	(0.295)		
Constant	-13.42***		
	(3.830)		
Observations	8,871	8,706	10,543
R-squared	0.208	0.927	
Number of dyad			1,523

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

TABLE 3.14 – Aid disbursement Level

	(1) OLS_lODA_su	(2) OLS_fix_effect_lODA_su	(3) PPML_fix_effect_lODA_su
VARIABLES	LnFDI	LnFDI	Level of FDI stock
lnGDP_o	0.269***	1.823***	0.613***
	(0.0783)	(0.306)	(0.209)
lnGDP_d	0.777***	0.454***	0.514***
	(0.102)	(0.151)	(0.0986)
Population	0.00751	-0.0318	-0.0717***
	(0.00777)	(0.0338)	(0.0201)
Remoteness	0.0263***	-0.0246**	-0.0236***
	(0.00525)	(0.0108)	(0.00634)
Export Concentration	-0.00541	0.00547	0.000268
	(0.00411)	(0.00431)	(0.00376)
Agriculture Share	-0.00141	-0.00600	-0.0357***
	(0.00624)	(0.0115)	(0.0116)
Low Elevated Coastal Zone	0.00754*	-0.0452**	0.150
	(0.00386)	(0.0203)	(0.253)
Disaster	-0.00619*	0.00312	0.00527**
	(0.00333)	(0.00359)	(0.00262)
Export Instability	0.000233	0.00162	0.00120
	(0.00459)	(0.00643)	(0.00719)
Agriculture Instability	-0.00290	-0.000713	0.00415
	(0.00381)	(0.00369)	(0.00458)
lODA_su	0.0133*	-0.00452	-0.00620**
	(0.00701)	(0.00577)	(0.00283)
distance	-1.103***		
	(0.224)		
contiguity	-4.191***		
	(1.223)		
language	0.797***		
	(0.295)		
Constant	-14.36***		
	(4.041)		
Observations	8,871	8,706	10,543
R-squared	0.206	0.927	
Number of dyad			1,523

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

TABLE 3.15 – Aid selection

	(1)	(2)	(3)
VARIABLES	Log of FDI	Log of FDI	Level of FDI
lnGDP_o	0.116	1.793***	0.596***
	(0.0772)	(0.308)	(0.211)
lnGDP_d	1.000***	0.637***	0.595***
	(0.0950)	(0.168)	(0.110)
ldistw	-1.117***		
	(0.216)		
contig	-3.515***		
	(1.170)		
comlang_off	-0.288		
	(0.322)		
col45	2.819***		
	(0.318)		
Population Index	0.0262***	-0.0217	-0.0668***
	(0.00735)	(0.0338)	(0.0202)
Remoteness	0.0283***	-0.0214**	-0.0231***
	(0.00531)	(0.0109)	(0.00630)
Export Concentration	-0.00479	0.00416	-0.000206
	(0.00390)	(0.00442)	(0.00364)
Agriculture Share	0.00438	-0.00818	-0.0333***
	(0.00609)	(0.0116)	(0.0117)
Low elevated costal Zone	0.00795**	-0.0478**	0.144
	(0.00369)	(0.0208)	(0.247)
Disaster	-0.00808**	0.00344	0.00523*
	(0.00319)	(0.00354)	(0.00298)
Export Instability	0.00107	0.000841	0.00394
	(0.00438)	(0.00661)	(0.00727)
Agriculture Instability	-0.00390	-0.00181	0.00323
	(0.00371)	(0.00375)	(0.00474)
Dummy Aid	1.496***	-0.0161	-0.0451
	(0.126)	(0.0606)	(0.0454)
Constant	-17.51***		
	(3.715)		
Observations	8,744	8,579	10,364
R-squared	0.272	0.927	
Number of dyad			1,504

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

TABLE 3.16 – Interaction with Aid dummy : OLS

VARIABLES	(1) lfdi	(2) lfdi	(3) lfdi	(4) lfdi	(5) lfdi	(6) lfdi	(7) lfdi	(8) lfdi
lnGDP_o	0.103	0.114	0.111	0.114	0.116	0.116	0.114	0.115
	(0.0765)	(0.0771)	(0.0770)	(0.0770)	(0.0772)	(0.0772)	(0.0772)	(0.0770)
lnGDP_d	0.985***	1.005***	0.993***	1.011***	0.999***	1.001***	0.951***	1.001***
	(0.0923)	(0.0943)	(0.0945)	(0.0954)	(0.0953)	(0.0961)	(0.0961)	(0.0948)
ldistw	-1.168***	-1.141***	-1.109***	-1.117***	-1.117***	-1.117***	-1.145***	-1.112***
	(0.213)	(0.214)	(0.216)	(0.216)	(0.216)	(0.216)	(0.217)	(0.216)
contig	-3.648***	-3.523***	-3.630***	-3.537***	-3.515***	-3.515***	-3.652***	-3.607***
	(1.159)	(1.136)	(1.181)	(1.175)	(1.170)	(1.170)	(1.164)	(1.186)
comlang_off	-0.125	-0.269	-0.265	-0.285	-0.288	-0.288	-0.241	-0.281
	(0.323)	(0.322)	(0.322)	(0.321)	(0.323)	(0.322)	(0.322)	(0.322)
col45	2.805***	2.804***	2.841***	2.851***	2.820***	2.820***	2.801***	2.834***
	(0.319)	(0.317)	(0.318)	(0.316)	(0.318)	(0.318)	(0.317)	(0.318)
POP	0.0421***	0.0265***	0.0254***	0.0269***	0.0261***	0.0262***	0.0244***	0.0262***
	(0.00749)	(0.00730)	(0.00731)	(0.00736)	(0.00739)	(0.00739)	(0.00737)	(0.00734)
REMOT	0.0288***	0.0359***	0.0284***	0.0284***	0.0283***	0.0283***	0.0268***	0.0283***
	(0.00523)	(0.00597)	(0.00531)	(0.00532)	(0.00530)	(0.00531)	(0.00526)	(0.00531)
XCON	-0.00645*	-0.00448	0.00146	-0.00446	-0.00481	-0.00478	-0.00496	-0.00519
	(0.00381)	(0.00389)	(0.00491)	(0.00391)	(0.00390)	(0.00389)	(0.00389)	(0.00390)
SHARE_AGRI	0.00422	0.00433	0.00440	0.0131*	0.00434	0.00438	0.00324	0.00432
	(0.00603)	(0.00608)	(0.00611)	(0.00750)	(0.00611)	(0.00610)	(0.00620)	(0.00610)
LECZ	0.00366	0.00785**	0.00748**	0.00824**	0.00834*	0.00796**	0.00609	0.00778**
	(0.00362)	(0.00368)	(0.00368)	(0.00371)	(0.00458)	(0.00370)	(0.00370)	(0.00369)
DISASTER	-0.00825***	-0.00828***	-0.00793**	-0.00856***	-0.00808**	-0.00795**	-0.00679**	-0.00806**
	(0.00310)	(0.00317)	(0.00318)	(0.00320)	(0.00319)	(0.00394)	(0.00320)	(0.00319)
X_INSTA	-0.000514	0.000846	0.00119	0.00174	0.00102	0.00112	0.00817	0.00118
	(0.00435)	(0.00434)	(0.00439)	(0.00437)	(0.00441)	(0.00439)	(0.00526)	(0.00438)
AGRI_INSTA	-0.00188	-0.00399	-0.00344	-0.00413	-0.00389	-0.00391	-0.00346	0.00180
	(0.00358)	(0.00369)	(0.00371)	(0.00371)	(0.00371)	(0.00370)	(0.00368)	(0.00515)
1.ODA_dum	2.417***	2.132***	1.769***	1.734***	1.510***	1.510***	1.900***	1.648***
	(0.193)	(0.291)	(0.188)	(0.184)	(0.156)	(0.288)	(0.177)	(0.165)
1.ODA_dum#c.POP	-0.0316***							
	(0.00437)							
1.ODA_dum#c.REMOT		-0.0119**						
		(0.00488)						
1.ODA_dum#c.XCON			-0.0108**					
			(0.00500)					
1.ODA_dum#c.SHARE_AGRI				-0.0124*				
				(0.00635)				
1.ODA_dum#c.LECZ					-0.000825			
					(0.00546)			
1.ODA_dum#c.DISASTER						-0.000240		
						(0.00441)		
1.ODA_dum#c.X_INSTA							-0.0220***	
							(0.00642)	
1.ODA_dum#c.AGRI_INSTA								-0.00787
								(0.00519)
Constant	-16.78***	-17.75***	-17.44***	-17.91***	-17.48***	-17.53***	-16.05***	-17.63***
	(3.650)	(3.696)	(3.703)	(3.727)	(3.731)	(3.787)	(3.745)	(3.712)
Observations	8,744	8,744	8,744	8,744	8,744	8,744	8,744	8,744
R-squared	0.286	0.273	0.273	0.273	0.272	0.272	0.276	0.272

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

TABLE 3.17 – Interaction with Aid dummy : PPML with fix effect

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	fdi	fdi	fdi	fdi	fdi	fdi	fdi
lnGDP_o	0.601***	0.594***	0.596***	0.595***	0.598***	0.596***	0.591***
	(0.210)	(0.211)	(0.211)	(0.210)	(0.211)	(0.211)	(0.209)
lnGDP_d	0.587***	0.599***	0.595***	0.592***	0.598***	0.596***	0.581***
	(0.111)	(0.110)	(0.110)	(0.111)	(0.110)	(0.113)	(0.111)
POP	-0.0681***	-0.0667***	-0.0664***	-0.0673***	-0.0669***	-0.0667***	-0.0698***
	(0.0203)	(0.0203)	(0.0204)	(0.0202)	(0.0202)	(0.0206)	(0.0201)
REMOT	-0.0228***	-0.0228***	-0.0232***	-0.0228***	-0.0235***	-0.0231***	-0.0232***
	(0.00624)	(0.00619)	(0.00638)	(0.00622)	(0.00649)	(0.00630)	(0.00632)
XCON	-0.000332	-3.86e-05	0.000115	-1.67e-05	-0.000398	-0.000197	-0.000300
	(0.00359)	(0.00373)	(0.00372)	(0.00378)	(0.00372)	(0.00361)	(0.00363)
SHARE_AGRI	-0.0334***	-0.0333***	-0.0335***	-0.0326***	-0.0326***	-0.0333***	-0.0323***
	(0.0117)	(0.0117)	(0.0117)	(0.0117)	(0.0117)	(0.0117)	(0.0117)
LECZ	0.133	0.141	0.147	0.134	0.142	0.145	0.117
	(0.233)	(0.243)	(0.250)	(0.236)	(0.247)	(0.248)	(0.225)
DISASTER	0.00552*	0.00529*	0.00522*	0.00527*	0.00519*	0.00519	0.00517*
	(0.00312)	(0.00303)	(0.00296)	(0.00296)	(0.00300)	(0.00326)	(0.00294)
X_INSTA	0.00385	0.00393	0.00383	0.00376	0.00396	0.00395	0.00144
	(0.00727)	(0.00724)	(0.00726)	(0.00722)	(0.00727)	(0.00731)	(0.00787)
AGRI_INSTA	0.00320	0.00313	0.00320	0.00334	0.00314	0.00325	0.00285
	(0.00472)	(0.00465)	(0.00472)	(0.00481)	(0.00475)	(0.00470)	(0.00477)
ODA_dum	-0.0586	-0.0654	-0.0402	-0.0337	-0.0593	-0.0478	-0.0845
	(0.0490)	(0.0676)	(0.0491)	(0.0542)	(0.0581)	(0.0629)	(0.0538)
interact_pop	0.000829						
	(0.00123)						
interact_remot		0.000376					
		(0.00114)					
interact_xcon			-0.000357				
			(0.00101)				
interact_sha_agri				-0.000989			
				(0.00207)			
interact_lecz					0.000804		
					(0.00157)		
interact_disaster						4.82e-05	
						(0.000928)	
interact_X_insta							0.00203*
							(0.00115)
Observations	10,364	10,364	10,364	10,364	10,364	10,364	10,364
Number of dyad	1,504	1,504	1,504	1,504	1,504	1,504	1,504

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Chapitre 4

Chinese Policy Uncertainty Shocks and the World Macroeconomy : Evidence from STVAR

[1]

1. écrit conjointement avec Idriss FONTAINE et Laurent DIDIER.

4.1 Introduction

"China's economy, long a reliable source of growth, is slowing, a situation that has created uncertainty in the global markets. Problems in China, the world's second largest economy, can crimp global growth, a big concern at a time when weak oil prices and geopolitical concerns are also clouding the outlook" [2]

This citation, taken from *The New York Times*, highlights the growing importance of the Chinese economy for the world economy. Indeed, since the implementation of structural market reforms in 1978, China is deeply integrated into international markets. For instance, Chinese imports currently represent one-tenth of the world imports, its output accounts for one-tenth of the global production and its investments make up one-fifth of world investments. However, during the last decade, a protracted period of uncertainty has appeared since the global financial crisis of 2007-2008. Examples are the Eurozone debt crisis in 2011, the US "fiscal cliff" in 2012, the Chinese stock market crash in 2015, the Brexit in 2016 and more recently the political crisis in Brazil and South Korea. Those events could impact macroeconomic activity not only for the interest country but also for a wide range of other connected economies. Furthermore, the increase in uncertainty to future growth prospects in emerging countries, especially in China, adds further concern about the future evolution of the world macroeconomy. As a result, it appears important to improve the understanding of the spillover effects of Chinese uncertainty shocks, measured by the Economic Policy Uncertainty (thereafter EPU) index of Baker, Bloom, and Davis (2016), on real activity for a sample of countries representing the main economic partners of China.

Our article can find its motivation in the following considerations. First, most of the papers in this literature underline that uncertainty is an important determinant of the business cycle. For instance, autarkic frameworks developed by Bloom (2009), Jurado, Ludvigson, and Ng (2015) or Caggiano, Castelnuovo, and Groshenny (2014), clearly show that uncertainty shocks are able to impede macroeconomic activity with a negative effect on economic growth, unemployment, private investment and consumption. Second, the literature moving to the analysis of international spillover effects of uncertainty mainly considers the United States (thereafter US) as the unique "exporter" of uncertainty. In this respect, Colombo (2013), Yin and Han (2014), Liyan, Mengchao, and Libo (2016), Caggiano, Castelnuovo, and Figueres (2017b) find that US uncertainty shocks contaminate other economies such as the Euro Area (EA thereafter), China or Canada. Here, by putting an exclusive attention on uncertainty spillovers originating in China on a set of developed and emerging countries/areas, our paper

2. Russell K. and K. K. Rebecca Lai, "Why China rattles the World", *The New York Times*, July 22, 2016.

substantially contributes to the literature and fills an important gap. Furthermore, it is also shown that the impact of international uncertainty shocks is country-specific. In this respect, Carrière-Swallow and Céspedes (2013), Feldkircher and Huber (2016), Choi (2017) and Tsai (2017) find strong differences between developed and developing countries in face of uncertainty shocks. These results can be explained by policy prescriptions, the behavior of firms and households but also the characteristics of the domestic market. That is why we focus our study on several countries/areas rather than just one. Third, Caggiano, Castelnuovo, and Groshenny (2014), Billio, Casarin, Ravazzolo, and Van Dijk (2016), Caggiano, Castelnuovo, and Figueres (2017b) underline that spillover effects of uncertainty are especially important during recessions. In particular, they find evidence that there is an underestimation of the impact of uncertainty shocks on real activity if one does not take into account the non-linear nature governing the transmission of such shocks. By contrast, during expansions, uncertainty spillovers appear to be much more limited. As a matter of fact, very little is known on the potential asymmetries existing for macroeconomic spillover effects related to Chinese policy uncertainty shocks on other economies. We explicitly take into account the presence of such non-linear effects by using a regime switching VAR model.

When studying spillover effects of Chinese policy uncertainty shocks, we focus on six countries/areas : the US, the EA, Japan, Brazil, Korea and Russia. The choice of the first three countries can be motivated by the work of Christou, Cunado, Gupta, and Hassapis (2017) showing that interconnections between major trading partners are a key explanation of the transmission channels of uncertainty spillovers. For instance, the US, the EA and Japan are the largest trading partners of China representing 19%, 14% and 6.3% of Chinese total exports in 2015, respectively. In a recent paper, Caggiano, Castelnuovo, and Figueres (2017b) already mentioned that this channel is particularly relevant to explain these uncertainty spillovers. The choice of Brazil, Korea and Russia is not motivated only by the trade relations. As a small open economy [3], Korea could be prominently affected by foreign uncertainty shocks. In this respect, Cheng (2017) shows that foreign US policy uncertainty shocks have a greater impact on macroeconomic variables than domestic EPU in Korea. Furthermore, the geographical proximity with China could reinforce spillovers between them. Then, we focus on Brazil because it is the first South-American trading partner of China and these two countries are members of the BRICS group. As indicated by Fernández-Villaverde, Guerrón-Quintana, Rubio-Ramírez, and Uribe (2011), South-American countries remain vulnerable to foreign shocks, especially volatility shocks which capture the notion of risk affecting the behavior of economic actors. Concerning Russia, which is another member of BRICS, it is one of the

3. We define a small open economy as an (open) economy that is too small to influence the level of world output and the commodity prices or the world interest rate.

main raw materials provider of China and they created together the Shanghai Cooperation Organisation (SCO) [4] which entered into force in 2003.

As a first step, we estimate a classical linear VAR model. Such a specification suggests that the spillover effects from Chinese uncertainty shocks are quite small. However, the Lagrange multiplier test of Teräsvirta and Yang (2015) strongly indicates that a non-linear model provides a better representation of the dynamics of the data generating process. Therefore, to capture potential non-linearities existing in the transmission of international spillovers of Chinese policy-related uncertainty shocks, we employ, as suggested by Auerbach and Gorodnichenko (2012) or Caggiano, Castelnuovo, and Groshenny (2014), a regime switching Smooth-Transition Vector Auto-Regressive model (STVAR). This empirical strategy allows for the identification, in the same model, of different propagation of the shock of interest, by distinguishing two regimes in the same macroeconomic system. More specifically, the first regime, qualified as expansionary, captures macroeconomic dynamics during good times, while the second, qualified as recessionary, captures the macroeconomic dynamics during phases of economic slack. Overall, the comparison of the output from STVAR to those from VAR indicates that the latter leads to an underestimation of the detrimental effects of Chinese EPU shocks.

Our main findings can be summarized as follows. First, our econometric models unveil important asymmetries in the responses of our sample of countries/areas to Chinese policy-related uncertainty shocks. Thus, we find that uncertainty contagion from China is important mainly during recessionary phases. For instance, US own uncertainty level rises of about 10% in recessions while almost no response is perceptible during expansions. With an impact response of approximately 15%, countries/areas such as the EA, South Korea or Brazil respond significantly much more to the Chinese shock. Second, Chinese uncertainty shocks are shown to impede significantly domestic macroeconomic activity mainly in bad times. In general, when hitting an economy in recessions, an unexpected spike in Chinese uncertainty is predicted to induce a fall in domestic industrial production and exports together with an increase in unemployment (except for Asian economies). At this stage, it should be observed that the qualitative patterns of the domestic responses could vary with the countries/areas studied. Third, the Forecast Error Variance Decomposition (thereafter, FEVD) analysis consistently reveals that the contribution of a policy uncertainty shock from China to domestic macro-variables fluctuations is larger in bad than in good times. Thus, its contribution to Korean own EPU (resp. the US) is 10 (resp. 4) times as large in recessions compared to expansions. Similar patterns can be found from the inspection of other macro-variables, especially in-

4. Since 1996, China, Kazakhstan, Kyrgyzstan, Russia and Tajikistan have decided to counterbalance the American presence through deeper economic, political and security cooperation in the region.

dustrial production, unemployment and trade. Fourth, both the Brazilian and the Russian economies stand out from the four other cases studied insofar they display reactions in both identified regimes. In the Brazilian case, this finding is clearly in line with the conclusion of Fernández-Villaverde, Guerrón-Quintana, Rubio-Ramírez, and Uribe (2011) and reinforces the idea that emerging economies are much more sensitive to foreign uncertainty shocks. Our general message is shown to be robust to several robustness checks.

This paper is structured as follows. Section 4.2 is a preliminary presenting the extant literature and the choice of our sample. Section 4.3 shows that a classical VAR model is not able to capture the macroeconomic consequences following Chinese EPU shocks. Then, it details our favorite empirical model, namely the STVAR. Section 4.4 analyzes the results for the US, the EA and Japan. Section 4.5 extends the empirical analysis to Brazil, South Korea and Russia. Section 4.6 checks for the robustness. Section 4.7 concludes the paper.

4.2 Preliminaries

4.2.1 Related literature

In this paper, we attempt to bridge a gap in the literature due to limited researches on uncertainty spillover effects from an emerging country, such as China, on real activity, for a sample of advanced and developing economies. Naturally, the first papers aiming at assessing the macroeconomic effects of uncertainty focus on an one-country analysis (mainly the US). In such a framework, Bloom (2009), Leduc and Liu (2016) and Jurado, Ludvigson, and Ng (2015) (among others) indicate that uncertainty shocks are likely to trigger recessionary effects by decreasing output and increasing unemployment. The current literature also underlines that uncertainty effects vary across the phases of business cycles. In this respect, Caggiano, Castelnuovo, and Groshenny (2014) or Caggiano, Castelnuovo, and Figueres (2017a) study the impact of US uncertainty shocks on unemployment during both expansion and recession periods through a non-linear Smooth-Transition VAR. They find asymmetric effects over the business cycle with a strong negative impact mainly during recessions. Likewise, by fitting a Markov-switching structural vector autoregression, Lhuissier and Tripier (2016) find that uncertainty does not matter in phase of "tranquil" regime while its effect is sharply higher during regime of financial stress.

At this stage, it should be observed that uncertainty measurement is a challenging task and a wide range of proxies is used. Examples include, the volatility of stock market returns (Bloom (2009), Lhuissier and Tripier (2016)), the frequency of newspaper articles related to economic policy uncertainty (Baker, Bloom, and Davis (2016), Caggiano, Castelnuovo, and

Groshenny (2014) or Caggiano, Castelnuovo, and Figueres (2017a)), the cross-sectional dispersion of production expectations in business surveys (Bachmann, Elstner, and Sims, 2013) or components of a set of macroeconomic indicators (Jurado, Ludvigson, and Ng (2015) or Meinen and Roehe (2017)).

When it comes at evaluating the international spillovers of uncertainty, several studies focused first on contagion effects arising from a developed country (generally the US) into another developed country or region. With a non-linear VAR, Caggiano, Castelnuovo, and Figueres (2017b) find that a policy uncertainty shock from US triggers a fall in industrial production, inflation and policy rate together with an increase in unemployment in Canada during recessions. By contrast, when occurring during prosperous periods, the same shock has almost no effect. According to them, the transmission channels come from the strong economic interdependence between Canada and the US, which partly propagate via trade. Cheng (2017) focuses on a small open economy like South Korea and estimates structural VARs. He shows that foreign policy uncertainty shocks coming from the US have a greater influence than domestic uncertainty on Korean macroeconomic variables. Colombo (2013) studies the effects of US EPU shocks on some European countries through structural VARs. She finds that an increase in US EPU yields a reduction in production and prices due to the decrease in aggregate demand in this developed region. She also shows that US EPU shocks have a greater impact than EA EPU shocks on the variation of the European industrial production. Netšunajev and Glass (2017) employ a Bayesian Markov-switching structural VAR with two measures of uncertainty shocks (labelled as "demand" and "financial") for the two largest economic regions namely the US and the EA. They find that US uncertainty shocks have greater negative influence than the Euro Area on local and foreign labor markets. Klößner and Sekkel (2014) investigate the spillover effects of policy uncertainty for 6 developed countries and find that US policy uncertainty have the highest impact on economic activity relative to the other economic policy uncertainty index. Lastly, Carrière-Swallow and Céspedes (2013) estimate VAR models for a sample of 40 countries and find heterogeneous effects of uncertainty shocks. They observe that emerging markets are more affected by uncertainty from foreign economies than the one from the local country. They explain such patterns by structural difference (e.g. sunk costs associated to investment decisions, the degree of irreversibility of capital) and different policy reactions in the face of uncertainty shocks.

4.2.2 Choice of countries

We focus on China and a set of countries (the US, the EA, Japan, Korea, Brazil and Russia) to analyze whether EPU originating in a large emerging country can influence real

macroeconomic fluctuations in heterogeneous economies. Three arguments explain our choice. First, since these last decades we witness the increase in economic relations between these countries and China. Indeed, the US, the EA, Japan and Korea are present in the top export destinations and import origins of China. For instance, the US represents 19% of Chinese total exports against respectively 14%, 6.3%, 4.6% for the EA, Japan and Korea in 2015. Besides, China became one of the main trading partners of Brazil (19% and 17% of Brazilian total exports and imports in 2015) and Russia (9.9% and 21% of Russian total exports and imports in 2015). Furthermore, intensive diplomatic exchanges also characterized the relations with China through strong bilateral cooperations such as the Asia-Pacific Economic Cooperation (APEC) since 1989, EU-China summits since 1998 and BRICS (Brazil, Russia, India, China and South Africa) summits since 2009. Second, investigations underline that macroeconomics effects of uncertainty shocks may spillover across countries and not exclusively between developed countries only or confined within a country (Colombo, 2013). In fact, the observed effects are likely to be country specific (Carrière-Swallow and Céspedes (2013), among others). Indeed, country-specific characteristics such as financial market access, quality of trade facilitation, social safety, purchasing decisions play a significant role in the face of uncertainty shocks. In this regard, our paper complements these contributions by investigating Chinese EPU shocks for a sample of countries not fully explored by the existing literature. The cases of Brazil, South Korea and Russia are very interesting relative to the other countries. On the one hand, Korea (but also Russia) is geographically near and has highly integrated relations with China which allow the possible spillover effects assessment between contiguous countries as suggested by Caggiano, Castelnuovo, and Figueres (2017b). Moreover, by its status of small open economy, Korea is likely to be vulnerable to external shocks (Armelius, Hull, and Stenbacka Köhler, 2017). On the other hand, Brazil and Russia are the main providers of raw materials to China through agribusiness, fuels and gas, allowing an increased economic interdependence sustained by the growing expansion of the Chinese domestic market. The third reason justifying our sample of countries relies on the availability of macro-data. First, as we try to understand spillover effects related to policy uncertainty shocks, we are limited to consider countries for which the EPU index exist. Second, data requirements are quite important because we need time series of monthly macro-variables. Furthermore, to be consistent with the main purpose of the paper, countries under scrutiny should experience some episodes of economic recession [5]. Considering these issues, our set of countries appears to us as a good departure point for studying the macroeconomic effects of Chinese uncertainty on the world macroeconomy.

5. At the preparation stage of the paper, we thought to add India in our sample. However, Indian EPU is available only since 2001 and from this date India does not experience deep economic downturns.

4.3 Empirical background

4.3.1 Data

For each country $i \in \{\text{US, EA, Japan, Brazil, Korea, Russia}\}$, our baseline model includes 6 time series in the following vector $Y_t^i = \left(EPU^{CHINA}, EPU_t^i, \Delta \ln(IPI_t^i), \ln(U_t^i), \Delta \ln(CPI_t^i), \ln(Export_t^i)\right)'$. The first two variables are our proxies for capturing the level of policy-related uncertainty : the Economic Policy Uncertainty indexes constructed by Baker, Bloom, and Davis (2016). These measures are generated via automated text searches of words in some leading newspapers. In particular, the EPU indexes aim at assessing the frequency of articles containing terms related to the economy (E), policy (P) and uncertainty (U) [6]. For some countries/areas included in our analysis the construction of an EPU index presented more challenges than in the US. Let us first consider the special case of China which corresponds to the country at the heart of our analysis. Censorship and state control, which sometimes characterize the Chinese economy, may introduce bias in our measure. Thus, to tackle this issue, Baker, Bloom, and Davis (2016) did not perform text searches on a Chinese newspaper but focused rather on the leading English newspaper in Hong Kong : the *South China Morning Post* [7]. The EA case is also singular since, at the written of this paper, no measure of EPU covering all the Eurozone exist. Therefore, to measure the policy uncertainty related to the Euro Area, we choose the European EPU based on a weighted average of major European countries such that France, Germany, Italy, Spain, and the UK. By doing so, we assume that the European index is a good approximation of EPU for the entire Eurozone [8].

The other endogenous variables of our analysis capture the real evolution of domestic economies [9]. We use the Industrial Production Index (IPI) rather than real GDP because the latter is not available at a monthly frequency [10]. In general, this choice is not a source of

6. More details on the data construction can be found in Baker, Bloom, and Davis (2016) or in the website (http://www.policyuncertainty.com/index.html) dedicated to the index.

7. In order to ensure that the automatic measure of Chinese EPU is not weak an audit is conducted on 500 articles included to the measure. Then, the auditors have to evaluate the relevance of the selected article to discuss economic policy uncertainty. The audit indicates that 492 articles effectively pertain to Chinese policy uncertainty.

8. The Japanese, Brazilian, Korean and Russian EPU are less challenging. They are constructed following the same construction method as in the US. For Japan, the EPU index is based on text searches in four major Japanese newspapers (Yomiuri, Asahi, Mainichi and Nikkei). For Brazil the index uses the newspaper Folha de Sao Paulo. For South Korea the index is based on six major newspapers. Lastly, Russian EPU index is based on the newspaper Kommersant. For more details, the interested reader can refer to the following webpage http://www.policyuncertainty.com/korea_monthly.html or the paper of Baker, Bloom, and Davis (2016).

9. All details about data sources are reported in appendix 4.A.

10. By doing so, we follow Caggiano, Castelnuovo, and Figueres (2017b), Caggiano, Castelnuovo, and

problem because IPI is a very good proxy of real Gross Domestic Products (GDP) [11]. The IPI enters in our vector of endogenous variables as a first difference of its logarithm. Naturally, to capture labor market response to uncertainty shocks, we include the logarithm of unemployment rate ($\ln(U)$), defined according to the ILO's standards [12]. As in many applications, we also add the growth rate (year-over-year percentualized) of domestic Consumer Price Index (CPI). The inclusion of such a variable is very important insofar the current theoretical literature is still unclear on the mechanisms affecting it after an increase in uncertainty. For instance, when Leduc and Liu (2016) claim that uncertainty shocks are deflationary, Guglielminetti (2015) indicates that such a response depends on the model assumptions especially the specification of the production and the inclusion (or not) of capital investment. Here, we address this issue from an empirical point of view and by studying the potential effects of foreign uncertainty shocks on inflation. Finally, in order to take into account that international spillovers of policy uncertainty could have a crowding-out effect on international trade, we include the log of domestic exports in Y_t [13].

In order to maximize the number of observations that we work on, for all countries except EA, we rely on monthly data starting in 1995M1 and ending in 2016M1 [14]. Finally, observe that we focus on the effect of a policy uncertainty surprise originating from China by putting attention on the existence of non-linearities. In the context of this paper, studying the opposite effect, for instance spillovers of US or Korean policy uncertainty on the Chinese economy, has no sense since China experienced no deep recession over the sample period. However, before moving to the non-linear VAR framework we operate step-by-step by presenting results obtained from the estimation of a more classical linear VAR model.

4.3.2 The linear model

Identification assumption

We begin our empirical analysis with the estimation of standard linear VAR models. More precisely, for each country in our sample the empirical model can be written as :

$$Y_t = \Pi(L)Y_t + \varepsilon_t \tag{4.1}$$

Figueres (2017a)

11. For instance, the correlation between IPI and GDP at a quarterly level is above 98% in the US case.
12. International Labour Organization
13. In a robustness check, we replace exports by imports.
14. In the special case of the EA, the sample is shorter and begins in 1999M1, i.e. the first date at which the EA data is available.

where Π is the coefficient matrix and ε the vector of reduced form residual. The number of lags included in the VAR is set according to the Hannan-Quinn and Aikake criteria. Both suggest including either 2 or 3 lags. In the baseline case, we opt for a parsimonious model featuring 2 lags. One of the major challenges in modeling VAR is the identification of structural shocks. Throughout the paper, to retrieve a structural Chinese policy uncertainty shock, we follow the bulk of the literature [15] by applying a Cholesky decomposition on the covariance matrix of residuals so that our set of domestic variables are able to respond contemporaneously to Chinese EPU shocks. By contrast, Chinese variables respond to domestic shocks with an one-period delay. Given the monthly frequency of our datasets, this identification strategy seems reasonable.

News from a linear VAR

Figures 4.1 and 4.2 show the impulse response functions (IRFs) of domestic variables, along with the 90% confidence interval bands, to a one-standard deviation shock to the Chinese policy uncertainty [16]. In qualitative terms, an unexpected increase in Chinese EPU has a recessionary influence on domestic economies. It implies an increase in domestic policy uncertainty and unemployment (except for South Korea) together with a fall in industrial production, inflation and exports. However, it should be observed that the quantitative impacts are quite small. Indeed, for our set of macro-variables, namely IPI, unemployment, inflation and exports, the IRFs are hardly significant for the 6 countries studied. An exception is about the responses of domestic policy-related uncertainty. For instance, a Chinese EPU shock increases Korean policy uncertainty (at its peak) of about 10% against 5% in the US, the EA, Japan and Brazil. For Russia, the EPU response remains indistinguishable from 0.

Overall, the linear VAR model suggests that spillover effects from Chinese policy uncertainty shocks exist but are somewhat limited. However, a natural concern is about the relevance of the linear framework to unveil the true impact of Chinese uncertainty shocks on the world macroeconomy.

Is the linear model the best one ?

To provide an answer to the subsection title, we run the Lagrange Multiplier test proposed by Teräsvirta and Yang (2015) aiming at confronting the null hypothesis of linearity against

15. Examples include Bloom (2009), Basu and Bundick (2017), Leduc and Liu (2016), Caggiano, Castelnuovo, and Groshenny (2014) and Caggiano, Castelnuovo, and Figueres (2017a)

16. For comparison purpose, we present in appendix 4.B the results obtained from the estimation of a linear VAR containing only Chinese macro-variables.

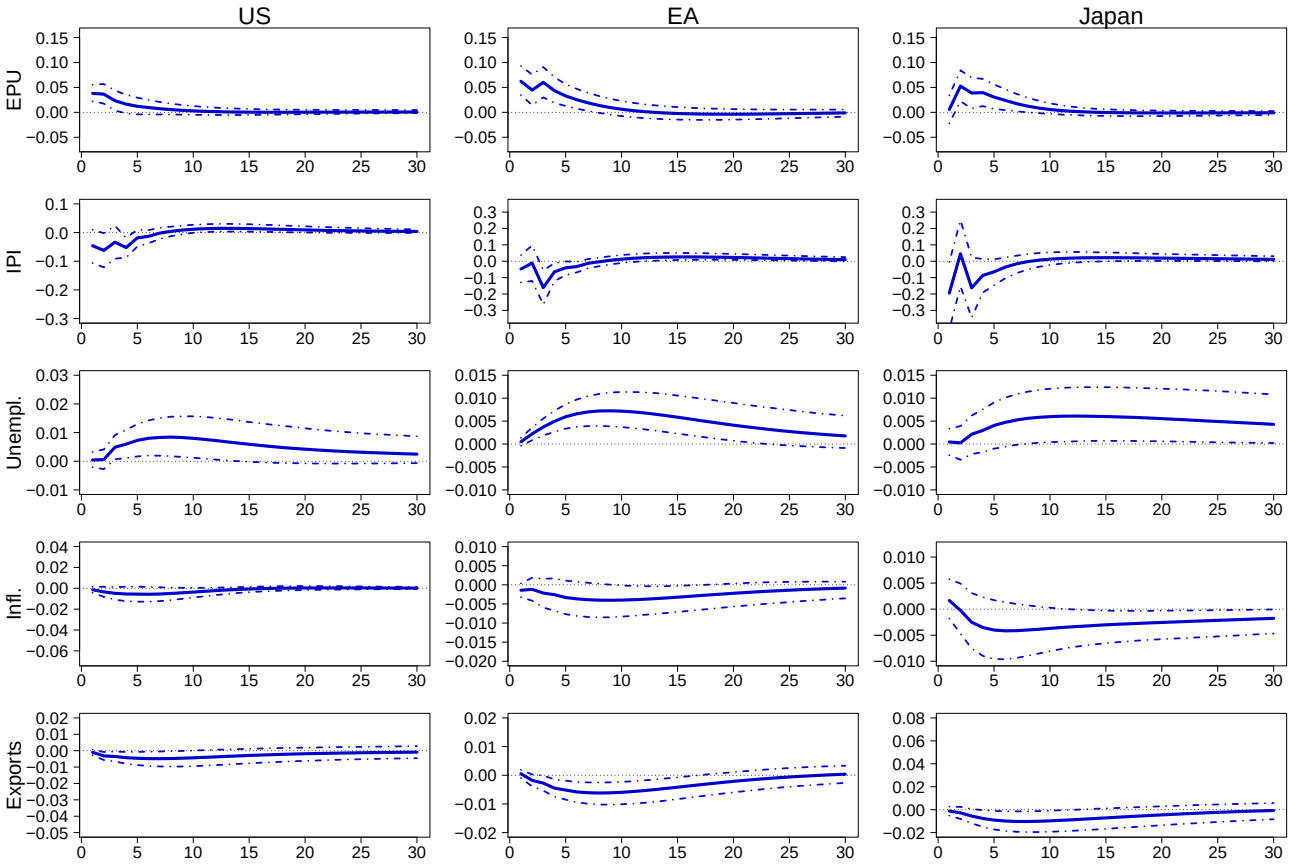


FIGURE 4.1 – Effects of a one-standard deviation shock to Chinese policy uncertainty on US, EA and Japanese macro-variables - Linear model.

Sources : Author's own calculations.

Notes : Impulse response functions to a 1 standard-deviation increase in Chinese policy uncertainty shocks. Blue error bands represent the 5th and 95th of the distribution of responses simulated by bootstrapping 10000 times the residuals of the VAR.

the alternative that a non-linear framework is more adequate. The application of this test is of particular importance because in the event that a non-linear framework is suited, the linear one has only a limited interest. In this case, and from a statistical viewpoint, a non-linear framework provides a better representation of the data generating process. We obtain values of the Lagrange Multiplier statistics equal to 157, 102 and 115 corresponding to a p-value of 0, for the US the EA and Japan respectively [17]. Unambiguously, we are able to reject the null hypothesis of linearity in our data at any conventional level of confidence. As a consequence, a linear model would provide an inconsistent picture of the joint dynamics of our variables of interest. Therefore, we move to a non-linear structure in the rest of the paper.

17. For Brazil, South Korea and Russia, the LM test is respectively equal to 139, 110 and 114 with p-values of zero which favor our non-linear specification.

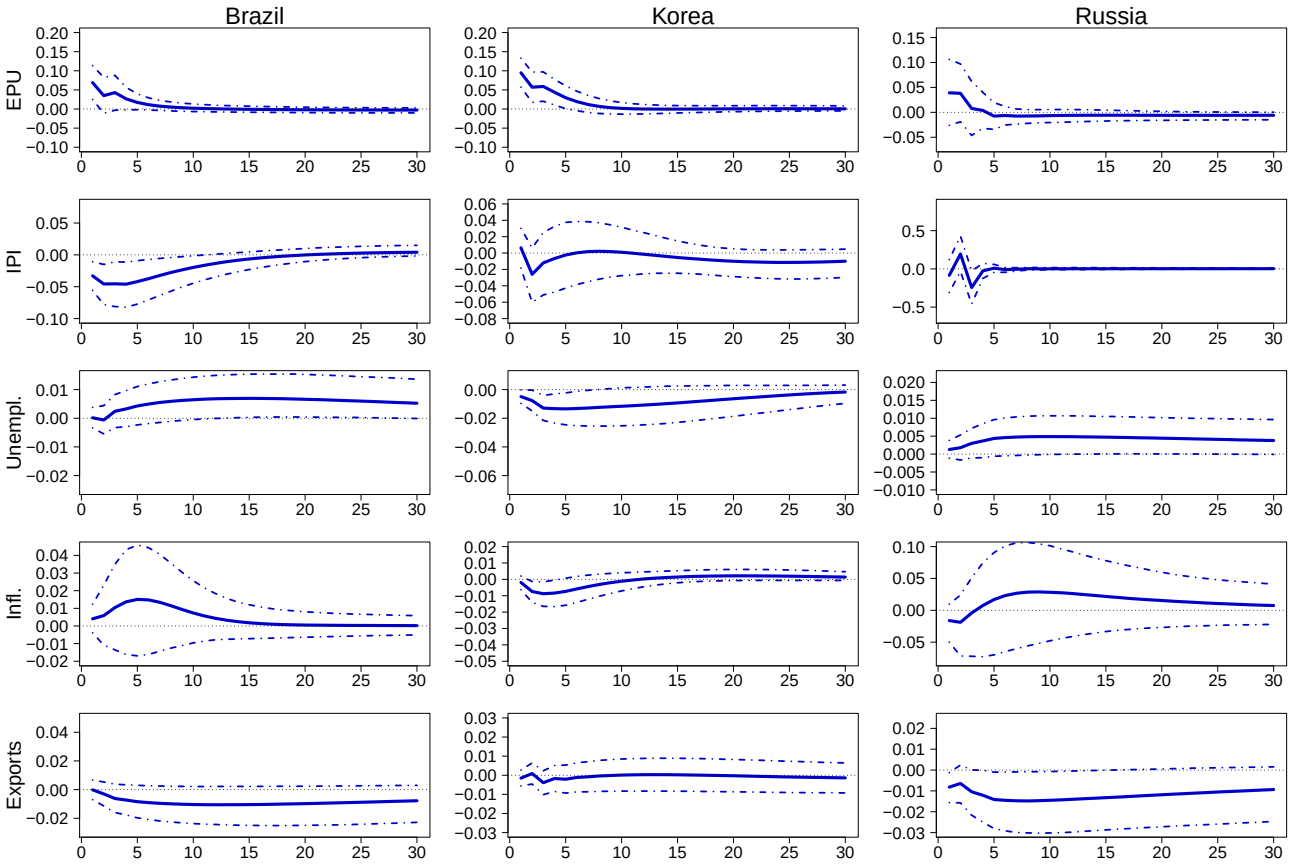


FIGURE 4.2 – Effects of a one-standard deviation shock to Chinese policy uncertainty on Brazilian, Korean and Russian macro-variables - Linear model.

Sources : Author's own calculations.

Notes : Impulse response functions to a 1 standard-deviation increase in Chinese policy uncertainty shocks. Blue error bands represent the 5th and 95th of the distribution of responses simulated by bootstrapping 10000 times the residuals of the VAR.

4.3.3 Beyond the linear model

The STVAR model

Given the results of the test applied in the last subsection, it seems relevant to drift to a non-linear structure. To address this issue, the literature proposes many alternatives. For instance, Mumtaz and Theodoridis (2015) or Lhuissier and Tripier (2016) (among others) use a Markov-swtiching VAR to model non-linearities between uncertainty and some macro-variables. This framework has the advantage of taking into account the possible regime changes in the data. However, it provides no control of the amplitude of the regime changes. Meanwhile, switching from one regime to another is immediate and appears abruptly [18]. In

18. Both Markov-switching and STVAR models are convenient for our research question. However, we focus on the novelty of applying the STVAR methodology in estimating policy uncertainty spillovers from China.

this paper, we take another route and we employ a regime switching Vector Auto-Regressive model where transitions across states are smooth (STVAR). By doing so, we are in the lines with the empirical specifications of Auerbach and Gorodnichenko (2012) and Caggiano, Castelnuovo, and Groshenny (2014). Such a model has some interesting features. In particular, compared to a Markov-Switching VAR, the STVAR framework allows for a control of transition phases. More precisely, transitions between each regime is calibrated through an indicator variable and a parameter which permit a smoother transition between phases. Our baseline econometric model is specified as follows

$$Y_t = F(z_{t-1})\Pi_R(L)Y_t + (1 - F(z_{t-1}))\Pi_E(L)Y_t + \varepsilon_t \text{ with } \varepsilon_t \hookrightarrow \mathcal{N}(0, \Omega_t) \tag{4.2}$$

$$\Omega_t = \Omega_R F(z_{t-1}) + \Omega_E(1 - F(z_{t-1})) \tag{4.3}$$

$$F(z_t) = \frac{\exp(-\gamma z_t)}{1 + \exp(-\gamma z_t)}, \text{ with } \gamma > 0 \text{ and } z_t \hookrightarrow \mathcal{N}(0, 1) \tag{4.4}$$

$F(z_t)$ captures the likelihood of being in a recession phase, in the form of a logistic transition function. γ is a parameter which ensures a smooth switch from one regime to another. Intuitively, the larger the parameter γ, the faster the transition within our phases. z_t is a transition indicator of the business cycles. Π_R and Π_E are matrices of coefficients which capture, respectively, the dynamics of the system during recessions and expansions. Finally, Ω_R and Ω_E are regime-dependent covariance matrices of the reduced form residuals of our model [19].

Interestingly, our model specification assumes that the joint dynamic of endogenous variables is a combination of two linear VARs : the first one describing fluctuations during recessions and the second one during expansions [20]. A crucial advantage of STVAR over estimating VAR models separately for each regime is that all information available in the data is used jointly to identify the two phases. In this respect, a STVAR overcomes the main shortcoming of the latter strategy which diminishes the number of observations and gives very imprecise estimates. Another interesting feature of our model is that it allows for two sources of differences in the transmission of structural shocks. The first one comes from contemporaneous differences due to different covariances matrices Ω_R and Ω_E. The second one comes from different propagation dynamics due to differences in lag polynomials Π_R and Π_E.

The model we aim at estimating is highly non-linear. Therefore, standard econometric tools cannot be used. Instead and along the lines of Auerbach and Gorodnichenko (2012),

19. It should be observed that the magnitude of shocks is normalized to be of the same size for the two regimes. This ensures the comparability of the impulse response functions between recessions and expansions.

20. STVAR model encompasses a standard linear VAR in the limiting cases (especially when $F(z) = 1$ or $F(z) = 0$.

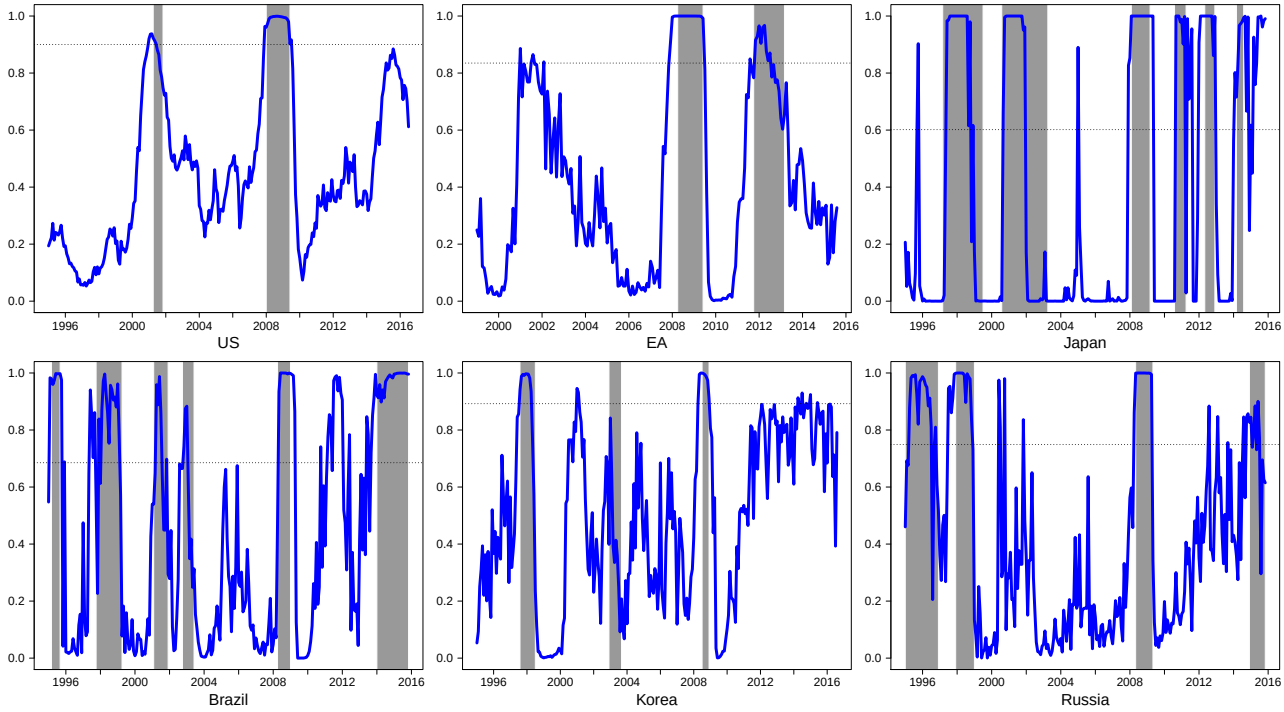


FIGURE 4.3 – Estimated probabilities of being in recessions.
Sources : Author's own calculations.
Notes : The blue lines correspond to our transition function $F(z_t^i)$. Shaded areas are the recessions dates as defined by the NBER (for the US), the CEPR (for EA) and ECRI (for Japan, Brazil, South Korea and Russia). The dotted lines represent the threshold value (dotted lines) above which a month is treated a recession.

for estimation and inference, we use the Markov Chain Monte Carlo (MCMC) algorithm initially proposed by Chernozhukov and Hong (2003). Conditional on γ and an initial guess for $\{\Omega_R, \Omega_E\}$ [21], the coefficient matrices Π_R and Π_E can be estimated by means of weighted least squares. Then, the algorithm looks for a maximum of the likelihood function by iterating over different set of value for Ω_R and Ω_E. Observe that the initial guess provided for $\{\Omega_R, \Omega_E\}$ is calibrated to approximately 1% on the parameter value. Then, we adjust it on the fly for the first 10000 draws [22]. We employ 50000 draws and we drop – as "burn-in" period – the first 10000 draws. The inference is so based on the last 80% draws.

Calibrating recession periods

When modeling STVAR, the choice of the indicator of economic conditions and the calibration of the smoothness parameter are non-trivial. For the first one, the literature generally

21. The initial values of $\{\Omega_R, \Omega_E\}$ can be computed by means of maximum likelihood estimations of a second order approximations of equations (4.2)-(4.4).
22. This is done to generate an acceptance rate of about 0.3.

employs a moving average (MA) of real GDP [23]. Here, as we consider monthly data, we use a MA of the growth rate of industrial production. Observe that the order of the MA is not identical across countries/areas of our analysis. Indeed, the MA order choice corresponds to the highest correlation between the index of business cycles and the indicator of recession periods. Thus, we employ a 18 MA of IPI for the US and the EA while we choose an order of 12 for Japan, Brazil, South Korea and Russia.

In order to calibrate the smoothness parameters γ^i, we use external information from the National Bureau of Economic Research (NBER), the Centre of Economic Policy Research (CEPR) and the Economic Cycle Research Institute (ECRI) about the dating of recession periods. To the best of our knowledge, these institutions use a very similar definition of recessions [24]. Given our choice of business cycle dates, we adjust γ^i so that our transition indicators replicate the frequency and the duration of recessions in the countries/areas considered. For example, in our US sample 10% of time is referred as recessions implying that a month is effectively classified as a bust in our model when $F(z_t^{US}) \geq 0.9$. In our EA sample, the CEPR considers that the proportion of time spent in economic downturns amounts to 16.5% leading that an observation is effectively classified as a recession when $F(z_t) \geq 0.835$. Therefore, our calibration strategy yields $\gamma^{US} = 1.9$ and $\gamma^{EA} = 3.65$ [25]. Figure 4.3 displays the estimated probability of being in a recession period together with the threshold above which a period is considered as a recession in our model and recession periods as defined by NBER, CEPR and ECRI (grey shaded areas). Clearly, it shows that our estimated transition probabilities closely track official business cycle dates in each area studied. However, our calibrated transition functions sometimes point out two other periods of downturns (sometimes not identified by the institutes as an official recession) which probably correspond i) to the international consequences of the 09/11 terrorist attacks (in the EA, South Korea and Russia) and ii) to some country-specific characteristics around 2012. For instance, the 2012 economic downturn

23. Examples include Auerbach and Gorodnichenko (2012), Berger and Vavra (2014) and Caggiano, Castelnuovo, and Groshenny (2014).

24. For the NBER a recession is "*a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales*" (see also http://www.nber.org/cycles.html). For the CEPR a recession is defined as "*a significant decline in the level of economic activity, spread across the economy of the euro area, usually visible in two or more consecutive quarters of negative growth in GDP, employment and other measures of aggregate economic activity for the euro area as a whole*" (see its website http://cepr.org/content/business-cycle-dating-committee-methodology). Furthermore, the CEPR also observe that "*Euro Area Business Cycle Dating Committee has been conceived to operate in a manner similar to the NBER Business Cycle Dating Committee, its deliberations and timing of announcements are independent*". Finally, ECRI recessions' date are available on https://www.businesscycle.com/. The ECRI dating perfectly match the NBER one, which reinforces the use of this alternative measure for Japan, Brazil, Korea and Russia.

25. Table 4.4 in appendix 4.C provides details on the gamma calibration for the other countries of our sample.

identified by the transition function in Brazil corresponds to a period of trade restrictions, tax cuts and real appreciation. In the special case of Japan, our model predicts two more dates of recession compared to the ECRI dating. Those dates (1996 and 2005) correspond to periods just after a surge in Yen's value and around elections. The fact that our calibration method identifies more periods of downturn than the official business cycle dates is not a matter of concern. First, these "supplementary events" have very small duration which do not exceed 3 months. Second, rather identifying official business cycle dates, our strategy should be seen as a way of capturing economic phases where the economic growth slows down.

4.4 Non-linear results for "developed" economies

This section presents the main results of this article for the US, the EA and Japan. First, we describe responses to Chinese policy-related uncertainty shocks. Second, in order to have more idea on the contribution of these shocks in accounting for the fluctuations of domestic variables, we present the FEVDs.

4.4.1 Impulse response analysis

When computing the IRFs in the non-linear framework, we follow Auerbach and Gorodnichenko (2012) and Caggiano, Castelnuovo, and Groshenny (2014) by assuming that once a shock hits the system during a regime, the macroeconomic relationship characterizing the dynamic of the economic system remains, throughout all the adjustment path, in this specific regime. Figure 4.4 plots the corresponding IRFs to Chinese policy-related uncertainty shocks for the US, the EA and Japan. Impulse responses during busts are reported in solid blue lines while those during booms are reported in red circle lines. Inspections of IRFs lead to some straightforward comments. The first striking feature is that strong asymmetries exist, especially for the US and the EA. In particular, Chinese uncertainty shocks, when hitting the US and the EA during expansions, have only a modest influence on these economies. However, domestic macro-variables react quantitatively much more when the same shock occurs during a phase of economic downturn. The Japanese economy stands out from the other two regions since it displays significant reactions during both regimes. Second, policy uncertainty contagion is estimated to be quite important for the US and the EA, especially in recessions. Specifically, the model predicts that US own policy uncertainty rises of about 10% during busts, while no statistically relevant effect is observed during prosperous periods. The picture is very similar for the EA but in quantitative terms the impact response of European uncertainty is stronger in bad times since it peaks at 15%. A comparison of obtained

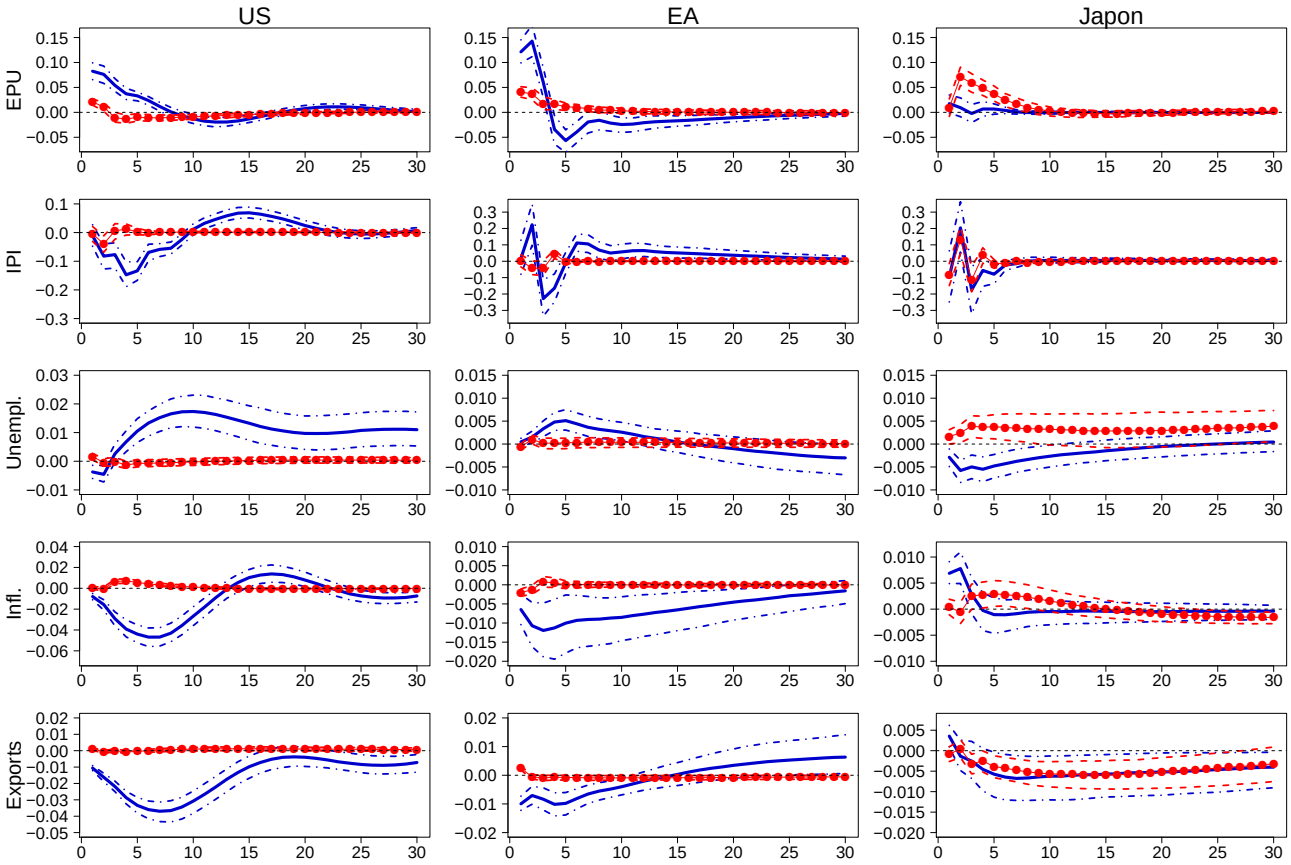


FIGURE 4.4 – Effects of a one-standard deviation shock to Chinese policy uncertainty on US, EA and Japanese macro-variables - Non-linear model.

Sources : Author's own calculations.

Notes : Impulse response functions to a 1 standard-deviation increase in Chinese policy uncertainty shocks. Blue solid lines correspond to median responses in recession phases, blue error bands (dot-dashed lines) represent the 16th and 84th percentiles of the posterior distribution. Red circle points correspond to median responses in expansion phases, red error bands (dashed lines) represent the 16th and 84th percentiles of the posterior distribution.

IRFs from STVAR and classical linear VAR models shows that the maximum response of domestic policy uncertainty (for the US and EA) is twice as large in the former than in the latter case (see also figure 4.1). It should also be mentioned that – though smaller – the Chinese EPU shock causes a significant increase in uncertainty during booms for both regions. Again, the Japanese case is in stark contrast with the US and the EA. Indeed, the response of the Japanese EPU is significantly higher in booms than in busts suggesting that uncertainty connections prevail in the former regime.

In the US and the EA, the responses of macro-variables such as the unemployment rate, exports and industrial production are strongly non-linear. However, the responses of European macro-variables are in general sharply lower compared to what they are in the US. In the US, the model predicts a hump-shape response of unemployment with a maximum of about

2% relative to steady state values during recessions. The response of European unemployment is also hump-shaped but its peak is weaker because it amounts to 0.5%. This rise during bad times is in line with Leduc and Liu (2016) who demonstrate that labor market frictions give rise to a new option-value channel through which uncertainty provokes recessionary effects on economic activity and especially unemployment. Furthermore, the fact that unemployment response is smaller in the EA than in the US can find its rationale from the presence of different wage setting schemes, dominated by trade unions and collective bargaining in the EA. These features have an impact not only on the transmission channels of shocks in general but also their magnitude [26]. Interestingly, the picture looks similar for exports. In both areas, the reaction of exports is negative during the first year, but the maximum (in absolute value) is larger in the US, for which it is around 4%, than in the EA, for which it is around 1%. In bad times, US industrial production reacts negatively but displays a significant overshoot during the second year following the foreign uncertainty shocks. Such a response from the US industrial production is in accordance with the model of investments with fixed adjustment costs - as developed in Bloom (2009) - indicating that in periods of high uncertainty, firms find it optimal to "wait-and-see" before engaging new investments and production. Furthermore, as soon as business conditions improve and uncertainty vanishes, many of firms that postponed their investments reengage strongly generating a rapid recovery and an overshoot in production. Differently, the response of IPI in busts for the EA is not clear-cut during the first two months after the impact. Then it falls significantly and displays a small overshoot 7 months after the foreign shock. Finally, a Chinese policy uncertainty shock is predicted to trigger a short run decline in US inflation with a significant overshoot. The response of inflation in the EA is also significantly negative but quantitatively lower. Overall, such negative responses of inflation is consistent with Basu and Bundick (2017) and Leduc and Liu (2016) who agree with the demand-driven interpretation of price formation.

As mentioned previously, the Japanese economy does not display the same type of responses than the other two countries/areas. The differences are especially about unemployment and inflation. As shown in the third column of figure 4.4, the Japanese unemployment rate increases when a Chinese shock occurs during booms while it decreases when the same shock acts during recessions [27]. However, compared to the US, Japanese unemployment responds much less. As regard to prices, the estimated impulse responses suggest that Japanese inflation increases in both phases. This is at odds with US and EA results. The theoretical model of Mumtaz and Theodoridis (2015) provides a potential explanation to such reactions. When prices and wage stickiness exist, firms could push their prices up in order to avoid

26. See also Netšunajev and Glass (2017) or Wolfgang and Pfeiffer (2002).

27. As we will show momentarily, we recover the same qualitative pattern for Korea during recessions, an another Asian economy.

cost associated with higher real wages. For the remaining, namely IPI and exports, Japanese responses are quite similar in booms and busts and they are of the same order (at their peak) than EA responses in economic downturns. The reactions of exports are however more persistent.

4.4.2 Forecast Error Variance Decomposition

The FEVDs of table 4.1 assess the importance of Chinese policy uncertainty shocks for domestic variables by contrasting the two regimes identified in our analysis. In line with the IRFs analysis, FEVDs show that the contribution of China's EPU shocks to the US economy are substantial while they are weaker for the EA and Japan. Furthermore, observe that Chinese uncertainty shocks are statistically irrelevant in booms for real variables in the US and the EA while their relative importance are small but of the same magnitude in both regimes in Japan.

In the US, foreign uncertainty shocks explain four times as much the variation of domestic EPU during bad times than in good times. It is noteworthy that the share of variance explained amounts to approximately 17% in the short-run as well as in the medium-run. Likewise, the FEVD analysis reveals a similar pattern for the EA and the Chinese shock explains around 11% of European uncertainty in the medium run. Differently, the Chinese EPU shock explains a larger share of the volatility of Japanese EPU in good times than in bad times (11% at the 18-month horizon against 0.5%, respectively). Conditional on recessions, Chinese uncertainty shocks are estimated to be at the origin of around 19% of US unemployment variance. In recessions, only 0.25% of US unemployment is generated by the identified shock. Differently and even in busts, the share of fluctuations in European and Japanese unemployment explained by the foreign shock is weaker. At impact, it is equal to 4.83% (resp. 5.76%) in economic downturns against 0.33% (resp. 2.43%) in prosperous periods in the EA (resp. Japan). Other US variables, as inflation and exports, are very sensitive to foreign shocks, reinforcing the idea that EPU spillovers are quantitatively important. For instance, at the 12-month horizon, Chinese EPU shocks account for almost 50% of the variation of US exports before converging to a non-marginal value of 39% at the 36-month horizon. In lines with previous European results, the foreign shock explains in the medium run 2.4% and 3.9% of the variance of exports and inflation. In Japan, although weak, the Chinese shock explains a higher share of forecast variance of exports (4.38%) and inflation (2.28%) in prosperous periods than in periods of economic slack. Finally, it should be observed that non-linear effects of the Chinese policy-related uncertainty shock on the FEVD of industrial production exist. At the 36-month horizon, Chinese uncertainty shocks explain approximately 9% of the volatility of US industrial production. In the EA and Japan, the

share of IPI variance explained does not exceed 4%.

Comments We find that the propagation of Chinese policy uncertainty shocks is asymmetric in the US and the EA. As a consequence, the estimation of a classical linear VAR model (as in the previous section) provides a misleading picture of the magnitude and the persistence of the macroeconomic effects of a Chinese EPU shock. Indeed, for these two countries, macroeconomic responses related to that shock differ drastically in both regimes identified. In this respect, the US and European evidence agrees with the view that foreign uncertainty shocks can be seen as negative demand shocks leading to a fall in output, exports and inflation together with an increase in unemployment (Leduc and Liu, 2016). In a DSGE setup featuring nominal rigidities and search frictions, the transmission channel relies on i) a change in household consumption behavior (in response to uncertainty the representative household consumes less and supplies more labor), ii) the inability of firms to freely charge new prices (so that they have to cut production to meet the new depressed demand (Basu and Bundick, 2017)) and iii) the apparition of a new option-value channel for each job match (when times are uncertain, the value of a job match declines so that the option value of waiting increases, firms open fewer vacancies leading ultimately to higher unemployment).

Our STVAR modeling framework also highlights that the responses of the Japanese economy to the Chinese shock are different and more difficult to rationalize. In particular, the Japanese model suggests that the negative patterns of uncertainty shocks exist in booms. By contrast, during bad times, foreign uncertainty shocks are less influential and provoke some confusing responses (especially an upsurge in unemployment). Overall, the results of this section confirm that a systematic and separate study of several countries allows us to put in evidence some differences in the transmission of Chinese policy uncertainty shocks.

A special comment should be made about the responses of exports. For the three countries under consideration in this section, exports decrease in bad times (and even in good times in Japan). This evidence is clearly in line with Handley (2014) who shows that sunk market entry cost combined with uncertainty about future conditions may give rise to an option value of waiting before exporting. The key mechanism resembles those described by Bloom (2009) about investment or Leduc and Liu (2016) about job creations. In the special context of international trade, companies trade-off the value of beginning to exports in the current period versus waiting to obtain more information about economic fundamentals. In times of uncertainty, the higher option value of waiting induces firms to postpone their decisions leading ultimately to a fall in exports.

Horizons	$\ln(EPU)$		$\Delta\ln(IPI)$		$\ln(U)$		$\Delta\ln(CPI)$		$\ln(Export)$	
	Rec.	Exp.	Rec.	Exp.	Rec.	Exp.	Rec.	Exp.	Rec.	Exp.
United States										
6	17.78	3.05	6.17	0.75	4.61	0.56	21.33	7.48	36.36	0.50
12	16.81	4.08	6.96	0.75	13.41	0.33	31.97	7.33	49.69	0.68
18	17.28	4.34	8.73	0.75	15.34	0.23	28.53	6.92	46.70	1.10
24	17.40	4.21	8.94	0.75	15.92	0.22	28.24	6.72	44.01	1.22
36	17.47	4.00	9.04	0.75	18.91	0.24	28.04	6.27	38.88	1.12
Euro Area										
6	15.35	8.99	3.42	1.54	4.83	0.33	3.25	1.13	8.34	2.95
12	12.35	8.24	3.61	1.55	3.80	0.36	3.52	0.98	7.14	2.57
18	11.49	7.53	3.74	1.55	2.13	0.41	3.74	0.96	4.09	2.58
24	11.29	6.95	3.83	1.55	1.45	0.45	3.88	0.94	2.68	2.65
36	11.21	6.11	3.86	1.55	1.56	0.48	3.89	0.91	2.39	2.80
Japan										
6	0.43	12.17	1.45	2.05	5.76	2.43	2.47	1.32	0.87	1.73
12	0.43	11.47	1.45	2.06	5.08	2.52	1.72	1.94	1.65	4.44
18	0.43	10.97	1.45	2.05	4.20	2.31	1.45	1.78	2.03	5.73
24	0.43	10.73	1.45	2.05	3.44	2.26	1.33	1.73	2.29	5.77
36	0.43	10.49	1.45	2.06	2.47	2.76	1.22	2.28	2.68	4.38
Brazil										
6	27.34	8.77	29.02	1.31	6.84	6.01	2.98	1.25	10.68	3.02
12	27.70	8.85	40.09	4.77	6.48	11.40	3.07	2.22	11.97	5.73
18	27.27	8.76	42.87	6.90	5.73	15.99	3.02	2.49	12.59	7.40
24	26.60	8.66	43.10	7.85	5.06	18.88	2.98	2.36	12.96	8.52
36	25.14	8.53	41.17	8.56	4.08	20.79	2.94	2.07	13.34	9.92
South Korea										
6	29.36	3.08	16.11	2.19	32.50	0.94	50.45	6.55	16.10	1.51
12	29.10	3.15	16.36	2.36	46.20	0.50	54.73	6.46	17.51	0.79
18	31.53	3.12	17.42	2.35	51.44	0.36	53.10	6.30	14.23	0.49
24	31.61	3.06	18.26	2.34	53.06	0.30	51.46	6.15	13.12	0.35
36	31.53	2.93	18.34	2.33	53.10	0.25	50.65	5.85	15.45	0.21
Russia										
6	5.62	2.55	15.29	0.47	10.55	2.36	0.67	1.14	1.36	4.22
12	5.29	2.54	15.24	0.47	16.83	3.47	0.81	1.70	0.72	2.23
18	5.21	2.53	15.23	0.47	17.22	3.08	0.74	2.02	0.89	1.53
24	5.19	2.52	15.22	0.47	16.23	2.56	0.86	2.12	1.44	1.15
36	5.20	2.48	15.21	0.47	14.64	1.88	1.26	2.02	2.80	0.75

TABLE 4.1 – Forecast Error Variance Decomposition of domestic macro-variables consecutive to a Chinese policy uncertainty shock.

Sources : Author's own calculations.

Notes : Rec. indicates recession periods. Exp. indicates expansion periods. Figures are reported in percentage. Horizons are reported in month.

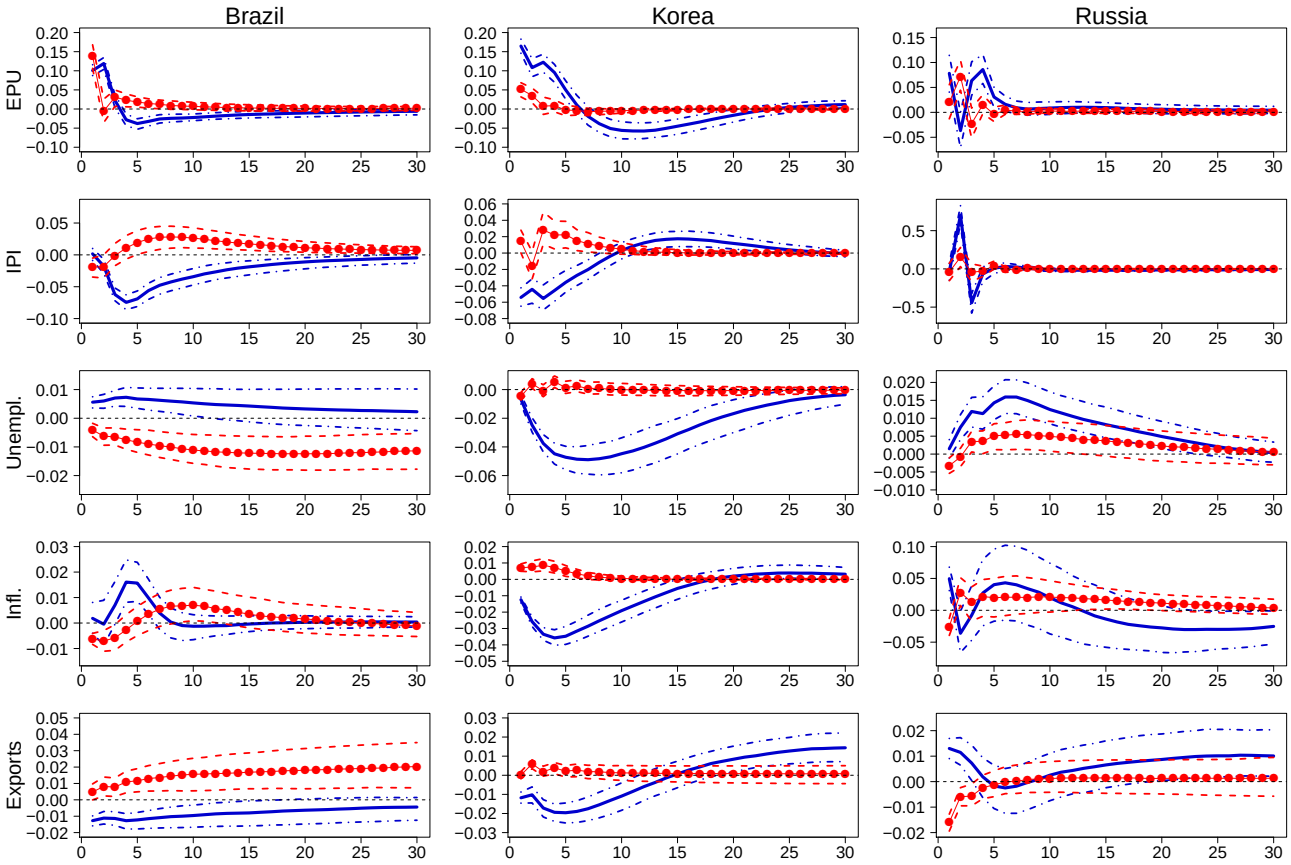


FIGURE 4.5 – Effects of a one-standard deviation shock to Chinese policy uncertainty on Brazilian, Korean and Russian macro-variables - Non-linear model.

Sources : Author's own calculations.

Notes : Impulse response functions to a 1 standard-deviation increase in Chinese policy uncertainty shocks. Blue solid lines correspond to median responses in recession phases, blue error bands (dot-dashed lines) represent the 16th and 84th percentiles of the posterior distribution. Red circle points correspond to median responses in expansion phases, red error bands (dashed lines) represent the 16th and 84th percentiles of the posterior distribution.

4.5 Non-linear results for Brazil, Korea and Russia

In this section, we move to the analysis of the second part of our sample. As in the previous section, we first present IRFs before describing FEVDs.

4.5.1 Impulse response analysis

Figures 4.5 draws the corresponding response functions of Brazil, South Korea and Russia to a Chinese EPU upsurge. Overall, effects appear quite different depending on the country under scrutiny. First, during expansions, where the US and the EA exhibit no reaction, Brazil and Russia respond in both regimes. More precisely, in Brazilian expansions, an uncertainty

shock leads to an immediate fall in industrial production with a significant overshoot between the 5th and the 15th months. This overshoot does not occur when the shock hits in recessions. In bad times, Brazilian unemployment increases of about 1% while exports decline of about 1%. Both return steadily to their pre-shock level. Looking at expansions, the foreign shock triggers a fall in unemployment and an increase in exports. The Russian economy is also sensitive to the Chinese shock in both regimes but the qualitative responses are closer (except for exports). For example, unemployment in Russia displays a similar hump-shaped pattern in both regimes identified. Furthermore, the maximum response of Russian unemployment is 3 times higher in recessions than what we observed by estimating a linear VAR model. It should also be observed that the reaction of Russian IPI is the highest observed among the countries we study. By contrast to Brazil and Russia, South Korea follows the same patterns than the US and the EA, except for unemployment. In good times, a Chinese uncertainty shock has almost no incidence on the Korean economy. However, during bad times it decreases industrial production, inflation and exports. As in the Japanese case, Chinese EPU shocks occurring in recessions imply a persistent fall, with a minimum of approximately 5%, in Korean unemployment.

Second, and perhaps more importantly, when the Chinese EPU shock causes an increase of about 10% in the level of uncertainty in the US, the contagion is higher in Brazil and Korea. Indeed, an impact increase of 15% is observed during recessions for Korean policy uncertainty and Brazil reacts (almost) at the same level in both regimes. Furthermore, the observed responses are higher of about 5 percentage points than what we observed by running linear VARs. The response of Russian own policy uncertainty are slightly higher in the STVAR model than the VAR model. However, for the former, Russian EPU response remains lower compared to what we observe for Brazil and South Korea.

A special concern should be addressed to the Brazilian and Russian inflation rate. In periods of downturn, Brazilian inflation rate is increasing for 2 or 3 periods before returning to steady state. During booms, despite a negative response at impact, a rise is then perceived. Although the response of Russian inflation could be positive, it is not clear-cut since it is barely significant. Overall, a positive response of inflation - as displayed in Brazil and to a lesser extent in Russia - is at odds with the theoretical conventional wisdom indicating that uncertainty shocks push inflation down (Leduc and Liu, 2016). One possible explanation to a positive response could be a change in inflation expectations (Istrefi and Piloiu, 2013). Changes in uncertainty combined to a total distrust to local authority are mutated to a shift in a relative price level . Therefore, households expect a higher price in the future leading to an increase in the current price in a context of rational expectation. Another justification could be found in Mumtaz and Theodoridis (2015) (see also subsection 4.1).

4.5.2 Forecast Error Variance Decomposition

At impact, variations related to Chinese policy uncertainty are important drivers of domestic EPU especially in Brazil and Korea. In particular, it accounts for about one-quarter of Brazilian EPU and about one-third of Korean EPU during phases of economic downturns. It should be mentioned that the contribution of the Chinese shock to Brazilian EPU is non-negligible in expansions since it is approximately equal to 9%. As mentioned in the IRF analysis, the pattern followed by the Korean economy is more in line with the one observed in the US. Besides, the share of Korean policy uncertainty explained by the Chinese shock in expansions is estimated to be unimportant. For the Russian policy uncertainty, the Chinese shock accounts for (only) 5% (resp. 2.50%) of the volatility of policy uncertainty during recessions (resp. expansions).

In accordance with the relative sensitivity of the Brazilian, Korean and Russian industrial production to the foreign shock unveiled by the IRFs, their share of FEVDs accounted by the latter are higher than those observed in our set of "developed" economies. In the medium run, 18% and 15% of Korean and Russian industrial production are generated by the Chinese uncertainty shock. In Brazil, this statistic is even higher since it amounts to 40%. Interestingly, only 4% of Brazilian unemployment fluctuations are imputed to foreign uncertainty shocks during downturns, while in booms the statistic is around 20%. This suggests that this economy remains sensitive to international uncertainty whatever the regime. For Russia, the contribution of the Chinese shock to the forecast error variance of unemployment peaks at 17% at the 18-month horizon in busts against 3% in booms. It is noteworthy that South Korea has its unemployment rate and inflation rate largely explained (57% and 48%, respectively) by our foreign uncertainty shock during busts. All previous insights on international trade are unaltered because 15% of Korean and Brazilian export variations are attributed to Chinese policy-related uncertainty shocks in busts [28]. Finally, inflation and exports in Russia seem to be less sensitive to foreign uncertainty shocks.

Comments Our evidence confirms that uncertainty shocks emanating from China have detrimental effects on countries like Brazil, South Korea and Russia. As suggested in Fernández-Villaverde, Guerrón-Quintana, Rubio-Ramírez, and Uribe (2011), our findings reinforce the idea that emerging economies (Brazil and Russia in our sample) remain sensitive to external shocks. The new insight from our empirical investigation is that those countries remain sensitive to that shock in both recessionary and expansionary phases. This point is in stark contrast with developed countries under scrutiny such as the US, the EA and even South

28. In Brazil, the FEVD of exports during booms is non-negligible in the medium-run (10%).

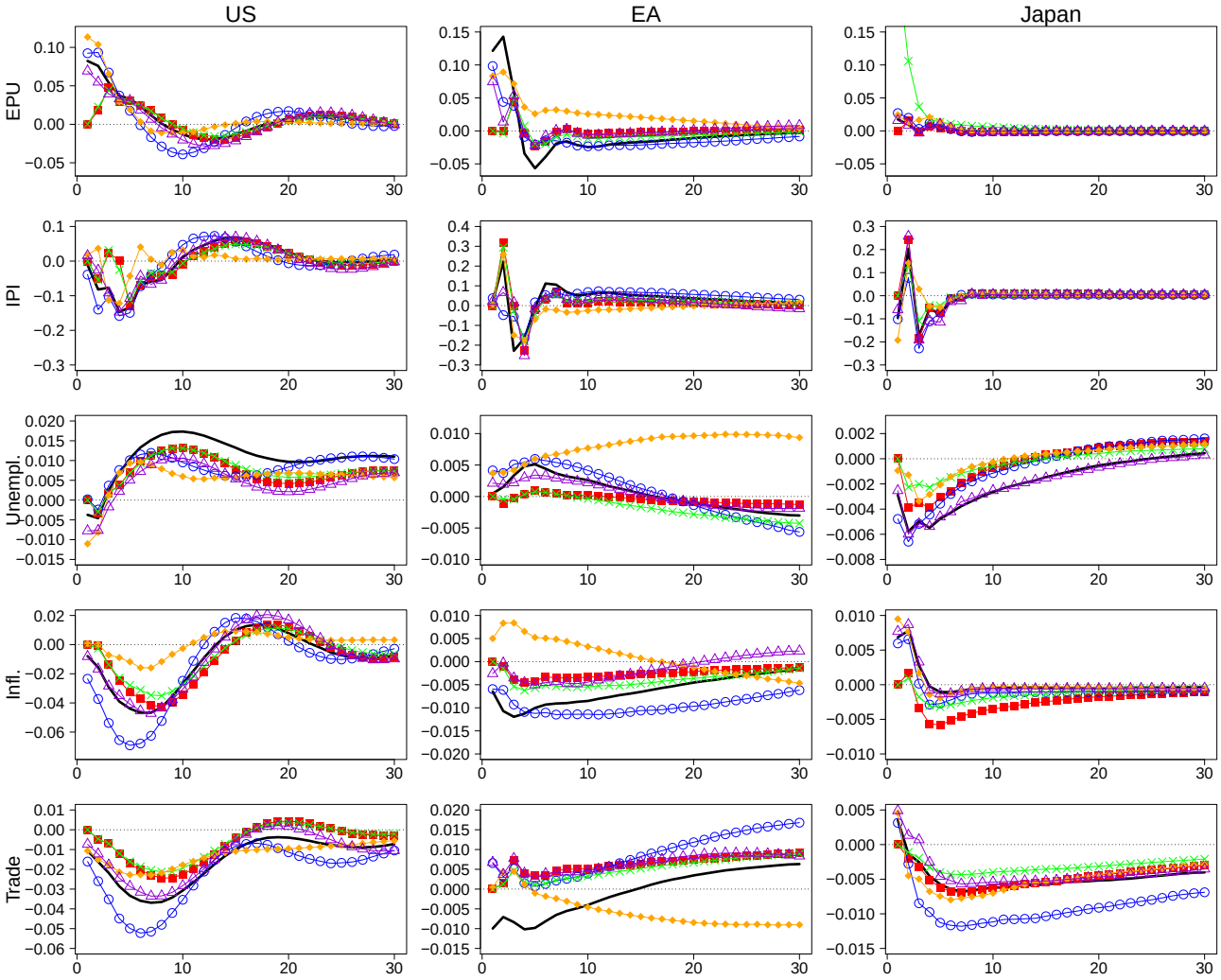


FIGURE 4.6 – The macroeconomic effects of Chinese policy uncertainty shock on US, EA and Japanese macro-variables during economic downturns - Robustness.

Sources : Author's own calculations.

Notes : Impulse response functions to a one-standard deviation increase in Chinese policy uncertainty shock. Black solid lines correspond to the baseline case. Red squares correspond to the case where Chinese EPU is ordered last in the VAR. Green cross correspond to the case where the Chinese EPU and US EPU are ordered last. Blue dot lines correspond to the case where export is replaced by import in the VAR. Orange diamonds correspond to the case where the switching variable is a 12 MA of IPI.

Korea.

As regards to the nature of the Chinese shock, our evidence does not allow us to strongly affirm that the identified shock could be labeled as "demand" shocks. For example, when the shock hits the Korean economy in recessions, all IRFs are in line with the demand nature of uncertainty shocks except the one of unemployment [29]. From our point of view, this finding is difficult to rationalize with the existing theoretical literature. Indeed, classical RBC models with flexible prices show that the labor market could react with an increase in labor input. However in such a framework, the general effects of uncertainty shocks are expansionary and an increase in output is observed (Basu and Bundick (2017) or Gilchrist, Sim, and Zakrajsek (2013)). In the Korean case, we do not observe these expansionary effects. For Brazil and Russia, the key variable to qualify a shock as demand driven, namely inflation, exhibits an unclear and a state-dependent pattern.

4.6 Robustness check

Overall, results of the last sections indicate that foreign uncertainty shocks from China have negative effects on our sample of countries. However, these findings could be sensitive to different model specifications. In this section, we run an array of robustness checks to confirm the pattern unveiled by our baseline model. Figures 4.6 and 4.7 report the results of our alternative estimations [30].

Alternative VAR ordering In our baseline model, our identification strategy is based on a recursive Cholesky assumption with the Chinese EPU index ordered first before the block of domestic variables. This identification scheme implies that Chinese policy-related uncertainty shocks have an immediate impact on domestic economic variables whereas Chinese and domestic EPU are not able to respond contemporaneously to other shocks of the system. Although this assumption is very standard in the literature, it could be more problematic when VAR models including international variables are of interest. In the current exercise, we address this potential issue by considering two novels ordering of our vector Y_t^i. In the first one, we place the Chinese EPU last in the VAR and our vector of endogenous variables becomes $Y_t^i = \left(EPU_t^i, \Delta \ln(IPI_t^i), \ln(U_t^i), \Delta \ln(CPI_t^i), \ln(Export_t^i), EPU^{CHINA}\right)'$. In the second one, we place both EPU variables last just after the block of domestic variables and our vector becomes $Y_t^i = \left(\Delta \ln(IPI_t^i), \ln(U_t^i), \Delta \ln(CPI_t^i), \ln(Export_t^i), EPU_t^i, EPU^{CHINA}\right)'$. These two alternatives ordering could change the dynamic of the system by allowing shocks

29. The next section show that this pattern is robust to all robustness check.
30. In order to save some space, we report only IRFs in recessions.

on other macroeconomic variables to affect the Chinese EPU index without a one-period delay. Corresponding IRFs are reported in red squares (for the first alternative ordering) and in green crosses (for the second alternative ordering).

Alternative switching variable Another important robustness check is to establish whether the results are similar if we employ another indicator of economic conditions. Indeed, this choice, which is at the discretion of the econometrician, may have important consequences on the results. In the baseline model, we consider a 18 MA of industrial production for the US and the EA and a 12 MA of industrial production for Japan, Brazil, Korea and Russia. To check the sensitivity of our results, we run the STVAR, with a 12 MA of IPI for the US and the EA while we use a 18 MA of IPI for Japan, Brazil, Korea and Russia [31]. The results for the corresponding model are displayed in orange diamonds.

Trade variable In the baseline model, we use exports as a measure of international trade. The latter has the advantage of capturing potential effects of Chinese uncertainty on local exporter decisions. Facing higher uncertainty from China, domestic exporters could change their behavior by exporting less. Another (also) consistent choice would be to consider imports because it reflects domestic demand for international goods. By contrast to exports, it could capture that higher uncertainty from China changes domestic demand behavior for international goods. Thus, we re-estimate our model and we replace exports by imports. Results obtained with such a model are displayed in blue circles.

Controlling for Chinese variables In our benchmark specification, the only variable for China is its EPU index. As the latter could be correlated with other Chinese macro-variables, such a parsimonious specification could confound genuine exogenous variations in uncertainty with movements related to the Chinese economy as a whole. Therefore, controlling for movements in Chinese aggregates is important to obtain a measure of Chinese uncertainty shocks *per se*. In order to ensure that our results hold, we enrich our empirical framework with the growth rate of Chinese GDP. The latter variable enters first and our vector of endogenous variables becomes : $Y_t^i = \left(\Delta \ln(GDP^{CHINA}), EPU^{CHINA}, EPU_t^i, \Delta \ln(IPI_t^i), \ln(U_t^i), \Delta \ln(CPI_t^i), \ln(Export_t^i)\right)'$ [32]. Corresponding IRFs are displayed in violet triangles.

31. We consistently re-calibrate γ^i in order to replicate as close as possible recession periods.

32. As an additional robustness check, we also include the growth rate of Chinese GDP second in the VAR. This does not change our results. These additional results are available upon request.

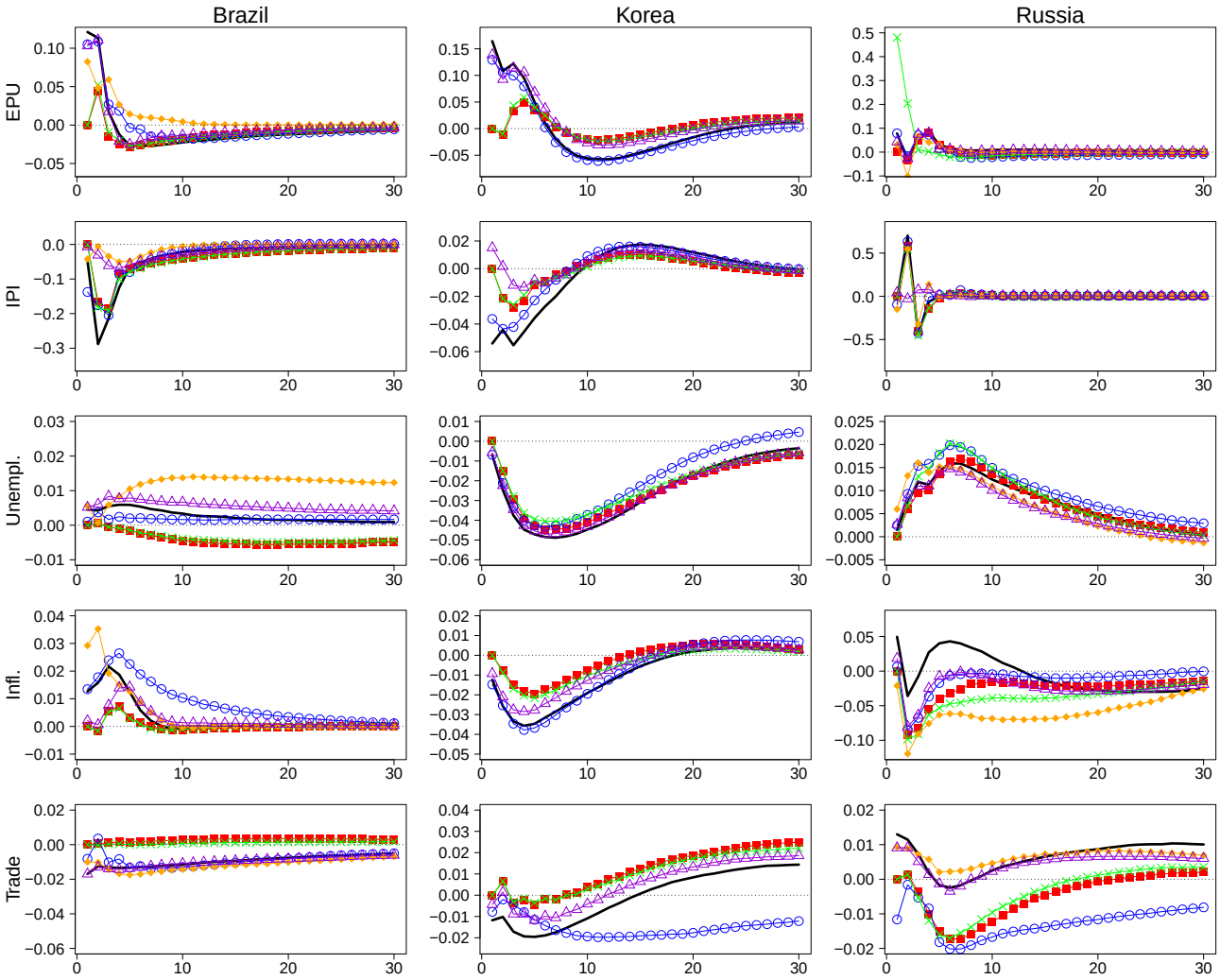


FIGURE 4.7 – The macroeconomic effects of Chinese policy uncertainty shock on Brazilian, Korean and Russian macro-variables during economic downturns - Robustness.

Sources : Author's own calculations.

Notes : Impulse response functions to a one-standard deviation increase in Chinese policy uncertainty shock. Black solid lines correspond to the baseline case. Red squares correspond to the case where Chinese EPU is ordered last in the VAR. Green cross correspond to the case where the Chinese EPU and US EPU are ordered last. Blue dot lines correspond to the case where export is replaced by import in the VAR.

Comments As shown in figures 4.6 and 4.7, results are quite insensitive to our set of robustness check for the US, Japan, South Korea and Russia. For the remaining two areas, namely the EA and Brazil, results appear more sensitive, especially with regards to the ordering of variables in the vector Y_t^i.

Let us first take a look on the first group of countries. In the US and Russia, each time we retrieve the hump-shape behavior of unemployment, the u-shape behavior of inflation and exports and the fall of industrial production before the overshoot (only in the US case). Moreover, observe that the qualitative but also the quantitative patterns are well reproduced (except for trade in Russia). The dynamic responses of Japan are also well reproduced except for inflation. In particular, when the Chinese EPU is ordered last, the response of inflation is weak on impact and becomes negative along the adjustment path. This finding echoes the difficulties of the literature to clearly identify the responses of prices after an uncertainty shock (Guglielminetti, 2015). The evidence provided here for Japan (but also Russia) suggests that this difficulty also exists when the international transmission of uncertainty shocks is studied (see also the EA case). It is interesting to observe that, as in South Korea, the negative response of unemployment is preserved in Japan. This quite surprising feature seems to be specific to Asian countries. However, providing a clear explanation of this pattern merits further investigations which are beyond the scope of the present paper. Concerning the EA and Brazil, IRFs are more sensitive, especially in regard to the Cholesky ordering. In particular, the quantitative effects of Chinese uncertainty are clearly dampened for unemployment and trade when we order the Chinese EPU last in the VAR.

Overall, replacing exports by imports suggests that domestic demand also respond significantly to the Chinese shock. For instance, in the US (resp. in Japan) the response of imports is stronger than the one of exports. It reaches its minimum at around -6% (resp. -1.22%), 7 months after the shock whereas exports fall of about 4.5% (resp 0.08%). Then, the orange diamond lines of figures 4.6 and 4.7 strongly indicate that our results are robust to the use of an alternative indicator of business cycle conditions. This is true except for European inflation which displays a positive response. Lastly, it is evident that our benchmark results are preserved when we augment the model with Chinese GDP. Except in some rare cases (e.g. EPU in Russia and Japan or IPI in Brazil), this is true for the 6 countries under scrutiny in this paper.

Our robustness check confirms our initial intuition : uncertainty spillovers from China exist but they affect differently other economies. In particular, the transmission channels are especially present (but probably for different reasons) in the US, Brazil, South Korea and Russia. In the EA and Japan, even they exist the detrimental effects of Chinese policy-related uncertainty shocks are lower of an order of magnitude.

4.7 Concluding remarks

Studies on spillover effects of uncertainty policy from emerging markets to other economies are under-researched. In this paper, we fill this void and investigate spillovers from a change in Chinese policy-related uncertainty on a sample of developed and developing economies. We propose a non-linear specification with a STVAR model to capture asymmetries related to business cycles phases. Compared to the vast majority of paper in this literature, our empirical framework explicitly distinguishes regimes of recessions and regimes of expansions.

Our STVAR models show that asymmetries in the transmission of China's EPU shocks are strong for the US, the EA, and Korea. For the remaining three countries, namely Japan, Brazil and Russia, regime-dependent effects are weaker since they exhibit significant response both in recessions and expansions. In a global view, findings are quite accurate in recessionary phases. In particular, it is shown that policy uncertainty contagion from China is important for all countries/areas studied here. Furthermore, economies like the US, the EA, South Korea and Russia, react to uncertainty shocks with a fall in industrial production, inflation and exports together with an increase in unemployment (except in Korea). In these countries/areas our finding is broadly in line with the view that uncertainty shocks resembles to demand shocks Leduc and Liu (2016). However, it should be observed that the quantitative effects vary. For instance, the main message is retained in the EA but with a more limited impact on real macro-variables compared to the US.

Some differences are however noteworthy. First, even if Russia responds in both phases of business cycles, the qualitative patterns followed are quite similar. In particular, the hump-shaped behavior of unemployment is preserved. By contrast, the Brazilian economy displays significant responses in both phases but the qualitative patterns of IRFs are more varying. While inflation reacts in the same way, unemployment and exports display opposite behavior. Lastly, Japanese policy uncertainty is much more sensitive to the Chinese shock in good than in bad times.

Our research could be a guide to policymakers in the understanding of international spillovers of uncertainty shocks. In particular, by putting evidence on non-linear effects we show that contagion from China to another country prevails in particular situations. Furthermore, the systematic and separate study of several countries allows us to put in evidence some differences in the transmission of Chinese policy uncertainty shocks. Even if we are aware that non-linearities in business cycles are not the only channel which exacerbates uncertainty shocks, we think that future theoretical models should try to internalize this channel.

4.A Data sources

Variable	Description	Source	ID
Uncertainty	Economic Policy Uncertainty	EPU's website	
US			
IPI	Industrial Production Index	FRED	INDPRO
Unemployment	Civilian Unemployment Rate	FRED	UNRATE
CPI	CPI for All Urban Consumers : All Items	FRED	CPIAUCSL
Exports	Total of Exports in Good and Services	BEA	
Imports	Total of Imports in Good and Services	BEA	
Euro Area			
IPI	Industrial Production Index	Eurostat	
Unemployment	Unemployment rate Eurozone	Eurostat	
HCPI	Harmonized CPI Eurozone	Eurostat	
Exports	Total of Exports	Eurostat	
Imports	Total of Imports	Eurostat	
Japan			
IPI	Production of Total Industry	FRED	JPNPROIND
Unemployment	Unemployment Rate : Aged 15-64	FRED	LRUN64TTJP
CPI	CPI : Total All Items	FRED	CPALTT01JP
Exports	Exports : Value Goods for Japan	FRED	XTEXVA01JP
Imports	Imports : Value Goods for Japan	FRED	XTIMVA01JP
Brazil			
IPI	Production of Total Industry in Brazil	FRED	BRAPROIND
Unemployment	Unemployment Rate : Aged 15 and Over	FRED	LRUNTTTTBR
CPI	CPI : All Items	FRED	BRACPIALL
Exports	Exports : Value Goods for Brazil	FRED	XTEXVA01BR
Imports	Imports : Value Goods for Brazil	FRED	XTIMVA01BR
South Korea			
IPI	Production of Total Industry	FRED	KORPROIND
Unemployment	Harmonized Unemployment Rate : All Persons	FRED	LRHUTTTTKR
CPI	CPI : All Items	FRED	KORCPIALL
Exports	Total of Exports	Korea International Trade Association	
Imports	Total of Imports	Korea International Trade Association	
Russia (the Russian Federation)			
IPI	Production of Total Industry	FRED	RUSPROIND
Unemployment	Registered Unemployment Rate	FRED	LMUNRRTTRU
CPI	CPI : All Items	FRED	RUSCPIALL
Exports	Exports : Value Goods	FRED	XTEXVA01RU
Imports	Imports : Value Goods	FRED	XTIMVA01RU

TABLE 4.2 – Data sources.

4.B The impact of Chinese uncertainty shocks on the Chinese economy

In this appendix, we present the IRFs of a linear VAR model containing only Chinese macro-variables. As mentioned in the main text, the estimation of a STVAR in the special case of China is not possible because this country does not experience recession during the 1995M1-2016M1 period. Figure 4.8 reports the IRFs of a VAR model including the following 5 Chinese macro-variables : EPU, the growth rate of real GDP, the inflation rate, exports and imports. The last 4 variables are constructed by Chang, Chen, Waggoner, and Zha (2015) and they are freely downloadable thanks to the following link : https://www.frbatlanta.org/cqer/research/china-macroeconomy.aspx?panel=2. The EPU, exports and imports variables enter the VAR in logarithm. As suggested by standard criterion 2 lags are included in the model. The linear VAR model suggests that uncertainty shocks have some limited

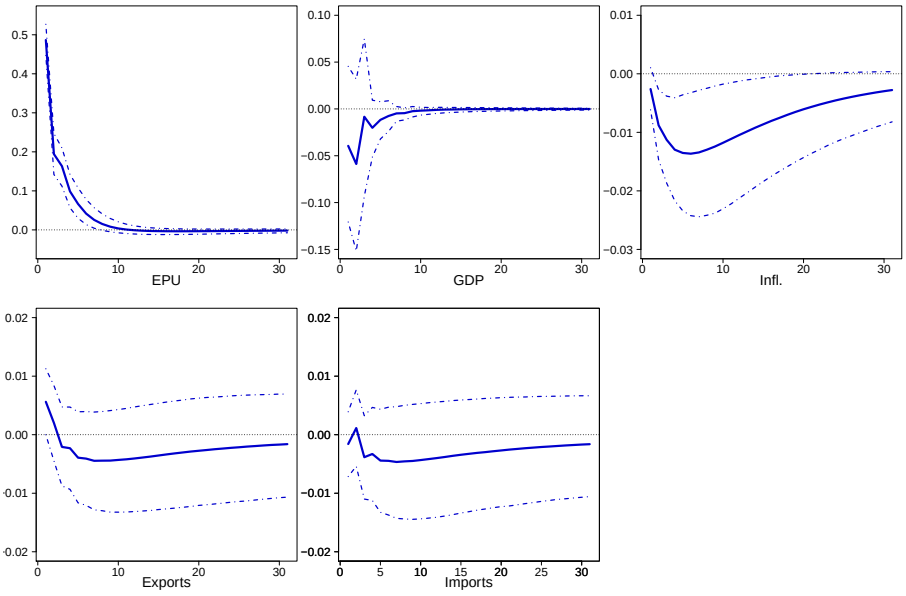


FIGURE 4.8 – IRFs of Chinese macro-variable to a one-standard deviation Chinese EPU shock.

Sources : Author's own calculations.
Notes : Impulse response functions to a 1 standard-deviation increase in Chinese policy uncertainty shocks. Blue error bands represent the 5th and 95th of the distribution of responses simulated by bootstrapping 10000 times the residuals of the VAR.

influence on the Chinese macroeconomy. In particular, real GDP, exports and imports do not respond significantly to the identified shock. Differently, inflation response is u-shaped with a maximum (in absolute value) of about -0.015. Combined with the FEVDs of table 4.3, this simple model suggests that domestic policy uncertainty shocks are not an important driver

of macro-variables in China. This is true except for the inflation rate.

Horizons	$\Delta \ln(GDP)$	$\Delta \ln(CPI)$	$\ln(Exports)$	$\ln(Import)$
6	0.75	6.96	0.89	0.72
12	0.77	9.33	1.40	1.21
18	0.77	9.88	1.44	1.31
24	0.77	9.99	1.35	1.28
36	0.77	9.96	1.16	1.16

TABLE 4.3 – Forecast Error Variance Decomposition of Chinese macro-variables consecutive to a Chinese policy uncertainty shock.
Sources : Author's own calculations.
Notes : Horizons are reported in month.

4.C Gamma calibration

Country	US	EA	Japan	Brazil	South Korea	Russia
% of recession	10.03	16.5	39.84	33.07	10.65	25.9
Gamma level	1.9	3.65	18.5	3.6	2.35	3.2

TABLE 4.4 – Recession periods and γ calibration.
Sources : Author's own calculations.

Conclusion Générale

Cette thèse avait pour but de permettre un compréhension de la localisation et de l'évolution des flux d'investissements face aux sources potentielles de vulnérabilité économique et de comprendre le cadre particulier de l'incertitude de la politique économique. Pour ce faire, les trois premiers chapitres de la thèse sont construits autour de l'analyse de la vulnérabilité ; le dernier chapitre,en revanche, fait un diagnostic particulier sur la transmission des chocs d'incertitude à travers les pays.

Le premier chapitre avait pour but de démontrer l'aspect néfaste des sources de vulnérabilités sur le choix d'implantation des firmes. Pour ce faire, il a été nécessaire de ne pas nous concentrer seulement sur le niveau agrégé de la mesure de vulnérabilité, mais de prendre en compte les différentes sources potentielles de la vulnérabilité des pays. Sous l'angle des différentes modélisations gravitaires, il semble que : i) toutes les sources de vulnérabilité ne se valent pas, ii) les facteurs prépondérants de la vulnérabilité qui affectent négativement le niveau d'investissement bilateral sont surtout issus de la petitesse du marché, de l'éloignement et la structure des marchés. Si ce résultat semble classique, il est intéressant de voir que l'exposition des marchés aux chocs exogènes reste un élément majeur de la détermination de la localisation des investissements.

Le second chapitre est dans la droite lignée du premier par la prise en compte de l'effet des traités d'investissements et de l'intégration économique des pays. Ainsi, si les traités d'investissements sont faits pour justement sécuriser l'investissement dans les pays concernés, l'analyse du lien entre ces traités d'investissement et la vulnérabilité des pays est nécessaire. Le niveau d'intégration économique jouant aussi un rôle dans cette relation, il est nécessaire de voir si il existe un effet combiné de l'intégration économique et des traités d'investissement. Si le premiers stades de l'intégration économique permettent d'augmenter le niveau d'investissement dans les pays, le contrôle des pays ayant un fort degré d'intégration ne booste pas forcément l'investissement. On essaie d'expliquer ce phénomène par l'arbitrage fait entre exportation et investissement étrangers rendant plus facile l'exportation des biens par la réduction des coûts à l'exportation.

Le troisième chapitre, se tourne plus vers la possibilité de relation entre l'aide au

développement, fait d'une manière bilatérale, et l'investissement direct étranger. Dans cette investigation,il est intéressant de revenir sur la fonction principale de l'aide au développement, qui peut être fonction de la volonté politique des pays. Dans ce cadre, l'aide au développement peut soit être complémentaire à l'investissement direct soit en concurrence à l'investissement direct. Le chapitre rappelle deux modélisations de ce lien et arrive à une difficulté de conclusion de l'interrelation des deux variables. Les résultats empiriques reviennent dans un premier lieu sur cette modélisation en ne considérant pas la possibilité de détermination conjointe des deux variables. Dans un second temps, l'interconnexion possible des deux flux est prise en compte par la mise en place d'équations simultanése pour le modèle de gravité. Les prédictions théoriques inconclusives entre l'aide au développement bilatérale et l'investissement se retrouvent de nouveau ici.

Le quatrième chapitre se tourne vers une vision plus large de la relation investissement et risque en prenant en compte les impacts de l'incertitude de la politique économique. Si les effets néfastes de l'incertitude de la politique économique sont connus au niveau de la littérature, les effets de contagions issues de chocs d'incertitude semblent encore à débattre. Nous essayons donc de combler ce manque en nous focalisons sur les effets de contagion des chocs d'incertitude de la politique économique chinoise sur ses principaux partenaires. Ensuite, nous différencions les effets de chocs d'incertitudes selon le cycle économique. Les résultats semblent indiquer que les effets de contagion des chocs d'incertitude dépendent à la fois de la phase économique des pays et du niveau de développement des pays. Les pays touchés par la contagion du choc d'incertitude de la politique économique chinoise en pleine récession voient une aggravation de la situation économique ; tandis que les mêmes effets ne se révèlent pas au niveau des périodes de croissance. En outre, la zone Euro semble moins sensible à ces chocs alors que les Etats-Unis et les pays en développement montrent une sensibilité plus accrue. On peut prendre l'exemple du Brésil qui voit son taux d'inflation grimper peu importe le cycle économique.

Si la majeure partie de la thèse a essayé de comprendre la vulnérabilité économique en tant que déterminant des investissements étrangers ; et de comprendre l'influence des variables bilatérales à travers les modèles de gravité, les perspectives d'amélioration de la thèse restent multiples. En effet, la limitation des données est assez importante au niveau de l'analyse bilatérale des IDE. L'amélioration de l'accessibilité et de la qualité des données dans ce domaine serait appréciable pour la robustesse des résultats de la thèse. De plus, dans le chapitre 2, il est important de préciser que l'on n'intègre pas l'analyse de la différentiation de l'hétérogénéité des traités d'investissement comme dans Dixon and Haslam (2016). La prise en compte de la qualité des traités d'investissement mérite réflexion sur l'efficacité de ces accords sur la protection des investissements au regard de la vulnérabilité économique. La

même remarque peut être fait sur la relation étroite entre investissement et aide étrangère. La prise en compte de donneurs exceptionnel comme la Chine, on parle ici donc d'aide du Sud vers le Sud (Bräutigam, 2011), offre une challenge assez intéressant sur la prise en compte de la vulnérabilité économique. Sur le volet de l'incertitude, notre analyse sur les chocs d'incertitude de politique économique ouvre les débats sur l'importance de la Chine sur le niveau international. Il comporte quelques limitations. Une des principales limitations se trouve dans le fait que l'analyse ne prend pas en compte le canal du commerce. En effet, il serait intéressant d'aborder l'incertitude de politique commerciale comme dans Handley and Limão (2015). Si l'on admet que les pays les plus touchés par les variations du niveau d'incertitude sont les principaux partenaires commerciaux, la contribution du commerce comme véhicule de l'incertitude est une chose non négligeable dans l'analyse. En outre, pour des raisons évidentes de données, nous n'avons pas été capable d'offrir des analyses sur un large panel de pays. La disponibilité récente des données d'incertitude de politique économique au niveau mondial (Ahir, Bloom, and Furceri, 2018) est une aubaine à ne pas négliger dans l'analyse de la montée de l'incertitude. Une extension de l'analyse sur des pays avec un tissu économique différent permettra d'avoir une meilleure compréhension des effets hétérogènes des chocs d'incertitude (Fernández-Villaverde, Guerrón-Quintana, Rubio-Ramírez, and Uribe, 2011).

Table des figures

1 Evolution du stock d'investissements 3

1.1 Top 1000 destination and source cities of FDI 21
1.2 Relationship FDI and GDP 45
1.3 Relationship FDI and EVI 46
1.4 EVI components 2005- 2011 comparison 48

2.1 Number of IIA 52

4.1 Effects of a one-standard deviation shock to Chinese policy uncertainty on US, EA and Japanese macro-variables - Linear model. 127
4.2 Effects of a one-standard deviation shock to Chinese policy uncertainty on Brazilian, Korean and Russian macro-variables - Linear model. 128
4.3 Estimated probabilities of being in recessions. 130
4.4 Effects of a one-standard deviation shock to Chinese policy uncertainty on US, EA and Japanese macro-variables - Non-linear model. 133
4.5 Effects of a one-standard deviation shock to Chinese policy uncertainty on Brazilian, Korean and Russian macro-variables - Non-linear model. 138
4.6 The macroeconomic effects of Chinese policy uncertainty shock on US, EA and Japanese macro-variables during economic downturns - Robustness. . . 141
4.7 The macroeconomic effects of Chinese policy uncertainty shock on Brazilian, Korean and Russian macro-variables during economic downturns - Robustness. 144
4.8 IRFs of Chinese macro-variable to a one-standard deviation Chinese EPU shock. 149

Liste des tableaux

1.1 EVI and FDI : Expected Relationships 25
1.2 FDI and Agregated level of Economic Vulnerability 31
1.3 FDI, Exposure and Magnitude of Shocks 32
1.4 FDI and Exposure to shocks 35
1.5 FDI and EVI subcomponents 37
1.6 Alternative gravity controls 39
1.7 Alternative controls (2) 40
1.8 Data sources. 43
1.9 Correlation Matrix 44
1.10 List of countries 47

2.1 Phase in Effect 60
2.2 Interactions 63
2.3 Overall effect of Economic integration 66
2.4 Joint Effect BIT and Economic Integration 67
2.5 Interactions EVI components and Economic integration agreements 69
2.6 Dilution and Threshold Effect 71
2.7 Reverse causality 73
2.8 Summary statistics 76

3.1 Bilateral Aid impact on FDI 92
3.2 OLS interaction 94
3.3 Fix-effect OLS 95
3.4 PPML Fix Effect interactions 96
3.5 Aid as transfer 98
3.6 Aid Commitment in Level 99
3.7 OLS interaction aid in level 100
3.8 OLS Fix effect with Aid level 101

3.9 PPML Aid in level 102
3.10 Correlation matrix FDI, Bilateral Aid Commitment and WGI 104
3.11 Estimation results : Joint Estimation 106
3.12 Summary statistics 108
3.13 Aid disbursement as transfer 111
3.14 Aid disbursement Level 112
3.15 Aid selection 113
3.16 Interaction with Aid dummy : OLS 114
3.17 Interaction with Aid dummy : PPML with fix effect 115

4.1 Forecast Error Variance Decomposition of domestic macro-variables consecutive to a Chinese policy uncertainty shock. 137
4.2 Data sources. 148
4.3 Forecast Error Variance Decomposition of Chinese macro-variables consecutive to a Chinese policy uncertainty shock. 150
4.4 Recession periods and γ calibration. 150

Bibliographie

Acemoglu, D., and J. A. Robinson (2013) : *Why nations fail : The origins of power, prosperity, and poverty*. Crown Business.

Acemoglu, D., J. A. Robinson, P. Aghion, and P. Hersant (2015) : *Prospérité, puissance et pauvreté : Pourquoi certains pays réussissent mieux que d'autres*. Markus Haller éditions, Genève, 1 edn.

Ahir, H., N. Bloom, and D. Furceri (2018) : "The World Uncertainty Index," *mimeo*, p. 33.

Akhtaruzzaman, M., N. Berg, and C. Hajzler (2017) : "Expropriation risk and FDI in developing countries : Does return of capital dominate return on capital ?," *European Journal of Political Economy*, 49, 84–107.

Aleksynska, M., and O. Havrylchyk (2013) : "FDI from the south : The role of institutional distance and natural resources," *European Journal of Political Economy*, 29, 38–53.

Alesina, A., and D. Dollar (2000) : "Who Gives Foreign Aid to Whom and Why ?," *Journal of Economic Growth*, 5(1), 33–63.

Allee, T., and C. Peinhardt (2010) : "Delegating Differences : Bilateral Investment Treaties and Bargaining Over Dispute Resolution Provisions," *International Studies Quarterly*, 54(1), 1–26.

Amighini, A., and M. Sanfilippo (2014) : "Impact of South–South FDI and Trade on the Export Upgrading of African Economies," *World Development*, 64, 1–17.

Amprou, J., P. Guillaumont, and S. G. Jeanneney (2007) : "Aid selectivity according to augmented criteria," *The World Economy*, 30(5), 733–763.

Anderson, J. E., M. Larch, and Y. V. Yotov (2018) : "GEPPML : General equilibrium analysis with PPML," *The World Economy*, 0(0).

Anderson, J. E., and E. Van Wincoop (2001) : "Gravity with gravitas : a solution to the border puzzle," Discussion paper, National bureau of economic research.

Anderson, J. E., and E. van Wincoop (2003) : "Gravity with Gravitas : A Solution to the Border Puzzle," *American Economic Review*, 93(1), 170–192.

Angeon, V., and S. Bates (2015) : "Reviewing Composite Vulnerability and Resilience Indexes : A Sustainable Approach and Application," *World Development*, 72, 140–162.

Antonakakis, N., and G. Tondl (2015) : "Robust determinants of OECD FDI in developing countries : Insights from Bayesian model averaging," *Cogent Economics & Finance*, 3(1), 1095851.

Arellano, M., and S. Bond (1991) : "Some Tests of Specification for Panel Data : Monte Carlo Evidence and an Application to Employment Equations," *The Review of Economic Studies*, 58(2), 277–297.

Armelius, H., I. Hull, and H. Stenbacka Köhler (2017) : "The timing of uncertainty shocks in a small open economy," *Economics Letters*, 155, 31–34.

Arvis, J.-F., and B. Shepherd (2013) : "The Poisson quasi-maximum likelihood estimator : a solution to the 'adding up' problem in gravity models," *Applied Economics Letters*, 20(6), 515–519.

Asiedu, E., Y. Jin, and B. Nandwa (2009) : "Does foreign aid mitigate the adverse effect of expropriation risk on foreign direct investment ?," *Journal of International Economics*, 78(2), 268–275.

Auerbach, A. J., and Y. Gorodnichenko (2012) : "Measuring the Output Responses to Fiscal Policy," *American Economic Journal : Economic Policy*, 4(2), 1–27.

Bachmann, R., S. Elstner, and E. R. Sims (2013) : ""Uncertainty and Economic Activity : Evidence from Business Survey Data"," *American Economic Journal : Macroeconomics*, 5(2), 217–249.

Baier, S. L., and J. H. Bergstrand (2007) : "Do free trade agreements actually increase members' international trade ?," *Journal of International Economics*, 71(1), 72–95.

——— (2009) : "Bonus vetus OLS : A simple method for approximating international trade-cost effects using the gravity equation," *Journal of International Economics*, 77(1), 77–85.

Baier, S. L., J. H. Bergstrand, and M. W. Clance (2018) : "Heterogeneous effects of economic integration agreements," *Journal of Development Economics*, 135, 587–608.

Baier, S. L., J. H. Bergstrand, P. Egger, and P. A. McLaughlin (2008) : "Do Economic Integration Agreements Actually Work ? Issues in Understanding the Causes and Consequences of the Growth of Regionalism," *World Economy*, 31(4), 461–497.

Baker, S. R., N. Bloom, and S. J. Davis (2016) : "Measuring Economic Policy Uncertainty," *The Quarterly Journal of Economics*, 131(4), 1593–1636.

Baltagi, B. H., P. Egger, and M. Pfaffermayr (2007) : "Estimating models of complex FDI : Are there third-country effects ?," *Journal of Econometrics*, 140(1), 260–281.

——— (2014) : "Panel Data Gravity Models of International Trade," Discussion Paper 4616, CESifo Working Paper.

Bandyopadhyay, S., and Younas (2014) : "Foreign Direct Investment, Aid and Terrorism," *Oxford Economics Paper*.

Barthel, F., E. Neumayer, P. Nunnenkamp, and P. Selaya (2014) : "Competition for Export Markets and the Allocation of Foreign Aid : The Role of Spatial Dependence among Donor Countries," *World Development*, 64, 350–365.

Basu, S., and B. Bundick (2017) : "Uncertainty Shocks in a Model of Effective Demand," *Econometrica*, 85(3), 937–958.

Berger, A., M. Busse, P. Nunnenkamp, and M. Roy (2011) : "More stringent BITs, less ambiguous effects on FDI ? Not a bit !," *Economics Letters*, 112(3), 270–272.

——— (2013) : "Do trade and investment agreements lead to more FDI ? Accounting for key provisions inside the black box," *International Economics and Economic Policy*, 10(2), 247–275.

Berger, D., and J. Vavra (2014) : "Measuring How Fiscal Shocks Affect Durable Spending in Recessions and Expansions," *American Economic Review*, 104(5), 112–15.

Bergstrand, J. H., and P. Egger (2007) : "A knowledge-and-physical-capital model of international trade flows, foreign direct investment, and multinational enterprises," *Journal of International Economics*, 73(2), 278–308.

——— (2013) : "What determines BITs ?," *Journal of International Economics*, 90(1), 107–122.

Berthélemy, J.-C. (2006) : "Bilateral donors' interest vs. recipients' development motives in aid allocation : do all donors behave the same ?," *Review of Development Economics*, 10(2), 179–194.

Billio, M., R. Casarin, F. Ravazzolo, and H. K. Van Dijk (2016) : "Interconnections Between Eurozone and US Booms and Busts Using a Bayesian Panel Markov-Switching VAR Model," *Journal of Applied Econometrics*, 31(7), 1352–1370, jae.2501.

Biscaye, P. E., T. W. Reynolds, and C. L. Anderson (2017) : "Relative Effectiveness of Bilateral and Multilateral Aid on Development Outcomes," *Review of Development Economics*, 21(4), 1425–1447.

Blancard, S., and J.-F. Hoarau (2016) : "Are Small Island Developing States more Economically Vulnerable than Other Developing Countries ?," *Revue économique*, Vol. 67(1), 117–142.

Blanchard, P., C. Gaigné, and C. Mathieu (2008) : "Foreign Direct Investment : Lessons from Panel Data," in *The Econometrics of Panel Data*, ed. by L. Mátyás, and P. Sevestre, no. 46 in Advanced Studies in Theoretical and Applied Econometrics, pp. 663–696. Springer Berlin Heidelberg.

Blomstrom, M., and A. Kokko (1997) : "Regional Integration and Foreign Direct Investment," Working Paper 6019, National Bureau of Economic Research.

Blonigen, B. A., R. B. Davies, and K. Head (2003) : "Estimating the Knowledge-Capital Model of the Multinational Enterprise : Comment," *American Economic Review*, 93(3), 980–994.

Blonigen, B. A., and J. Piger (2014) : "Determinants of foreign direct investment," *Canadian Journal of Economics/Revue canadienne d'économique*, 47(3), 775–812.

Bloom, N. (2009) : "The Impact of Uncertainty Shocks," *Econometrica*, 77(3), 623–685.

——— (2014) : "Fluctuations in Uncertainty," *Journal of Economic Perspectives*, 28(2), 153–176.

Blundell, R., and S. Bond (1998) : "Initial conditions and moment restrictions in dynamic panel data models," *Journal of Econometrics*, 87(1), 115–143.

Bénassy-Quéré, A., M. Coupet, and T. Mayer (2007) : "Institutional Determinants of Foreign Direct Investment," *World Economy*, 30(5), 764–782.

Brainard, S. L. (1997) : "An Empirical Assessment of the Proximity-Concentration Trade-off Between Multinational Sales and Trade," *The American Economic Review*, 87(4), 520–544.

Breusch, T., M. B. Ward, H. T. M. Nguyen, and T. Kompas (2011) : "On the Fixed-Effects Vector Decomposition," *Political Analysis*, 19(2), 123–134.

Briguglio, L., E. J. Kisanga, and C. Secretariat (2004) : *Economic vulnerability and resilience of small states*. Formatek Malta.

Bräutigam, D. (2011) : "Aid 'With Chinese Characteristics' : Chinese Foreign Aid and Development Finance Meet the OECD-DAC Aid Regime," *Journal of international development*, 23(5), 752–764.

Burger, M., F. v. Oort, and G.-J. Linders (2009) : "On the Specification of the Gravity Model of Trade : Zeros, Excess Zeros and Zero-inflated Estimation," *Spatial Economic Analysis*, 4(2), 167–190.

Burnside, C., and D. Dollar (2000) : "Aid, policies, and growth," *American economic review*, pp. 847–868.

Busse, M., J. Königer, and P. Nunnenkamp (2010) : "FDI promotion through bilateral investment treaties : more than a bit ?," *Review of World Economics*, 146(1), 147–177.

Cadot, O., A. Fernandes, J. Gourdon, A. Mattoo, and J. de Melo (2014) : "Evaluating Aid for Trade : A Survey of Recent Studies," *The World Economy*, 37(4), 516–529.

Caggiano, G., E. Castelnuovo, and J. M. Figueres (2017a) : "Economic policy uncertainty and unemployment in the United States : A nonlinear approach," *Economics Letters*, 151, 31 – 34.

——— (2017b) : "Economic Policy Uncertainty Spillovers in Booms and Busts," Working Paper.

Caggiano, G., E. Castelnuovo, and N. Groshenny (2014) : "Uncertainty shocks and unemployment dynamics in U.S. recessions," *Journal of Monetary Economics*, 67, 78–92.

Caggiano, G., E. Castelnuovo, and G. Nodari (2017) : "Uncertainty and Monetary Policy in Good and Bad Times," Working Paper.

Cardwell, R., and P. L. Ghazalian (2018) : "The effects of aid agency independence on bilateral aid allocation decisions," *World Development*, 106, 136–148.

Cariolle, G. (november 2013) : "A retrospective economic vulnerability index 1990-2011 - Using the 2012 UN-CDP definitions," *Ferdi Working Paper I17*.

Cariolle, J., and M. Goujon (2013) : "A retrospective economic vulnerability index, 1990-2011 - Using the 2012 UN-CDP definitions | FERDI," Ferdi, Document de travail I17.

Carr, D. L., J. R. Markusen, and K. E. Maskus (2003) : "Estimating the Knowledge-Capital Model of the Multinational Enterprise : Reply," *The American Economic Review*, 93(3), 995–1001.

Carrière-Swallow, Y., and L. F. Céspedes (2013) : "The impact of uncertainty shocks in emerging economies," *Journal of International Economics*, 90(2), 316 – 325.

Castelnuovo, E., G. Lim, and G. Pellegrino (2017) : "A Short Review of the Recent Literature on Uncertainty," *Australian Economic Review*, 50(1), 68–78.

Chakraborty, C., and P. Nunnenkamp (2008) : "Economic Reforms, FDI, and Economic Growth in India : A Sector Level Analysis," *World Development*, 36(7), 1192–1212.

Chaney, T. (2008) : "Distorted Gravity : The Intensive and Extensive Margins of International Trade," *American Economic Review*, 98(4), 1707–1721.

Chang, C., K. Chen, D. F. Waggoner, and T. Zha (2015) : *Trends and Cycles in China's Macroeconomy*pp. 1–84. University of Chicago Press.

Chenaf-Nicet, D., and E. Rougier (2016) : "The effect of macroeconomic instability on FDI flows : A gravity estimation of the impact of regional integration in the case of Euro-Mediterranean agreements," *International Economics*, 145, 66–91.

Cheng, C. H. J. (2017) : "Effects of foreign and domestic economic policy uncertainty shocks on South Korea," *Journal of Asian Economics*, 51, 1 – 11.

Cheong, J., D. W. Kwak, and K. K. Tang (2015) : "Heterogeneous Effects of Preferential Trade Agreements : How does Partner Similarity Matter ?," *World Development*, 66, 222–236.

Chernozhukov, V., and H. Hong (2003) : "An MCMC approach to classical estimation," *Journal of Econometrics*, 115(2), 293 – 346.

Choi, S. (2017) : "Variability in the effects of uncertainty shocks : New stylized facts from OECD countries," *Journal of Macroeconomics*, 53, 127 – 144.

Choi, S., and S. Myunckyu (2017) : "Financial vs. Policy Uncertainty in Emerging Market Economies," *Working Paper*.

Christou, C., J. Cunado, R. Gupta, and C. Hassapis (2017) : "Economic policy uncertainty and stock market returns in PacificRim countries : Evidence based on a Bayesian panel VAR model," *Journal of Multinational Financial Management*, 40, 92–102.

Colen, L., D. Persyn, and A. Guariso (2016) : "Bilateral Investment Treaties and FDI : Does the Sector Matter ?," *World Development*, 83, 193 – 206.

Collier, P., and D. Dollar (2002) : "Aid allocation and poverty reduction," *European Economic Review*, 46(8), 1475–1500.

Colombo, V. (2013) : "Economic policy uncertainty in the US : Does it matter for the Euro area ?," *Economics Letters*, 121(1), 39 – 42.

Dabla-Norris, E., C. Minoiu, and L.-F. Zanna (2015) : "Business Cycle Fluctuations, Large Macroeconomic Shocks, and Development Aid," *World Development*, 69, 44–61.

Daude, C., and E. Stein (2007) : "The Quality of Institutions and Foreign Direct Investment," *Economics & Politics*, 19(3), 317–344.

Desbordes, R., and V. Vicard (2009) : "Foreign Direct Investment and Bilateral Investment Treaties : an International Political Perspective," *Journal of Comparative Economics*, 37(3), 372–386.

di Giovanni, J., A. A. Levchenko, and I. Mejean (2014) : "Firms, Destinations, and Aggregate Fluctuations," *Econometrica*, 82(4), 1303–1340.

Dicaprio, A., and A. U. Santos-Paulino (2011) : "Can Free Trade Agreements Reduce Economic Vulnerability ?," *South African Journal of Economics*, 79(4), 350–375.

Didier, L., and P. Koenig (2016) : "Has China Replaced Colonial Trade ?," .

Dixit, A. K., and R. S. Pindyck (1994) : *Investment under Uncertainty*. Princeton University Press, Princeton, N.J, first printing edition edn.

Dixon, J., and P. A. Haslam (2016) : "Does the Quality of Investment Protection Affect FDI Flows to Developing Countries ? Evidence from Latin America," *The World Economy*, 39(8), 1080–1108.

Donaubauer, J., A. Glas, B. Meyer, and P. Nunnenkamp (2018) : "Disentangling the impact of infrastructure on trade using a new index of infrastructure," *Review of World Economics*, pp. 1–40.

Donaubauer, J., B. Meyer, and P. Nunnenkamp (2016) : "Aid, Infrastructure, and FDI : Assessing the Transmission Channel with a New Index of Infrastructure," *World Development*, Complete(78), 230–245.

Dreher, A., J.-E. Sturm, and J. R. Vreeland (2009) : "Global horse trading : IMF loans for votes in the United Nations Security Council," *European Economic Review*, 53(7), 742–757.

Druant, M., S. Fabiani, G. Kezdi, A. Lamo, F. Martins, and R. Sabbatini (2012) : "Firms' price and wage adjustment in Europe : Survey evidence on nominal stickiness," *Labour Economics*, 19(5), 772 – 782.

Dunning, J. H. (2001) : "The Eclectic (OLI) Paradigm of International Production : Past, Present and Future," *International Journal of the Economics of Business*, 8(2), 173–190.

Durlauf, S. N., A. Kourtellos, and A. Minkin (2001) : "The local Solow growth model," *European Economic Review*, 45(4), 928–940.

Eaton, J., and S. Kortum (2002) : "Technology, Geography, and Trade," *Econometrica*, 70(5), 1741–1779.

Economides, G., S. Kalyvitis, and A. Philippopoulos (2008) : "Does foreign aid distort incentives and hurt growth ? Theory and evidence from 75 aid-recipient countries," *Public Choice*, 134(3-4), 463–488.

Egger, P., and M. Pfaffermayr (2004a) : "Distance, trade and FDI : a Hausman–Taylor SUR approach," *Journal of Applied Econometrics*, 19(2), 227–246.

——— (2004b) : "The impact of bilateral investment treaties on foreign direct investment," *Journal of Comparative Economics*, 32(4), 788–804.

Erdogan, C. (2017) : "How Deep is Your Love ? - Regional Integration and FDI in Sub-Saharan Africa," SSRN Scholarly Paper ID 2908874, Social Science Research Network, Rochester, NY.

Fally, T. (2015) : "Structural gravity and fixed effects," *Journal of International Economics*, 97(1), 76–85.

Falvey, R., and N. Foster-McGregor (2017) : "Heterogeneous effects of bilateral investment treaties," *Review of World Economics*, pp. 1–26.

Feenstra, R. C. (2002) : "Border effects and the gravity equation : consistent methods for estimation," *Scottish Journal of Political Economy*, 49(5), 491–506.

Feindouno, S., and M. Goujon (2016) : "The retrospective economic vulnerability index, 2015 update | FERDI," Ferdi Working Paper P147.

Feldkircher, M., and F. Huber (2016) : "The international transmission of US shocks—Evidence from Bayesian global vector autoregressions," *European Economic Review*, 81, 167–188.

Fernández-Villaverde, J., P. Guerrón-Quintana, J. F. Rubio-Ramírez, and M. Uribe (2011) : "Risk Matters : The Real Effects of Volatility Shocks," *American Economic Review*, 101(6), 2530–2561.

Ferrara, L., S. Lhuissier, and F. Tripier (2017) : "Uncertainty Fluctuations : Measures, Effects and Macroeconomic Policy Challenges," CEPII Policy Brief 2017-20, CEPII.

Funds, I. M. (2003) : "Finances & Développement," .

Gamberoni, E. (2007) : "Do unilateral trade preferences help export diversification ? An investigation of the impact of European unilateral trade preferences on the extensive and intensive margin of trade," Working Paper 17/2007, HEI Working Paper.

Gilchrist, S., J. W. Sim, and E. Zakrajsek (2013) : "Uncertainty, Financial Frictions and Irreversible Investment," Working paper.

Gnangnon, S. K. (2015) : "Trade openness and structural vulnerability in developing countries," *Journal of Economic Studies*, 43(1), 70–89.

Gnangnon, S. K. (2018) : "Effect of multilateral trade liberalization on foreign direct investment outflows amid structural economic vulnerability in developing countries," *Research in International Business and Finance*, 45, 15–29.

Gnangnon, S. K., and H. Iyer (2017) : "Structural Economic Vulnerability, Trade Policy and FDI Inflows," *Journal of International Commerce, Economics and Policy*, 08(01), 1750005.

Gopinath, G., E. Helpman, and K. Rogoff (2014) : "Handbook of International Economics," in *Handbook of International Economics*, vol. 4 of *Handbook of International Economics*, p. iii. Elsevier.

Gradeva, K., and I. Martínez-Zarzoso (2016) : "Are Trade Preferences more Effective than Aid in Supporting Exports ? Evidence from the 'Everything But Arms' Preference Scheme," *The World Economy*, 39(8), 1146–1171.

Grauwe, P. D., R. Houssa, and G. Piccillo (2012) : "African trade dynamics : is China a different trading partner ?," *Journal of Chinese Economic and Business Studies*, 10(1), 15–45.

Greene, W. (2011) : "Fixed Effects Vector Decomposition : A Magical Solution to the Problem of Time-Invariant Variables in Fixed Effects Models ?," *Political Analysis*, 19(2), 135–146.

Greene, W. H. (1994) : "Accounting for Excess Zeros and Sample Selection in Poisson and Negative Binomial Regression Models," SSRN Scholarly Paper ID 1293115, Social Science Research Network, Rochester, NY.

Grossman, G. M., E. Helpman, and A. Szeidl (2006) : "Optimal integration strategies for the multinational firm," *Journal of International Economics*, 70(1), 216–238.

Guglielminetti, E. (2015) : "The Effects of Uncertainty Shocks on the Labor Market : A Search Approach," Working Paper.

Guillaumont, P. (2009) : "An economic vulnerability index : its design and use for international development policy," *Oxford Development Studies*, 37(3), 193–228.

Guillaumont, P., and L. Chauvet (2001) : "Aid and Performance : A Reassessment," *The Journal of Development Studies*, 37(6), 66–92.

Guillaumont, P., M. McGillivray, and L. Wagner (2015) : "Performance Assessment, Vulnerability, Human Capital, and the Allocation of Aid Among Developing Countries," *World Development*.

Guillaumont, P., and L. Wagner (2014) : "Aid Effectiveness for Poverty Reduction : Lessons from Cross-country Analyses, with a Special Focus on Vulnerable Countries," *Revue d'économie du développement*, 22(HS01), 217–261.

Hajzler, C. (2014) : "Resource-based FDI and expropriation in developing economies," *Journal of International Economics*, 92(1), 124–146.

Hallward-Driemeier, M. (2003) : *Do Bilateral Investment Treaties Attract Foreign Direct Investment ? Only a Bit ? and They Could Bite*, Policy Research Working Papers. The World Bank, DOI : 10.1596/1813-9450-3121.

HANDLEY, K. (2014) : "Exporting under trade policy uncertainty : Theory and evidence," *Journal of International Economics*, 94(1), 50 – 66.

HANDLEY, K., AND N. LIMÃO (2013) : "Policy Uncertainty, Trade and Welfare : Theory and Evidence for China and the U.S.," Working Paper 19376, National Bureau of Economic Research.

——— (2015) : "Trade and Investment under Policy Uncertainty : Theory and Firm Evidence," *American Economic Journal : Economic Policy*, 7(4), 189–222.

HARMS, P., AND M. LUTZ (2006) : "Aid, Governance and Private Foreign Investment : Some Puzzling Findings for the 1990s*," *The Economic Journal*, 116(513), 773–790.

HASLAM (2007) : "A 'Flexibility for Development' Index : Can International Investment Agreements be Compared Quantitatively ?," *The European Journal of Development Research*, 19(2), 251–273.

HEAD, K., AND T. MAYER (2013) : "Gravity Equations : Workhorse, Toolkit, and Cookbook," SSRN Scholarly Paper ID 2210293, Social Science Research Network, Rochester, NY.

HEAD, K., T. MAYER, AND J. RIES (2010) : "The erosion of colonial trade linkages after independence," *Journal of International Economics*, 81(1), 1–14.

HEAD, K., AND J. RIES (2008) : "FDI as an Outcome of the Market for Corporate Control : Theory and Evidence," *Journal of International Economics*, 74(1), 2–20.

HELPMAN, E., M. MELITZ, AND Y. RUBINSTEIN (2008) : "Estimating Trade Flows : Trading Partners and Trading Volumes," *The Quarterly Journal of Economics*, 123(2), 441–487.

HELPMAN, E., M. J. MELITZ, AND S. R. YEAPLE (2004) : "Export Versus FDI with Heterogeneous Firms," *American Economic Review*, 94(1), 300–316.

HWANG, W., AND J. LEE (2017) : "Economic Integration and Political Cooperation Between South Korea and China : Implications for Korea-US Relations," *Asian Perspective*, 41(1), 99–120.

ISTREFI, K., AND A. PILOIU (2013) : "Economic Policy Uncertainty, Trust and Inflation Expectations," SSRN Scholarly Paper ID 2286088, Social Science Research Network, Rochester, NY.

Jin, Y., and Z. Zeng (2017) : "Expropriation and foreign direct investment in a positive economic theory of foreign aid," *Economic Theory*, 64(1), 139–160.

Jones, P. M., and E. Olson (2015) : "The International Effects of US Uncertainty," *International Journal of Finance & Economics*, 20(3), 242–252, IJFE-14-0261.R1.

Jurado, K., S. C. Ludvigson, and S. Ng (2015) : ""Measuring Uncertainty"," *American Economic Review*, 105(3), 1177–1216.

Kaufmann, D., A. Kraay, and M. Mastruzzi (2010) : "The Worldwide Governance Indicators : Methodology and Analytical Issues," SSRN Scholarly Paper ID 1682130, Social Science Research Network, Rochester, NY.

Kerner, A. (2009) : "Why Should I Believe You ? The Costs and Consequences of Bilateral Investment Treaties," *International Studies Quarterly*, 53(1), 73–102.

Kimura, H., and Y. Todo (2010) : "Is Foreign Aid a Vanguard of Foreign Direct Investment ? A Gravity-Equation Approach," *World Development*, 38(4), 482–497.

Kleinert, J., and F. Toubal (2010) : "Gravity for FDI," *Review of International Economics*, 18(1), 1–13.

Klössner, S., and R. Sekkel (2014) : "International spillovers of policy uncertainty," *Economics Letters*, 124(3), 508 – 512.

Krugman, P. (1991) : "Increasing Returns and Economic Geography," *Journal of Political Economy*, 99(3), 483–499.

Krugman, P. R. (1979) : "Increasing returns, monopolistic competition, and international trade," *Journal of International Economics*, 9(4), 469–479.

Lectard, P., and E. Rougier (2018) : "Can Developing Countries Gain from Defying Comparative Advantage ? Distance to Comparative Advantage, Export Diversification and Sophistication, and the Dynamics of Specialization," *World Development*, 102, 90–110.

Leduc, S., and Z. Liu (2016) : "Uncertainty shocks are aggregate demand shocks," *Journal of Monetary Economics*, 82, 20–35.

Lee, H.-H., and J. Ries (2016) : "Aid for Trade and Greenfield Investment," *World Development*, 84, 206–218.

Lewbel, A. (2012) : "Using Heteroscedasticity to Identify and Estimate Mismeasured and Endogenous Regressor Models," *Journal of Business & Economic Statistics*, 30(1), 67–80.

Lewer, J. J., and H. Van den Berg (2008) : "A gravity model of immigration," *Economics Letters*, 99(1), 164–167.

Lhuissier, S., and F. Tripier (2016) : "Do Uncertainty Shocks Always Matter for Business Cycles ?," Working Papers 2016-19, CEPII.

Li, X., D. Banik, L. Tang, and J. Wu (2014) : "Difference or indifference : China's development assistance unpacked," *IDS Bulletin*, 45(4), 22–35.

Li, X.-M., and L. Peng (2017) : "US economic policy uncertainty and co-movements between Chinese and US stock markets," *Economic Modelling*, 61, 27 – 39.

Lin, F., W. Yan, and X. Wang (2017) : "The impact of Africa-China's diplomatic visits on bilateral trade," *Scottish Journal of Political Economy*, 64(3), 310–326.

Liu, A., and B. Tang (2018) : "US and China aid to Africa : Impact on the donor-recipient trade relations," *China Economic Review*, 48, 46–65.

Liyan, H., Q. Mengchao, and Y. Libo (2016) : "Macroeconomic policy uncertainty shocks on the Chinese economy : a GVAR analysis," *Applied Economics*, 48(51), 4907–4921.

Markusen, J. R., and A. J. Venables (1999) : "Foreign direct investment as a catalyst for industrial development," *European Economic Review*, 43(2), 335–356.

Martínez-San Román, V., M. Bengoa, and B. Sánchez-Robles (2016) : "Foreign direct investment, trade integration and the home bias : evidence from the European Union," *Empirical Economics*, 50(1), 197–229.

Martínez-Zarzoso, I., N.-L. D. Felicitas, and N. Horsewood (2009) : "Are regional trading agreements beneficial ? : Static and dynamic panel gravity models," *The North American Journal of Economics and Finance*, 20(1), 46–65.

Martínez-Zarzoso, I., F. Nowak-Lehmann, M. D. Parra, and S. Klasen (2014) : "Does Aid Promote Donor Exports ? Commercial Interest versus Instrumental Philanthropy," *Kyklos*, 67(4), 559–587.

Mathews, J. A. (2006) : "Dragon multinationals : New players in 21st century globalization," *Asia Pacific Journal of Management*, 23(1), 5–27.

Mayer, T., and S. Zignago (2011) : "Notes on CEPII's distances measures : The GeoDist database," *CEPII Working Paper 2011-25*.

MEDVEDEV (2006) : *Beyond Trade : The Impact Of Preferential Trade Agreements On Foreign Direct Investment Inflows*. The World Bank.

MEINEN, P., AND O. ROEHE (2017) : "On measuring uncertainty and its impact on investment : Cross-country evidence from the euro area," *European Economic Review*, 92, 161 – 179.

MELITZ, M. J. (2003) : "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica*, 71(6), 1695–1725.

MELITZ, M. J., AND G. I. P. OTTAVIANO (2008) : "Market Size, Trade, and Productivity," *The Review of Economic Studies*, 75(1), 295–316.

MENARD, A., AND A. GARY (2018) : "Aid, trade and migration : How do bilateral flows interact ?," *The World Economy*, 41(2), 431–456.

METELLI, L., AND F. NATOLI (2017) : "The effect of a Chinese slowdown on inflation in the euro area and the United States," *Economic Modelling*, 62, 16 – 22.

MITZE, T., B. ALECKE, AND G. UNTIEDT (2011) : "Trade-fdi linkages in a simultaneous equations system of gravity models for german regional data, Abstract," *Economie internationale*, (122), 121–161.

MUMTAZ, H., AND K. THEODORIDIS (2015) : "The International Transmission of Volatility Shocks : an Empirical Analysis," *Journal of the European Economic Association*, 13(3), 512–533.

NETŠUNAJEV, A., AND K. GLASS (2017) : "Uncertainty and employment dynamics in the euro area and the US," *Journal of Macroeconomics*, 51, 48 – 62.

NEUMAYER, E. (2003) : "What Factors Determine the Allocation of Aid by Arab Countries and Multilateral Agencies ?," *The Journal of Development Studies*, 39(4), 134–147.

NEUMAYER, E., P. NUNNENKAMP, AND M. ROY (2016) : "Are stricter investment rules contagious ? Host country competition for foreign direct investment through international agreements," *Review of World Economics*, 152(1), 177–213.

NEUMAYER, E., AND L. SPESS (2005) : "Do bilateral investment treaties increase foreign direct investment to developing countries ?," *World Development*, 33(10), 1567–1585.

NWAOGU, U. G., AND M. J. RYAN (2015) : "FDI, Foreign Aid, Remittance and Economic Growth in Developing Countries," *Review of Development Economics*, 19(1), 100–115.

Paniagua, J. (2011) : "FDI gravity equation : Models, estimations and zeros," *mimeo*.

Paniagua, J., et al. (2015) : "A gravity model for foreign re-investment," *Economics Bulletin*, 35(1), 627–632.

Persson, M., and F. Wilhelmsson (2016) : "EU Trade Preferences and Export Diversification," *The World Economy*, 39(1), 16–53.

Petri, P. A. (2012) : "The determinants of bilateral FDI : Is Asia different ?," *Journal of Asian Economics*, 23(3), 201 – 209.

Pettersson, J., and L. Johansson (2013) : "Aid, Aid for Trade, and bilateral trade : An empirical study," *The Journal of International Trade & Economic Development*, 22(6), 866–894.

Plümper, T., and V. E. Troeger (2011) : "Fixed-Effects Vector Decomposition : Properties, Reliability, and Instruments," *Political Analysis*, 19(2), 147–164.

Rajan, R. G., and A. Subramanian (2011) : "Aid, Dutch disease, and manufacturing growth," *Journal of Development Economics*, 94(1), 106–118.

Redding, S., and A. J. Venables (2003) : "Geography and Export Performance : External Market Access and Internal Supply Capacity," Working Paper 9637, National Bureau of Economic Research.

——— (2004) : "Economic geography and international inequality," *Journal of International Economics*, 62(1), 53–82.

Romer, P. M. (1990) : "Human capital and growth : Theory and evidence," *Carnegie-Rochester Conference Series on Public Policy*, 32, 251–286.

Salacuse, J. W., and N. P. Sullivan (2005) : "Do BITs Really Work : An Evaluation of Bilateral Investment Treaties and Their Grand Bargain," *Harvard International Law Journal*, 46, 67.

Sauvant, and Sachs (2009) : "The Effect of Treaties on Foreign Direct Investment," .

Selaya, P., and E. R. Sunesen (2012) : "Does Foreign Aid Increase Foreign Direct Investment ?," *World Development*, 40(11), 2155–2176.

Silva, J. M. C. S., and S. Tenreyro (2006) : "The Log of Gravity," *Review of Economics and Statistics*, 88(4), 641–658.

Sin, C.-y. (2015) : "The economic fundamental and economic policy uncertainty of Mainland China and their impacts on Taiwan and Hong Kong," *International Review of Economics & Finance*, 40, 298 – 311.

Sirr, G., J. Garvey, and L. A. Gallagher (2017) : "Bilateral Investment Treaties and Foreign Direct Investment : Evidence of Asymmetric Effects on Vertical and Horizontal Investments," *Development Policy Review*, 35(1), 93–113.

Slangen, A. H. L., and S. Beugelsdijk (2010) : "The impact of institutional hazards on foreign multinational activity : A contingency perspective," *Journal of International Business Studies*, 41(6), 980–995.

Sousa, J. d., and J. Lochard (2011) : "Does the Single Currency Affect Foreign Direct Investment ?*," *The Scandinavian Journal of Economics*, 113(3), 553–578.

Stubbs, T. H., A. E. Kentikelenis, and L. P. King (2016) : "Catalyzing Aid ? The IMF and Donor Behavior in Aid Allocation," *World Development*, 78, 511–528.

Temple, J., and N. Van de Sijpe (2017) : "Foreign aid and domestic absorption," *Journal of International Economics*, 108, 431–443.

Teräsvirta, T., and Y. Yang (2015) : "Linearity and Misspecification Tests for Vector Smooth Transition Regression Models," Research Papers 2014-04, CREATES, School of Economics and Management, Universty of Aarhus (revised on July 2015).

Tobin, J. L., and M. L. Busch (2010) : "A BIT Is Better Than a Lot : Bilateral Investment Treaties and Preferential Trade Agreements," *World Politics*, 62(1), 1–42.

Tobin, J. L., and S. Rose-Ackerman (2011) : "When BITs have some bite : The political-economic environment for bilateral investment treaties," *The Review of International Organizations*, 6(1), 1–32.

Todaro, M., and S. C. Smith (2014) : *Economic Development*. Pearson, Harlow, 12th edition edn.

Tsai, I.-C. (2017) : "The source of global stock market risk : A viewpoint of economic policy uncertainty," *Economic Modelling*, 60, 122–131.

UN-Habitat, and I.-E. U. Rotterdam (2018) : *The State of African Cities 2018 – The geography of African investment*.

UNCTAD (2011) : "Foreign Direct Investment in LDCs : Lessons Learned from the Decade 2001–2010 and the Way Forward," .

United Nations Conference on Trade and Development (2018) : *World Investment Report 2018 : Investment and New Industrial Policies*, United Nations Conference on Trade and Development (UNCTAD) World Investment Report (WIR). UN.

Vernon, R. (1992) : "INTERNATIONAL INVESTMENT AND INTERNATIONAL TRADE IN THE PRODUCT CYCLE*," in *International Economic Policies and their Theoretical Foundations (Second Edition)*, ed. by J. M. Letiche, Economic Theory, Econometrics, and Mathematical Economics, pp. 415–435. Academic Press, Boston, DOI : 10.1016/B978-0-12-444281-8.50024-6.

Vijil, M. (2014) : "Aid for Trade Effectiveness : Complementarities with Economic Integration," *The World Economy*, 37(4), 555–566.

Vijil, M., and L. Wagner (2012) : "Does Aid for Trade Enhance Export Performance ? Investigating the Infrastructure Channel," *The World Economy*, 35(7), 838–868.

Voeten, E., A. Strezhnev, and M. Bailey (2018) : "United Nations General Assembly Voting Data," Discussion paper.

Windmeijer, F. a. G., and J. M. C. Santos Silva (1997) : "Endogeneity in Count Data Models : An Application to Demand for Health Care," *Journal of Applied Econometrics*, 12(3), 281–294.

Wolfgang, F., and F. Pfeiffer (2002) : "The Rationale for Wage Rigidity : Survey Evidence from German and US Firms," Discussion Papers 02-60, ZEW.

Woods, N. (2008) : "Whose aid ? Whose influence ? China, emerging donors and the silent revolution in development assistance," *International Affairs*, 84(6), 1205–1221.

Yildiz, H. M. (2013) : "Foreign direct investment and customs union : Incentives for multilateral tariff cooperation over free trade," *The Journal of International Trade & Economic Development*, 22(2), 298–316.

Yin, L., and L. Han (2014) : "Spillovers of macroeconomic uncertainty among major economies," *Applied Economics Letters*, 21(13), 938–944.

Yotov, Y. V., and M. Larch (2016) : "An Advanced Guide to Trade Policy Analysis : The Structural Gravity Model," .

UNIVERSITÉ DE LA RÉUNION

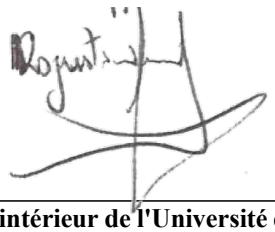
Pôle Recherche
Ecoles doctorales

LETTRE D'ENGAGEMENT DE NON-PLAGIAT

Je, soussigné(e) RAZAFINDRAVAOSOLONIRINA en ma qualité de doctorant(e) de l'Université de La Réunion, déclare être conscient(e) que le plagiat est un acte délictueux passible de sanctions disciplinaires. Aussi, dans le respect de la propriété intellectuelle et du droit d'auteur, je m'engage à systématiquement citer mes sources, quelle qu'en soit la forme (textes, images, audiovisuel, internet), dans le cadre de la rédaction de ma thèse et de toute autre production scientifique, sachant que l'établissement est susceptible de soumettre le texte de ma thèse à un logiciel anti-plagiat.

Fait à Saint-Denis le : 22/11/2018

Signature :



Extrait du Règlement intérieur de l'Université de La Réunion
(validé par le Conseil d'Administration en date du 11 décembre 2014)

Article 9. Protection de la propriété intellectuelle – Faux et usage de faux, contrefaçon, plagiat

L'utilisation des ressources informatiques de l'Université implique le respect de ses droits de propriété intellectuelle ainsi que ceux de ses partenaires et plus généralement, de tous tiers titulaires de tes droits.
En conséquence, chaque utilisateur doit :
- utiliser les logiciels dans les conditions de licences souscrites ;
- ne pas reproduire, copier, diffuser, modifier ou utiliser des logiciels, bases de données, pages Web, textes, images, photographies ou autres créations protégées par le droit d'auteur ou un droit privatif, sans avoir obtenu préalablement l'autorisation des titulaires de ces droits.

La contrefaçon et le faux
Conformément aux dispositions du code de la propriété intellectuelle, toute représentation ou reproduction intégrale ou partielle d'une œuvre de l'esprit faite ans le consentement de son auteur est illicite et constitue un délit pénal.
L'article 444-1 du code pénal dispose : « Constitue un faux toute altération frauduleuse de la vérité, de nature à cause un préjudice et accomplie par quelque moyen que ce soit, dans un écrit ou tout autre support d'expression de la pensée qui a pour objet ou qui peut avoir pour effet d'établir la preuve d'un droit ou d'un fait ayant des conséquences juridiques ».
L'article L335_3 du code de la propriété intellectuelle précise que : « Est également un délit de contrefaçon toute reproduction, représentation ou diffusion, par quelque moyen que ce soit, d'une œuvre de l'esprit en violation des droits de l'auteur, tels qu'ils sont définis et réglementés par la loi. Est également un délit de contrefaçon la violation de l'un des droits de l'auteur d'un logiciel (…) ».

Le plagiat est constitué par la copie, totale ou partielle d'un travail réalisé par autrui, lorsque la source empruntée n'est pas citée, quel que soit le moyen utilisé. Le plagiat constitue une violation du droit d'auteur (au sens des articles L 335-2 et L 335-3 du code de la propriété intellectuelle). Il peut être assimilé à un délit de contrefaçon. C'est aussi une faute disciplinaire, susceptible d'entraîner une sanction.
Les sources et les références utilisées dans le cadre des travaux (préparations, devoirs, mémoires, thèses, rapports de stage…) doivent être clairement citées. Des citations intégrales peuvent figurer dans les documents rendus, si elles sont assorties de leur référence (nom d'auteur, publication, date, éditeur…) et identifiées comme telles par des guillemets ou des italiques.

Les délits de contrefaçon, de plagiat et d'usage de faux peuvent donner lieu à une sanction disciplinaire indépendante de la mise en œuvre de poursuites pénales.