



# Impact of financial Frictions on international Trade in Brazil and emerging Countries

Fatma Bouattour

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# THÈSE DE DOCTORAT

de l'Université de recherche Paris Sciences et Lettres  
PSL Research University

Préparée à l'Université Paris-Dauphine

Impact of financial frictions on international trade in Brazil  
and emerging countries

École Doctorale de Dauphine — ED 543

Spécialité **Sciences économiques**

**Soutenue le 25.03.2016  
par Fatma BOUATTOUR**

Dirigée par **Pr. Jean-Marc SIROËN**

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Nul ne peut atteindre l'aube sans passer par le chemin de la nuit. *Khalil Gibran*

L'escalier de la science est l'échelle de Jacob, il ne s'achève qu'aux pieds de Dieu. *Albert Einstein*





*A l'âme de mon papa,*

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# Introduction Générale

*"L'économie est, non pas une discipline achevée, mais une science elle-même toujours en voie de développement."* - Paul SAMUELSON (1915-2009)

## 1 Contexte Général

L'économie mondiale se caractérise par une interdépendance accrue favorisée par l'expansion du commerce international. Celle-ci s'explique notamment par l'approfondissement de la division internationale des processus productifs, et la croissance des flux d'investissements directs à l'étranger (IDE). Alors que les liens commerciaux et financiers entre les pays ont permis l'évolution vers un marché mondialisé depuis les années 80, la relation entre la sphère financière et la sphère réelle reste un sujet d'actualité.

La réduction des entraves à l'échange a permis la création d'un marché mondialisé. Depuis le 19ème siècle, l'amélioration des transports a permis une expansion rapide des flux commerciaux. La croissance des exportations a même excédé celle de la production mondiale. Alors que la production mondiale a été multipliée par 60 depuis mi-1800, le commerce mondial a quant à lui été multiplié par 140 (Maddison, 2008). La Figure 1 montre que la part des exportations dans la production mondiale n'a cessé d'augmenter, pour atteindre environ 30% en 2013. La mondialisation commerciale a été par la suite soutenue par une libre circulation des flux financiers. Cet aspect de la mondialisation a été favorisé surtout par les avancées dans les techniques de communication. Les investissements directs à l'étranger ont accompagné cette évolution, comme le montre la Figure 2. Ces flux d'IDE ont favorisé la fragmentation des processus productifs et la forte croissance des échanges des biens intermédiaires. En se basant sur la notion de l'avantage comparatif, la production d'un même bien se fait désormais sur plusieurs continents, chaque pays se spécialisant dans le segment sur lequel il détient un avantage comparatif, notamment l'assemblage d'inputs importés dans les pays émergents.

### 1.1 Pays Emergents : Nouveaux acteurs internationaux

L'approfondissement de la division internationale des processus productifs a favorisé la montée en puissance des pays émergents. Durant les trente dernières années, la part des pays en développement et émergents dans le commerce international (des biens) a augmenté aux

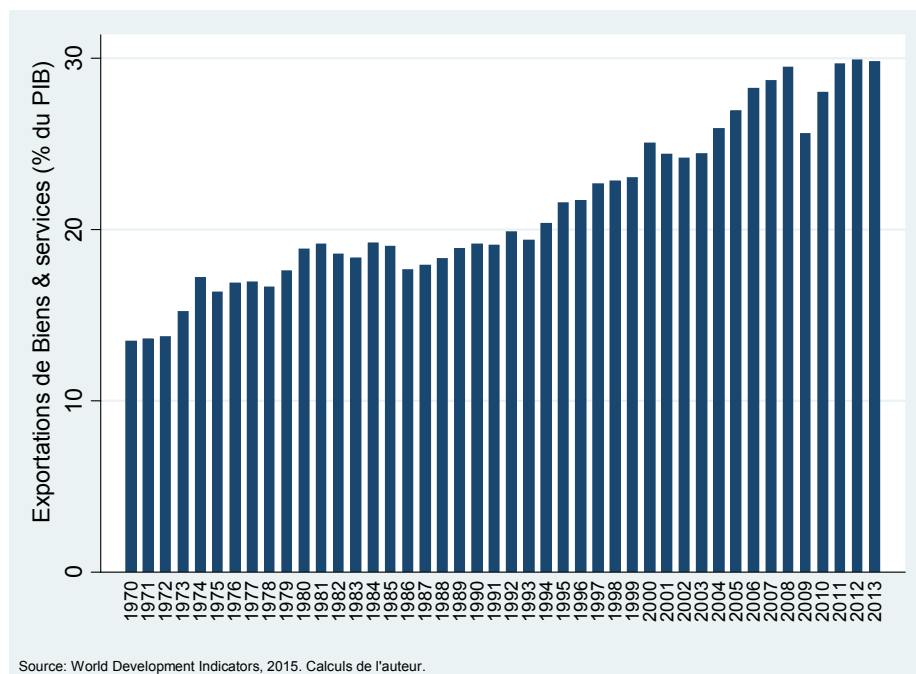


Figure 1: Evolution du commerce mondial 1970-2013

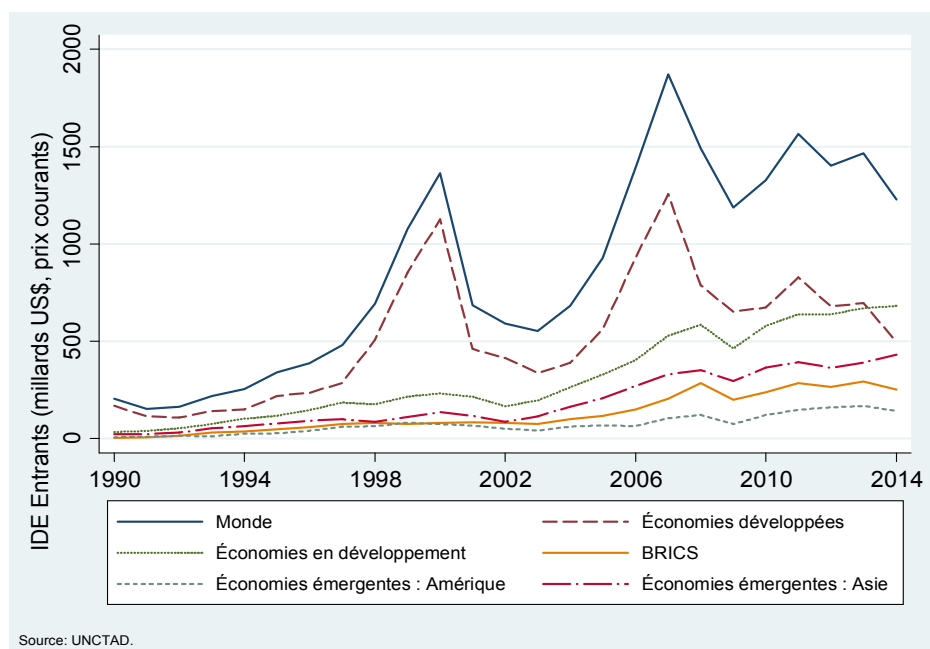


Figure 2: Evolution des IDE par région du monde 1990-2014

dépens de celle des pays avancés, de 34% en 1980 à 47% en 2011 (World Trade Report, 2013). L'intégration de ces pays émergents dans le système de commerce global est en partie due aux mouvements de délocalisation (Becker et Muendler, 2012), motivés par les avantages de coût dans ces pays. Ces délocalisations se sont traduites par des entrées massives de capitaux vers ces pays dès le début des années 2000. Ces flux d'IDE Nord-Sud ont particulièrement visé les pays d'Asie et l'Amérique Latine dans une moindre proportion (Figure 2). Les prêts bancaires internationaux constituent aussi une forme de flux de capitaux vers les pays émergents, davantage orientés vers les pays émergents d'Europe que vers l'Asie ou l'Amérique Latine. Ces différentes mutations ont créé une *dynamique de crédit*. L'expansion du crédit peut cependant être interprétée de deux manières différentes. La première vision est optimiste. Elle consiste à la considérer comme un signe d'intégration dans le système financier international traduisant un rattrapage des économies émergentes. Une autre vision, moins optimiste, considère l'expansion du crédit comme à l'origine d'un excès de liquidité qui augmente le risque d'instabilité macroéconomique. Sa (2006) suggère que les effets sur le risque de boom de crédit, des flux de capitaux vers les pays émergents varient en fonction de la nature des flux de capitaux et des caractéristiques des pays récipiendaires.

Quatre pays émergents ont particulièrement un poids grandissant sur la scène mondiale, compte tenu de la taille de leurs économies et leur potentiel de croissance : le Brésil, la Russie, l'Inde et la Chine, formant ainsi le groupe des BRIC, proposé pour la première fois par la Banque Goldman Sachs en 2001, l'Afrique du Sud ajoutant ensuite un «S» final pour former le groupe BRICS. L'émergence des BRICS a bouleversé la scène économique mondiale, et sont apparus dans les années 2000 comme la locomotive des pays avancés par ailleurs plus atteints par la crise de 2008. Les pays du BRICS comptent pour un tiers de la production mondiale. L'intégration de ces pays dans le système productif mondial s'est aussi traduite par une évolution continue de leurs échanges internationaux (Figure 3) et de leur part dans le commerce mondial, comme le montre la Figure 4. Le commerce des BRICS se fait essentiellement avec le reste du monde. Selon les statistiques de l'UNCTAD (la Conférence des Nations unies sur le Commerce et le Développement), plus de 90% des échanges commerciaux du groupe BRICS s'est fait avec des pays extra-BRICS, dans les années 2000. Cela suggère que l'expansion du groupe est *tributaire* des relations avec le reste des pays.

En ce qui concerne les flux financiers, les IDE entrants vers les BRICS affichent une croissance de plus de 230% entre 2000 et 2008. Ce fait rejoint le processus de libéralisation des mouvements de capitaux entamé dans ces pays depuis les années 1990<sup>1</sup>. Même si des différences existent en termes de libéralisation des flux de capitaux entre les différents pays BRICS, l'ouverture de ces pays aux flux d'IDE a bel et bien eu lieu. Ces afflux de capitaux, synonymes d'une expansion de l'activité des firmes multinationales dans ces pays, ont favorisé l'industrialisation du Brésil (Goldstein et Lemoine, 2013, p.74), et surtout de la Chine.

Malgré l'importance du groupe des BRICS dans le système mondial, une hétérogénéité

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<sup>1</sup> Même si les flux de capitaux restent contrôlés dans ces pays.

existe entre les différents pays du groupe. L'évolution la plus marquée dans le commerce mondial est accordée à la Chine. Selon l'UNCTAD, la part de la Chine dans le commerce mondial a augmenté de 1% en 1980 à plus de 12% en 2014. L'Inde et la Russie qui ne figuraient même pas dans le top 10 des exportateurs mondiaux ont vu leur part dans le commerce augmenter à 1 et 2% respectivement en 2014. La part du Brésil dans le commerce mondial, par contre, ne semble pas évoluer entre 1980 et 2014 (1%). Enfin, pour l'Afrique du Sud, la part dans le commerce mondial reste faible (moins de 1% en 2014). D'après ces statistiques, il semble clair que le poids des pays BRICS sur la scène mondiale est surtout donné par l'activité de la Chine. Les pays du BRICS présentent aussi de fortes différences en termes de spécialisation et de rôle dans la chaîne de valeur. Hanson (2012) indique que l'expansion des pays émergents est particulièrement due au poids grandissant de la Chine et de l'Inde. L'auteur met la lumière sur l'importance du commerce Sud-Sud et précise que ces deux pays absorbent plus de 25% des exportations des pays à revenus moyens, surtout dans le secteur des matières premières et de l'électronique. Les économies chinoise et indienne semblent changer de spécialisation sur les deux dernières décennies en réduisant leur commerce des biens à faible valeur ajoutée comme le textile (*Apparel*) et les chaussures (*Footwear*) et en augmentant leur commerce de l'électronique et des machines. L'économie chinoise présente particulièrement des mutations lui permettant d'exporter de plus en plus des biens plus sophistiqués comme les téléphones cellulaires ou les ordinateurs, même si la valeur ajoutée apportée par cette économie reste faible.

En contraste, les exportations du Brésil couvrent plutôt l'agriculture et les produits miniers, notamment le pétrole et le fer. Malgré la présence accrue des firmes multinationales et l'évolution du commerce brésilien des biens manufacturiers, le Brésil semble conserver sa spécialisation dans les matières premières, ce qui est en concordance avec la relative haute part de valeur ajoutée dans les exportations brésiliennes (87%), comme proposé par Koopman et al. (2010). Ces auteurs ont en effet décomposé la valeur ajoutée dans les exportations totales en trois composantes : matières premières, industries et services. Leurs résultats pour l'année 2004 montrent que la valeur ajoutée liée aux secteurs industriels, dans le total des exportations, compte pour 37% pour le Brésil et la Chine. Cependant, le Brésil dépasse la Chine en termes de la part de la valeur ajoutée totale (tous secteurs confondus) dans les exportations, notamment en raison de ses performances dans le secteur des matières premières (87% pour le Brésil contre 62% pour la Chine). La Russie et l'Afrique du Sud présentent des caractéristiques similaires au Brésil du point de vue de la spécialisation. Les exportations russes et sud-africaines sont surtout de matières premières, ce qui se traduit par une forte part de la valeur ajoutée dans le total des exportations, de 89 et de 81% respectivement.

## 1.2 Financement du Commerce

Un autre fait majeur est l'expansion des moyens de financement du commerce qui est la traduction de *Trade Finance*. L'activité d'exportation nécessite une disponibilité de ressources



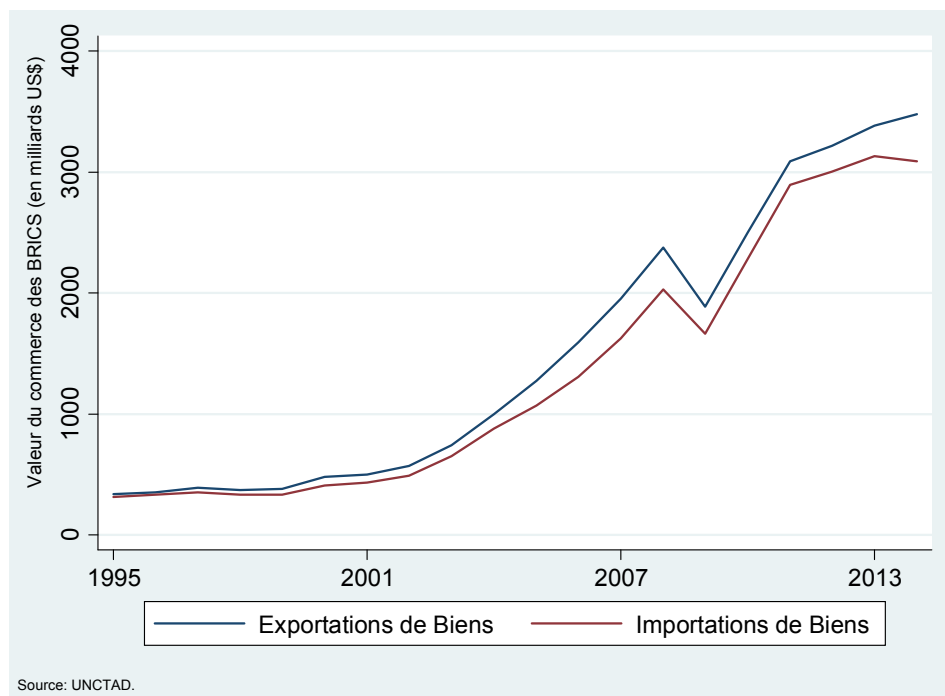


Figure 3: Evolution du Commerce des BRICS 1995-2013

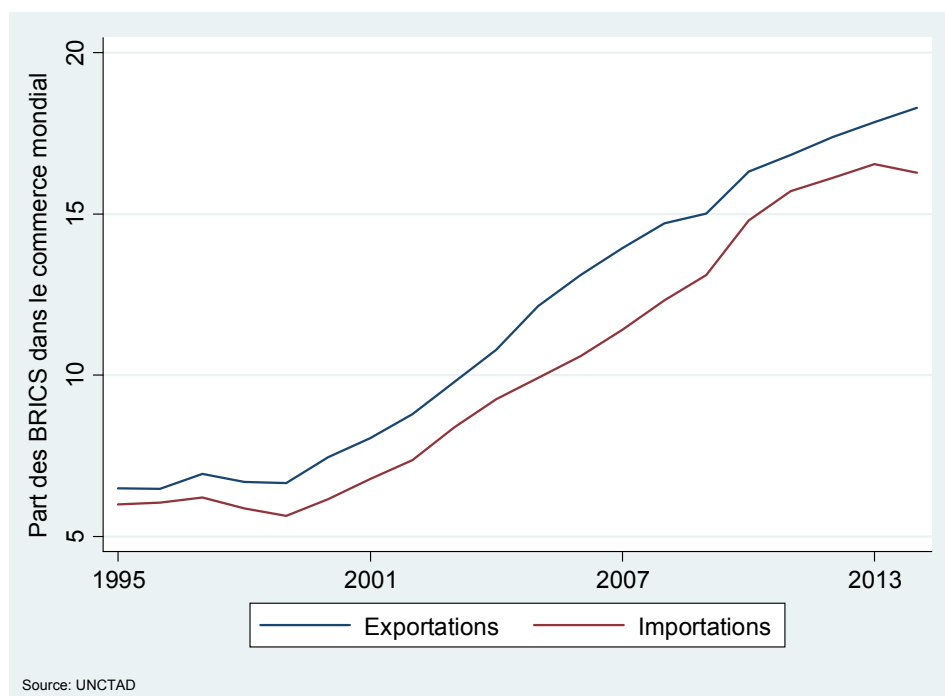


Figure 4: Evolution de la part des BRICS dans le commerce 1995-2013

financières. En effet, les firmes exportatrices ont généralement des coûts fixes à engager avant d'entrer sur le marché d'exportation (Melitz, 2003). De plus, la production nécessite des coûts variables qui peuvent être immédiatement supérieurs aux coûts des biens vendus sur le marché local, compte tenu des dépenses d'adaptation aux préférences.

Les banques nationales et internationales proposent ainsi des instruments financiers afin de satisfaire les besoins des acteurs du commerce international. A travers cette *Trade Finance*, les banques fournissent du financement aux firmes ayant un besoin de liquidité, et les aident à se couvrir contre les risques associés à l'activité à l'international. Ces risques peuvent être par exemple liés à la qualité des partenaires commerciaux ou aux fluctuations des prix et des taux de change. L'instrument de financement du commerce le plus connu est la *lettre de crédit*. Il s'agit d'un instrument garantissant au vendeur international d'être payé par la banque de l'acheteur (importateur) à la livraison de la marchandise. Les banques peuvent aussi fournir des crédits aux exportateurs et importateurs pour satisfaire leurs besoins de fonds de roulement. Alors que le financement du commerce relève principalement de l'activité des banques, les gouvernements et les organisations peuvent aussi participer au financement du commerce. Certaines banques centrales, par exemple, proposent des schémas de refinancement qui consistent à traiter les factures commerciales des exportateurs à des tarifs préférentiels. De plus, les gouvernements peuvent agir à travers des banques de développement pour faciliter aux acteurs du commerce international l'accès aux financements. Au Brésil, par exemple, le gouvernement permet de fournir des crédits à des taux d'intérêt inférieurs aux taux du marché à travers la banque brésilienne publique de développement, BNDES. Cette banque propose des lignes de financement spécifiques, notamment *BNDES-exim's*, pour aider les exportateurs avant et après l'expédition des marchandises, et s'interpose aussi parfois entre les importateurs brésiliens et les exportateurs étrangers pour faciliter les paiements. Il existe aussi des agences spécialisées qui ciblent les besoins des exportateurs et des importateurs. On peut citer à titre d'exemple l'*Export - Import Bank* américaine.

Il est aussi commode de préciser la différence entre le financement du commerce (*Trade Finance*) et les crédits commerciaux (*Trade Credit*). Alors que la *Trade Finance* se réfère aux crédits accordés par les institutions financières, les crédits commerciaux consistent en des délais de paiement permettant aux acheteurs de régler le vendeur ultérieurement à l'achat.

Selon le site de l'Organisation Mondiale du Commerce (OMC), environ 80 à 90% du commerce mondial repose sur la *Trade Finance*. Il existe, cependant, des difficultés dans l'obtention de l'information détaillée sur le volume du financement du commerce (WTO e-learning, 2013). Selon un rapport de la Banque des Règlements Internationaux (BRI) en 2014<sup>2</sup>, le volume du financement du commerce fourni par les banques atteint en 2011 un flux se situant entre 6.5-8 billions de dollars, dont 2.8 liés aux lettres de crédit. Seulement quelques pays recensent au niveau national les transactions sur le marché de la *Trade Finance*. Selon la même source, le montant du financement du commerce à travers les banques au Brésil, par

<sup>2</sup>Dans un rapport de la BRI, intitulé « Trade finance: developments and issues » préparé par le *Committee on the Global Financial System*, N° 50.

Figure 5: Tendances de la *Trade Finance* 2007-2013 (Source: BRI, 2014, CGFS-N°50)

exemple, est de l'ordre de 57 milliards de dollars en 2011, et financent 24% du commerce des biens. Pour la Chine, les statistiques montrent que le financement du commerce est de 218 milliards de dollars, finançant 47% du commerce des biens. Malgré la possible imprécision des données, ces chiffres attestent de l'importance majeure du financement externe pour le déroulement de l'activité du commerce international.

Quelques tendances globales peuvent être détectées sur la Figure 5 fournie par le rapport de la BRI évoqué ci-dessus. La Figure 5 confirme à travers le premier schéma que le commerce international est bien corrélé avec le volume du financement du commerce. En se concentrant sur les pays émergents, il est clair qu'il existe une tendance à la hausse de la *Trade Finance* pour la Chine, l'Inde ou la Corée du Sud, malgré la baisse spectaculaire des financements pendant la crise financière (le troisième trimestre de 2008). L'évolution de la *Trade Finance* semble moins spectaculaire par contre pour le Brésil. Cela peut être justifié par le niveau des taux d'intérêt qui reste relativement haut, et qui se traduit par un haut coût des financements bancaires. En ce qui concerne les économies avancées, on peut remarquer que le financement du commerce après la crise de 2008 n'a pas retrouvé son niveau de l'avant-crise sauf pour les Etats Unis. Cela nous amène à l'étude des effets de la crise financière de 2008.

### 1.3 Crise Financière de 2008

La crise financière de 2008 a dévoilé une autre facette de la globalisation. Comme détaillé précédemment, le processus de globalisation a permis l'intégration des pays dans un système mondial de production et de relations financières. Pourtant, c'est cette interdépendance accrue entre les pays qui a diffusé et amplifié la récente crise financière. Bien que la crise soit

d'abord apparue aux Etats Unis, ses effets se sont propagés aux autres économies. De plus, malgré l'origine financière de la crise, la baisse des flux de commerce international a été d'une ampleur inattendue. Ce fait renvoie à la relation entre la finance et le commerce international. La crise financière a causé une pénurie du crédit au niveau mondial, suite à la faillite de Lehman Brothers en l'automne de 2008. Par l'importance de la *Trade Finance* dans les échanges internationaux, cette pénurie a pu affecter le commerce international qui a connu une baisse sans précédent de 37% entre Septembre 2008 et Février 2009<sup>3</sup>. Néanmoins, certains économistes ne confirment pas ce *canal financier* de la transmission de la crise, confirmé pour des crises précédentes par Ronci (2004). En effet, les estimations montrent que la baisse du commerce international a été plus marquée que celle des financements du commerce. Seulement 15% de la baisse du commerce, durant la crise, pourrait ainsi être attribuée à la pénurie de financements. Song (2014) confirme le faible lien de causalité entre la *Trade finance* et la baisse du commerce durant la crise pour le cas de la Corée du Sud. Une enquête sur des banques durant la crise, élaborée conjointement par le Fonds Monétaire International (FMI) et le BAFT<sup>4</sup>, montre que les banques attribuent la baisse du financement du commerce *principalement* à une baisse de la *demande* des crédits par les clients. En phase avec ce résultat, Eaton et al (2011) attribuent plus de 70% de la baisse du ratio commerce sur PIB à la baisse importante de la demande durant la récession causée par la crise. Ces résultats nous amènent à une deuxième hypothèse sur la transmission de la crise de 2008 qui attribue la baisse des échanges internationaux à la baisse de la demande des biens. Du fait de la division internationale des processus productifs, la baisse de la demande dans les pays initialement touchés par la crise s'est propagée par un effet domino aux autres pays de la chaîne de production mondiale, amplifiant ainsi la chute du commerce : la baisse des exportations d'un bien final entraînant aussi la chute des exportations d'inputs à leurs différents stades d'élaboration. En effet, l'ajustement des inventaires suite au choc de demande causé par la crise a engendré une transmission de la crise à toutes les composantes de la chaîne de valeur. Il s'agit particulièrement du *bullwhip effect* (Stadtler, 2008) qui se traduit par une accentuation du choc de demande initial tout au long de la chaîne de valeur. Cet effet a été confirmé dans le cadre de la crise de 2008 par Escaith et al (2010), et par Altomonte et al (2012).

Prenant en compte ces différentes visions, la crise financière de 2008 a donc suscité un intérêt renouvelé dans l'étude du lien entre la finance et le commerce.

## 2 Développement financier et avantage comparatif

La fin du 20ème siècle a été particulièrement marquée par une domination des pays avancés dans le commerce international, ce qui a conduit à formuler des modèles théoriques basés sur les rendements d'échelle croissants et la concurrence monopolistique (Helpman and Krug-

<sup>3</sup>Précisément, les statistiques sur les exportations mensuelles de biens, fournies par l'OMC. Calculs de l'auteur.

<sup>4</sup>IMF/BAFT-IFSA Trade Finance Survey, 2009.

man, 1985). Avec l'émergence des puissances à revenus moyens, la dernière décennie a été au contraire marquée par une réévaluation du rôle de l'*avantage comparatif* dans l'explication des échanges internationaux.

Depuis David Ricardo, les théories du commerce international ont mis en évidence l'importance de la notion de l'avantage comparatif (*Comparative Advantage*) comme déterminant la trajectoire du commerce international et de la spécialisation des économies. Alors que Ricardo accorde les différences en termes d'avantage comparatif aux *différences de technologie* entre les différents secteurs, les économistes Eli Hecksher et Bertil Ohlin ont souligné l'importance de l'hétérogénéité des pays en termes de *dotations factorielles* et les *différences sectorielles en termes d'intensité en facteurs de production*, comme déterminants de la spécialisation. Dans ce contexte, la littérature récente sur le commerce international a mis l'accent sur rôle de la finance, plus précisément le niveau de développement financier. Le développement financier est en effet assimilé à une dotation factorielle qui permet le bon acheminement de la ressource du capital. Ainsi, les pays présentant des secteurs financiers développés auront un avantage comparatif dans les secteurs qui sont plus intensifs en capital. Ces pays auront donc plus d'avantage par rapport aux pays moins développés financièrement, dans leurs échanges commerciaux dans les secteurs avec plus de besoins en capital, notamment le financement bancaire.

## 2.1 Qu'est-ce que le développement financier ?

Sur un marché financier parfait, un entrepreneur devrait être indifférent quant à la source du financement de son projet : fonds internes ou finance externe (Modigliani et Miller, 1958). Mais en présence d'imperfections sur le marché financier, le coût de la finance externe diffère du coût des fonds internes de l'entreprise. Dans ce contexte, le développement financier consiste à refléter la facilité avec laquelle une entreprise peut obtenir du financement externe, et à réduire le risque pour un investisseur de ne pas recevoir les revenus espérés. Le développement financier est considéré comme un des mécanismes d'allocation des ressources en capital (De Lucinda, 2003). Dans un contexte de marchés imparfaits, le développement financier est supposé diriger les flux d'épargne (et donc de capital) vers les projets à plus fort potentiel de croissance (Čihák et al., 2012). Fisman et Love (2004) suggèrent que, sur le long terme, le développement financier permet l'acheminement du capital vers les secteurs dépendants de la finance externe.

Levine (1997) considère que le développement financier permet la réduction des asymétries d'information entre les prêteurs et les emprunteurs et la réduction des coûts de transaction. De façon plus générale, Levine (1997) propose cinq fonctions du développement financier : faciliter l'échange, la couverture, la diversification, et la mutualisation des risques, faciliter l'allocation des ressources, exercer le contrôle des entreprises, favoriser l'épargne et faciliter l'échange des biens et services.

Ici, nous focalisons l'intérêt sur le rôle du développement financier dans l'amélioration

de la qualité de l'intermédiation financière, particulièrement de l'accès au crédit, et dans la réduction des coûts de transaction. Le développement financier permet d'assurer une meilleure allocation du capital dans le temps et entre les différents secteurs et firmes. Ainsi, les firmes et secteurs ayant le plus besoin de la finance externe devraient avoir accès à la finance avec un coût de capital optimal, leur permettant de satisfaire leur demande de crédit et réaliser leurs investissements.

Rajan et Zingales (1998, RZ) partent de l'*hypothèse* que les Etats Unis présentent un marché financier développé, présentant le moins de distorsions et permettant ainsi une allocation des ressources entre les différents secteurs selon leurs besoins *intrinsèques* en termes de financements externes. En utilisant des données de firmes américaines dans les années 80, les auteurs proposent des indicateurs au niveau sectoriel, qui reflètent les besoins des différents secteurs en termes de finance externe. En se basant sur l'hypothèse concernant la qualité des institutions financières américaines, ces indicateurs ont été par la suite considérés comme référence pour les besoins de finance externe des industries manufacturières.

Notons que la littérature propose différentes mesures du développement financier. Une première mesure la part des dépôts bancaires dans le Produit Intérieur Brut (PIB) ce qui reflète l'importance des financements bancaires dans le financement de l'économie. Une seconde mesure est liée à l'émission des actions définie comme la part des émissions d'actions par les firmes domestiques dans la formation brute de capital fixe. Emettre des actions peut en effet être considéré comme un moyen de financement des investissements. Deux autres mesures peuvent aussi refléter l'importance du marché des actions : la valeur de la capitalisation boursière et le nombre d'entreprises cotées en bourse (Rajan and Zingales, 2003). Dans ce travail, nous allons considérer l'expansion du secteur bancaire comme indicateur de développement financier. Par conséquent, la part des crédits accordés par le système bancaire dans le PIB sera la mesure utilisée pour approximer le niveau de développement financier. Malgré le fait que cette mesure ne capte pas la structure des actifs des banques, ce ratio a été principalement utilisé dans la littérature sur l'effet de la finance sur le commerce international.

## 2.2 Développement financier et commerce international : Causalité

En se basant sur le modèle d'Heckscher-Ohlin, Kletzer et Bardhan (1987) fût le premier travail théorique à considérer que les imperfections du marché financier peuvent affecter les coûts de production, même en présence d'une même technologie et de dotations factorielles similaires. Partant de cette innovation théorique, Beck (2002) fût le premier à étudier le lien entre le développement financier et le commerce international. L'auteur met en évidence un lien de causalité entre la qualité de la finance et les performances d'exportation dans le secteur manufacturier. Les travaux se sont succédé par la suite pour étudier les effets du développement financier sur le commerce international (Svaleryd and Vlachos, 2005 ; Becker and Greenberg, 2005). La principale conclusion est que les différences en termes de développement financier déterminent la spécialisation des pays et la nature de leurs échanges commerciaux, ce qui

rejoint la notion de l'avantage comparatif.

En même temps, un nombre de travaux se sont questionné sur le lien de causalité inverse entre le développement financier et les performances économiques réelles, notamment la croissance économique et le commerce international. Rajan et Zingales (2003), par exemple, trouvent que l'ouverture au commerce est corrélée avec le développement financier, surtout en présence d'une libre circulation du capital. Leur étude s'intéresse particulièrement aux effets de l'ouverture commerciale sur l'*offre* de la finance externe. Dans le même contexte, Huang et Temple (2005) montrent, à travers l'étude d'un panel de pays sur la période 1990-2001, que l'ouverture commerciale affecte positivement le niveau de développement financier, particulièrement dans les pays à hauts revenus, et que ces effets durent sur le long-terme. Do et Levchenko (2007) proposent par contre un impact du commerce sur le développement financier via la *demande* de la finance externe. Les auteurs suggèrent que l'avantage comparatif lié au commerce affecte la spécialisation du pays, ce qui affecte par la suite la demande de finance externe. De ce fait, les pays qui se spécialisent dans la production de biens nécessitant des financements externes auront une forte demande de la finance externe ce qui se traduit par une meilleure qualité de l'intermédiation financière.

Afin de pallier au possible problème d'endogénéité du développement financier, RZ introduisent l'*hétérogénéité* intersectorielle en termes de besoins de finance externe comme un facteur qui affecte l'impact du développement financier sur la croissance. Ce travail pionnier de RZ (1998) est devenu une référence dans la littérature étudiant le lien entre le développement financier et le commerce international (Manova, 2008 ; 2013). La conclusion principale de ces nouvelles contributions théoriques dans le domaine du commerce international est que les pays les plus développés financièrement ont un avantage comparatif de commerce dans les secteurs financièrement vulnérables.

### 2.3 Vulnérabilité financière des secteurs : Définition

Dans ce travail, les secteurs vulnérables financièrement sont ceux qui dépendent le plus de la finance externe, comme cela a été défini par RZ (1998). Ces auteurs attribuent en effet l'hétérogénéité intersectorielle de vulnérabilité financière à des *différences technologiques* entre les différents secteurs. Alors que le développement financier affecte l'*offre* de crédit, l'appartenance d'une firme à un secteur déterminé affectera ses besoins en termes de finance externe (*demande* de crédit). Sous l'hypothèse de qualité supérieure des institutions financières aux Etats Unis, la vulnérabilité financière d'un secteur reflète exclusivement la *demande* de finance externe. En effet, comme le secteur financier américain est considéré comme représentant le moins de distorsions, l'offre de capital est supposée satisfaire la demande de finance externe des différents secteurs, basée sur leurs différences *technologiques*.

La vulnérabilité financière peut être aussi liée à la disponibilité des actifs tangibles (Braun, 2003). Les secteurs qui, de par leur nature, présentent une part importante d'actifs tangibles peuvent être considérés comme moins contraints financièrement. En effet, les firmes dans les

secteurs concernés pourront présenter leurs actifs tangibles comme collatéral au moment de la demande de crédits du secteur bancaire.

La vulnérabilité financière d'un même secteur peut cependant varier entre les pays. Les imperfections du marché financier ainsi que les spécificités économiques et industrielles des pays peuvent affecter le niveau de vulnérabilité financière d'un même secteur dans le temps et entre les pays. Dans ce cas, le terme de vulnérabilité financière peut capter non seulement les caractéristiques technologiques d'un secteur mais aussi les caractéristiques du pays en question, notamment son niveau de développement financier. Le niveau de vulnérabilité financière d'un secteur reflètera donc la situation du secteur après avoir tenu en compte les *besoins* de finance externe du secteur (demande) et l'*accès* au crédit (offre).

### 3 Contexte de firmes hétérogènes

De nouvelles contributions théoriques s'intéressent aux déterminants du commerce international en se référant à l'entité microéconomique, qu'est la firme. Melitz (2003) propose un cadre théorique dans lequel les firmes sont hétérogènes par leur niveau de productivité. L'auteur montre que seules les firmes les plus productives sont capables de supporter les coûts fixes liés à l'exportation, et elles sont donc les seules à pénétrer le marché d'exportation (*marge extensive*) ; les autres firmes desservent uniquement le marché domestique. Pareillement, les caractéristiques des firmes déterminent les volumes de leurs exportations (*marge intensive*). Considérant l'importance des conditions financières dans les performances commerciales, des travaux théoriques ont introduit les contraintes de crédit dans un cadre de firmes hétérogènes à la Melitz. Selon Chaney (2013), seules les firmes les plus productives arrivent à générer de la liquidité à partir de leurs activités domestiques, et ont par la suite plus de chances d'exporter. Manova (2013) présente un cadre similaire de firmes hétérogènes en présence des contraintes de crédit, c'est-à-dire dans un contexte de marchés financiers imparfaits. Selon Manova, les firmes ont besoin de financer une partie de leurs coûts à l'exportation en faisant appel au secteur financier. Il y a donc nécessité pour ces firmes de payer un collatéral et de rembourser le crédit en fin de période. Seules les firmes les plus productives arrivent à générer des profits suffisants, et vont donc exporter. Le paiement du collatéral ainsi que la probabilité de faire défaut sont conditionnés par le degré de vulnérabilité financière du secteur et le niveau du développement financier du pays domestique. Le modèle de Manova (2013) suggère que le développement financier influence positivement la probabilité d'exporter ainsi que le volume d'exportation. Cet effet est accentué dans les industries qui dépendent le plus de la finance externe, comme l'ont proposé Rajan et Zingales (1998). Une littérature empirique s'est développée par la suite pour vérifier ces prédictions théoriques (Manova et al., 2011 ; Chor et Manova, 2012 ; Claessens et al., 2014a).

Parallèlement, une littérature s'est intéressée à l'importance des caractéristiques des firmes en relation avec leurs contraintes financières. Dans un contexte de marchés financiers parfaits,



la taille de la firme peut être considérée comme une mesure de la productivité de la firme. La relation positive entre la taille de la firme et sa productivité totale des facteurs (TFP) a été par exemple confirmée par Van Biesebroeck (2005) pour le cas des entreprises africaines dans le secteur manufacturier. Rao et Tang (2000) montrent que l'avantage de la taille lié à la TFP continue à exister même en contrôlant pour la part du capital étranger, l'âge ou l'intensité d'exportation. En présence d'imperfections du système financier, par contre, la relation entre la taille de la firme et le niveau de productivité peut être affectée. La littérature considère la taille de la firme comme mesure des contraintes financières au niveau de la firme. En se basant sur les résultats d'une enquête sur l'investissement au Brésil, Kumar et Francisco (2005) montrent que la taille de la firme affecte l'accès au crédit, particulièrement les crédits de long-terme. De façon similaire, Beck et al. (2005) exploitent une enquête sur des firmes dans 54 pays, et montrent que les contraintes financières, légales et liées à la corruption dépendent de la taille de la firme et sont plus marquées pour les petites firmes. Plus récemment, Vargas (2015) montre, à partir de données sur la Bolivie, que l'importance des différentes contraintes pour les entreprises varie selon la taille de l'entreprise. L'auteur trouve que les problèmes d'électricité ou de transport affectent davantage les moyennes et grandes firmes, et que l'accès au crédit se présente comme une contrainte importante surtout pour les petites firmes. Dans la même lignée, Kounouwewa et Chao (2011) suggèrent à travers une étude portant sur 16 pays africains, que la taille de la firme et la structure du capital affectent les contraintes de financement des entreprises. Sur ce point, Manova et al. (2011) considèrent que les firmes multinationales, implantées en Chine, ont moins de contraintes de financement que les firmes domestiques chinoises et trouvent, en contrôlant pour la taille, que les firmes ayant une part de capital étranger sont plus performantes en termes d'exportation. Ces effets sont encore plus marqués dans les secteurs qui dépendent plus de la finance externe. En considérant ces différents travaux, les contraintes financières au niveau des firmes peuvent être donc approximées par la taille de la firme. Alors que les grandes firmes sont généralement considérées comme moins contraintes financièrement, une vision opposée considère que les grandes firmes sont par nature plus dépendantes à la finance externe ce qui fait d'elles des firmes plus contraintes financièrement. Cette contradiction fera l'objet du chapitre 2 de cette thèse.

## 4 Motivation et objectifs

Deux principaux faits d'actualité motivent cette thèse. Comme présenté précédemment, la dernière décennie est marquée par le poids grandissant des pays émergents sur la scène mondiale, notamment dans les échanges internationaux. L'émergence de ces pays a créé des mutations dans le profil des spécialisations et dans la direction des échanges internationaux. Les travaux portant sur les caractéristiques des pays émergents étaient jusque-là peu abondants. De plus, quand elles existent, les études portent surtout sur la Chine, en tant qu'acteur

global. Le second fait d'actualité est la crise financière de 2007-2008. Les effets de la crise sur le commerce international ont été sans précédent. Les économistes ont donc été conduits à réexaminer le lien entre la finance et le commerce, dans un contexte de globalisation et d'interdépendance des systèmes de production.

Plus précisément, un débat s'est installé sur le principal canal de transmission de la crise aux échanges commerciaux. Deux canaux de transmission principaux sont suggérés par la littérature. D'un côté, la transmission d'une crise financière peut passer à travers des chocs de demande (Levchenko et al., 2010 ; Abiad et al., 2014). La grande dépression de 1930 a causé une contraction du commerce due à des chocs de demande, et aux recours aux mesures protectionnistes (loi de Smoot-Hawley de 1930). Un effet similaire est trouvé lors des crises financières dans certains pays émergents dans les années 80. De l'autre côté, les crises financières affecteraient la disponibilité de la finance externe, particulièrement les financements du commerce (Ahn et al., 2011). En se concentrant sur la récente crise financière, Chor et Manova (2012) mettent en évidence l'importance du canal de la *Trade Finance* du côté des exportateurs. En étudiant les effets de la crise financière de 2008 sur un échantillon de pays émergents et en développement, Malouche (2009) ajoute que la crise a affecté la disponibilité du financement du commerce pour les exportateurs et pour les importateurs.

Ce débat renvoie à l'importance de la disponibilité des financements du commerce et plus généralement à celle de la finance externe. Il s'agit particulièrement des crédits domestiques fournis par le secteur financier et bancaire. Dans un contexte de marchés financiers imparfaits, la littérature pointe du doigt le rôle du développement financier dans l'allocation du capital entre les différents secteurs et firmes. Wugler (2000) montre que la part des investissements dans la valeur ajoutée des secteurs ayant des potentiels de croissance augmente avec la qualité des systèmes financiers, suggérant ainsi un lien positif entre le développement financier et l'efficacité de l'allocation du capital. Ce résultat est en phase avec l'hypothèse proposée par Rajan et Zingales (1998) qui se basent sur la qualité du système financier américain pour considérer que les différences intersectorielles en termes de besoins de la finance externe sont dues aux différences technologiques entre les secteurs. Malgré le fait que le niveau de développement financier change dans le temps et que le niveau de développement financier du début du 20ème siècle ne fut dépassé qu'à partir des années 90 (Rajan and Zingales, 2003), les différences intersectorielles captées par les indicateurs de RZ(1998) sont supposées persister dans le temps et entre les pays. Relativement à ce point, les indicateurs de RZ ont été largement utilisés dans la littérature pour approximer les différences intersectorielles en termes de vulnérabilité financière dans d'autres pays comme la Chine (Manova et al., 2011) et sur des périodes récentes.

En parallèle, un petit nombre de travaux de recherche adaptent les indicateurs de RZ(1998) aux périodes récentes (Korszner et al., 2007 ; Bruno et Claessens, 2007) et aux pays concernés (Bricongne et al., 2010). Cela suscite des questions sur la pertinence des indicateurs de RZ (1998) pour approximer les différences intersectorielles dans d'autres pays et sur d'autres péri-

odes. Dans ce même contexte, Bena et Ondko (2012) réexaminent le lien entre le développement financier et l'allocation du capital en considérant cette fois la dépendance à la finance externe au niveau des firmes. Les auteurs expliquent les besoins (l'utilisation) de finance externe d'une firme par le niveau de développement financier du pays, le niveau de dépendance à la finance externe basé sur la technologie, telle que proposée par Rajan et Zingales (1998) et aussi des effets fixes sectoriels et par pays. Cette spécification suggère donc que le niveau de dépendance à la finance externe dépend des caractéristiques des pays et ne relève pas *forcément* des seules caractéristiques technologiques des secteurs.

L'étude des contraintes financières pour le Brésil peut s'avérer d'intérêt. Premièrement, malgré l'émergence de ce pays, la qualité de son intermédiation financière apparaît faible. Ce pays est connu par un coût de capital particulièrement élevé dû à des politiques monétaires très restrictives destinées à assurer la stabilité macroéconomique et la maîtrise de l'inflation. Cela peut avoir des effets directs sur l'investissement des firmes brésiliennes et sur leur demande de finance externe, indépendamment de leurs caractéristiques technologiques. De plus, Le gouvernement brésilien intervient pour alléger les contraintes de crédit, en proposant des crédits à des taux d'intérêt inférieurs aux taux du marché, via la banque de développement brésilienne BNDES. Ces crédits ne sont pas systématiquement orientés vers les secteurs à fort potentiel de croissance, ce qui peut affecter l'allocation de capital entre les secteurs. Enfin, comme de nombreux pays émergents, le Brésil a mis en place des contrôles de capitaux entrants avant les années 80 qu'il a réinstallés après la crise financière de 2008. Ces contrôles sont en mesure de limiter la liquidité disponible sur le marché brésilien, ce qui peut affecter la finance externe dans le pays.

Partant de ces constats, un *premier objectif* de cette thèse serait d'étudier le niveau de vulnérabilité financière des secteurs manufacturiers brésiliens dans la période des années 2000. La considération des spécificités du Brésil permettra de mieux appréhender les contraintes de financement des entreprises opérant dans les secteurs manufacturiers. A ma connaissance peu de travaux ont pris en compte l'importance des spécificités des pays dans l'explication des différences intersectorielles en termes de contraintes de financement externe. La réalisation de cet objectif de la thèse passera tout d'abord par une *discussion* sur la pertinence des indicateurs de Rajan et Zingales (1998). Il s'agit de vérifier la pertinence de l'hypothèse sur la stabilité des différences intersectorielles en termes de besoins de financements externes, *dans le temps* et *à travers les pays*. Ensuite, le but est de confronter les besoins de financements externes basés sur les différences technologiques (Rajan and Zinagles, 1998) avec les besoins de financements des secteurs brésiliens, compte tenu des caractéristiques économiques et financières du pays. Les indicateurs américains étant considérés comme référence, les besoins de financement spécifiques aux secteurs brésiliens reflèteraient un possible problème d'allocation du capital au Brésil.

Comme présenté précédemment, le lien entre la finance et le commerce a eu un regain d'intérêt dans la littérature récente théorique (Chaney, 2013 ; Manova, 2008 ; 2013) et em-

pirique. L'évolution de la *Trade Finance* a en partie permis l'expansion des échanges commerciaux, en satisfaisant les besoins de financement induits par les exportations. Dans un contexte de firmes hétérogènes, les caractéristiques inhérentes aux firmes peuvent affecter leurs besoins de financement. Une littérature s'est intéressée à détecter les contraintes financières au niveau firme en proposant différentes mesures. Depuis la mesure de sensibilité des investissements aux cash-flows proposée par Fazzari et al. (1998), un débat sur la bonne mesure des contraintes financières s'est installé. La littérature récente sur ce sujet fournit de nouvelles mesures, basées entre autres, sur la *taille* de la firme (Hadlock et Pierce, 2010 ; Bellone et al., 2009). Dans ce travail, nous considérons la taille de la firme comme indicateur des contraintes de financement. La littérature propose généralement un lien positif et assez évident entre la taille d'une firme et la valeur de ses exportations. En l'absence de contraintes de financement, la taille de la firme peut servir à approximer son niveau de productivité (Melitz, 2003). Cependant, en présence de marchés financiers imparfaits, cette relation peut être altérée.

Beck et al. (2000) confirment le rôle de la taille dans le relâchement des contraintes financières. Crisostomo et al. (2012) confirment, pour le Brésil, le rôle de la taille des entreprises dans l'accès au crédit. Cette relation ne semble pourtant pas évidente pour le cas des firmes brésiliennes exportatrices. Une enquête sur les firmes exportatrices effectuée en 2014 par la Confédération Nationale Brésilienne de l'Industrie montre que les exportateurs brésiliens continuent à rencontrer des défis, en matière de financement entre autres, et que les grandes firmes exportatrices brésiliennes sont aussi sujettes à des contraintes de financement. Ce résultat rend l'étude des effets de la taille et des financements sur les exportations brésiliennes intéressante.

Considérant ces différents éléments, un *deuxième objectif* de la thèse est de contribuer à la littérature sur les effets des contraintes financières sur le commerce international en revisitant le lien existant entre taille et contraintes financières au niveau microéconomique. L'attention est particulièrement portée sur les caractéristiques des firmes brésiliennes. L'étude du cas brésilien peut être motivée par un nombre d'évolutions et de caractéristiques de l'économie brésilienne. Depuis les années 1990, le gouvernement brésilien a entrepris de nombreuses réformes structurelles afin de promouvoir l'économie. Après une période de protectionnisme de type ISI (*Import Substitution Industrialization*), l'ouverture commerciale du Brésil, qui accompagne le « Plan Real » mis en place en 1994 (Averbug, 2002), conduit à la diminution des barrières non-tarifaires et la réduction des tarifs douaniers. Les exportations et les importations brésiliennes ont donc évolué pendant la dernière décennie. Ces évolutions restent cependant relativement faibles par rapport au potentiel du commerce international de l'économie brésilienne, notamment en termes d'exportation (Canuto et al., 2013). Ainsi, cette thèse contribue à la littérature sur le commerce international en proposant des explications pour ces faibles performances des firmes brésiliennes, basées sur les problèmes de financement.

Enfin, le débat sur le lien entre finance et commerce international a été alimenté par les

effets de la crise financière de 2008. Des travaux ont mis l'accent sur le canal financier de transmission de la crise financière (Asmundson et al., 2011 ; Chor et Manova, 2012). Le financement bancaire pour le commerce a chuté durant la crise, affectant ainsi les activités du commerce international. Cela s'est aussi traduit par une hausse du coût de la finance externe (Shelburne, 2010). Malgré l'historique des crises dans les pays émergents (Crise asiatique en 1997, crise brésilienne en 1999), la récente crise de 2008 a émergé dans les pays avancés. Ces pays, généralement caractérisés par des marchés financiers développés, ont été le plus touchés par la crise. Même si le développement financier est supposé réduire les asymétries d'information et les risques de crises, il semble que l'ouverture des pays développés au marché financier international est derrière la propagation rapide de la crise. Ce fait rejoint une littérature qui associe le développement financier aux risques de formation de crises financières (Kaminsky et Reinhart, 1999 ; Rajan, 2005). Cela amène à se poser des questions sur le seuil à partir duquel le développement des marchés financiers devient porteur de risques et de vulnérabilité, ce qui affecte l'offre de crédits et par la suite l'activité du commerce. Alors que l'effet du développement financier sur le commerce dans les temps tranquilles a été étudié, peu d'attention a été accordée au rôle du développement financier dans le canal financier de transmission de la récente crise. Cette question s'apparente, en effet, au débat sur les bienfaits et les risques liés à la globalisation (Schmukler et al., 2003 ; OCDE, 2012).

En considérant ces éléments, un *troisième objectif* de la thèse consiste à vérifier le rôle du développement financier dans l'explication du commerce, avec un zoom sur la récente crise de 2008. Si le développement financier du pays exportateur est considéré comme un avantage comparatif dans les secteurs dépendants de la finance externe, cette thèse contribue à la littérature sur le commerce international en vérifiant la persistance de cet avantage en période de crise. Il s'agit donc précisément de vérifier le rôle du développement financier dans le *canal financier* de transmission de la récente crise.

Nous portons une attention particulière aux échanges avec les BRICS. En effet, ces pays ont connu une croissance de leurs échanges commerciaux pendant la dernière décennie et même après la crise. Compte tenu de l'intégration continue des pays du BRICS dans le système productif international, la part des secteurs intensifs en recherche et développement (R&D) dans leurs échanges commerciaux augmente, notamment pour la Chine. Ce fait est d'importance par rapport à l'objet de cette thèse puisque les secteurs intensifs en R&D sont généralement plus dépendants de la finance externe, et donc plus sensibles au niveau de développement financier du pays exportateur. Bien qu'il existe un débat sur l'ampleur des effets de la crise sur les pays émergents, il semble que ces pays ont plutôt bien récupéré après la crise, en comparaison avec les économies avancées (Didier et al., 2011), ce qui ne préjuge pas de la portée du ralentissement qu'on observe aujourd'hui, l'Inde faisant pour l'instant exception. L'évolution du commerce avec les BRICS après la crise a même dépassé les niveaux de l'avant-crise, notamment en ce qui concerne les exportations des pays de l'Union Européenne UE- 28 ou celles des Etats Unis.

Une autre idée derrière le choix des pays du BRICS est liée aux financements. Malouche (2009) montre que la chute de la *Trade Finance* a affecté non seulement les exportateurs mais aussi les importateurs. Cette contraction des financements pour le commerce peut être d'autant plus sévère pour les pays des BRICS, vu leur installation des contrôles de capitaux après la crise afin de limiter ses effets comme l'a suggéré le Fonds Monétaire International (FMI). Malgré le fait que cette thèse s'intéresse au développement financier dans les pays exportateurs, les contraintes du point de vue des importateurs (pays du BRICS) seront aussi prises en considération.

## 5 Structure de la Thèse

Cette thèse s'inscrit dans la littérature empirique traitant du rôle que joue la finance, et plus particulièrement les contraintes de financement, dans les performances commerciales. Il s'agit d'apporter des éléments pour confirmer les effets positifs de l'accès au financement externe sur les performances d'exportation, à deux niveaux. Dans un premier temps, nous nous intéressons à l'étude des déterminants des exportations des *firmes* brésiliennes vers le reste du monde. L'accent est donc mis sur les caractéristiques de la  *firme* ainsi que sur les caractéristiques de son *secteur d'activité*. Relativement à ce point, une première partie sera dédiée à l'étude des contraintes de financement externe des secteurs brésiliens. Dans un deuxième temps, nous considérons l'importance de l'hétérogénéité entre les pays en termes de développement financier dans l'explication des exportations dans des secteurs ayant des niveaux différents de vulnérabilité financière. L'accent est donc mis sur les exportations *sectorielles* vers les différents pays du BRICS. Dans ce cadre, un intérêt particulier sera accordé aux effets de la crise financière de 2008. Cette thèse comporte trois principaux chapitres.

### Chapitre 1

Ce premier chapitre a pour but de fournir une image des besoins de financements externes des secteurs manufacturiers brésiliens dans la récente période des années 2000. Pour ce faire, ce chapitre propose tout d'abord une discussion sur la pertinence des indicateurs de dépendance à la finance externe proposés par le travail pionnier de Rajan et Zingales (1998). Motivés par la qualité du système financier américain, ces indicateurs, calculés en utilisant des données de firmes américaines sur la période des années 80, sont supposés refléter les différences intersectorielles en termes de besoins de la finance externe, basés sur des différences de technologie. Ces différences sont aussi supposées persister entre les pays et dans le temps.

Afin de vérifier la stabilité de ces différences entre les pays et dans le temps, des tests de robustesse basés principalement sur des analyses de corrélation ont été mis en œuvre. Les résultats confirment la stabilité des différences entre les secteurs américains dans le temps. Une discussion sur la stabilité des différences intersectorielles entre les pays suggère plus de précaution, vu les différences technologiques qui pourraient exister entre les pays pour un

même secteur.

Une deuxième partie de ce chapitre propose, en suivant la méthodologie de RZ, des indicateurs de dépendance à la finance externe pour les industries manufacturières brésiliennes sur la période 2000-2012. Pour ce faire, nous utilisons des données financières sur l'ensemble des firmes brésiliennes dans le secteur manufacturier, cotées sur la BOVESPA (Bourse de São Paulo) sur la période 2000-2012. Nous proposons aussi une autre mesure liée à la vulnérabilité financière et initialement proposée par Braun (2003) : la tangibilité des actifs.

Contrairement à la prédiction de la littérature, une analyse de corrélation entre les mesures brésiliennes montre une liaison positive entre la dépendance à la finance externe et le degré de tangibilité des actifs ce qui suggère que ce sont les industries qui accèdent plus facilement à la finance externe, qui en dépendent le plus. Ce résultat peut traduire les problèmes de disponibilité du crédit. Des tests de robustesse montrent que les indicateurs sont relativement stables dans le temps et robustes aux différentes constructions possibles.

Une analyse des corrélations entre les indicateurs brésiliens de dépendance à la finance externe et les indicateurs de RZ montre une certaine tendance positive entre les deux indicateurs, suggérant que les mesures de besoins de financements externes des industries brésiliennes captent certainement les différences technologiques intersectorielles. Ces indicateurs captent cependant plus d'information, notamment le degré de développement financier au Brésil, et les effets des crédits alloués par la BNDES aux différents secteurs et firmes. Autrement dit, les indicateurs brésiliens des besoins sectoriels de financements externes reflètent non seulement les caractéristiques intrinsèques des secteurs, mais aussi les effets de la qualité du système financier et de l'intervention du gouvernement sur l'allocation du capital entre les différents secteurs brésiliens.

Ce premier chapitre contribue ainsi à la littérature sur les mesures des contraintes financières et sur la relation entre le développement financier et l'allocation des ressources. Il suggère que même si les indicateurs américains de RZ restent valables dans le cas de pays intégrés au système productif international, l'utilisation des mesures spécifiques aux industries brésiliennes s'avère plus pertinente, en donnant de l'information supplémentaire sur les conditions de financement externe au Brésil.

## Chapitre 2

Ce chapitre s'inscrit dans la littérature sur les effets des contraintes financières sur le commerce international. Il propose une étude empirique au niveau microéconomique. Plus précisément, ce travail analyse les déterminants des exportations des firmes brésiliennes opérant dans le secteur manufacturier en 2010. En se basant sur les innovations théoriques de Manova (2013), il s'agit particulièrement de *revisiter* le lien entre la taille d'une firme et ses performances d'exportation, et de voir si l'avantage lié à la taille persiste lors de la prise en compte des contraintes de financement au niveau sectoriel.

Pour ce faire, nous construisons une base de données originale comprenant des informations

sur un échantillon exhaustif de firmes exportatrices brésiliennes opérant dans des industries manufacturières, en 2010. La construction de cette base a nécessité la collecte de données sur le commerce à partir du SECEX (secrétariat du commerce international brésilien), des données sur la taille à partir de l'enquête sur le travail formel au Brésil (RAIS) et la base ORBIS, générée par le Bureau Van Dijk pour le compte de l'OCDE. Cette base a été complétée par une collecte manuelle de données sur l'appartenance sectorielle des firmes à partir des nomenclatures du ministère des finances brésilien. Les données sur la valeur d'exportation étant des fourchettes d'exportation, la méthode économétrique utilisée est la régression par intervalle. A ma connaissance, cette méthode d'estimation n'a jamais été mobilisée dans la littérature récente sur le commerce international. Cette méthode peut donc s'avérer être une contribution technique à la littérature. Afin de capter les différences intersectorielles en termes de besoins de financement externe, nous utilisons les indicateurs brésiliens de vulnérabilité financière calculés dans le premier chapitre, ainsi que les indicateurs de RZ pour vérifier les effets de différences technologiques intersectorielles.

Les résultats confirment tout d'abord l'effet positif de la taille de la firme sur ses performances d'exportation. L'avantage de la taille est cependant réduit quand on considère les besoins de financement externe au niveau sectoriel. Les grandes firmes semblent perdre une partie de leurs avantages quand elles opèrent dans des secteurs dépendants de la finance externe et dans ceux qui présentent une part importante d'actifs tangibles. Comme précisé au premier chapitre, cela peut être justifié par la situation du système financier brésilien. Le coût de capital élevé et la faible qualité du développement financier freinent les grandes firmes lorsqu'elles opèrent dans des secteurs qui ont le plus besoin des financements externes. Ces résultats restent globalement robustes aux ajouts de variables de contrôle notamment le salaire par tête, la nature juridique de la firme ou l'appartenance régionale de la firme. D'autres résultats montrent que l'avantage de la taille baisse surtout lorsqu'on considère les premiers (primo) établissements au Brésil, des entreprises domestiques ou étrangères. De plus, l'avantage de la taille baisse davantage dans la région développée du Sud-est brésilien, en comparaison avec le reste des régions brésiliennes. Enfin, une exploration des effets de crédits BNDES alloués aux différents secteurs montre que ces crédits permettent aux entreprises d'avoir une meilleure performance à l'exportation. Ce résultat plaide pour une certaine efficacité à ces soutiens financiers, qui apparaissent néanmoins aussi comme distorsifs dans l'allocation du capital entre les secteurs.

Dans une deuxième partie, nous nous focalisons sur la dépendance sectorielle à la finance externe basée sur les différences technologiques, telles que définies par RZ. Ce test permet aussi de pallier le possible problème d'endogénéité des indicateurs brésiliens de la dépendance à la finance externe. D'autres mesures sectorielles de vulnérabilité financière proposées dans la littérature ont été mobilisées. Les résultats sont similaires aux premiers résultats, suggérant ainsi que l'avantage de la taille des firmes brésiliennes en termes de performances d'exportation baisse dès lors qu'est pris en considération l'hétérogénéité des secteurs en termes dépendance



et d'accès à la finance externe. Ces résultats confirment les contraintes de financement rencontrées par les firmes brésiliennes et suggèrent, par conséquent, que les faibles performances brésiliennes en termes d'exportation peuvent être en partie expliquées par les problèmes de financement domestique.

### Chapitre 3

Ce chapitre présente une étude empirique sur les effets des conditions financières sur les exportations au niveau sectoriel. Il s'agit particulièrement de vérifier les prédictions de Manova (2013) sur les déterminants financiers des exportations, en considérant les échanges commerciaux avec les BRICS. Plus précisément, le but est de voir que si le niveau du développement financier permet bien de réduire le coût du capital et s'il présente ainsi une source d'*avantage comparatif* pour les secteurs les plus dépendants de la finance externe. Ce chapitre met l'accent sur les effets de la crise financière de 2008 en considérant la relation qui peut exister entre le financement du commerce (*Trade Finance*), le développement financier et le commerce international.

Pour ce faire, nous nous positionnons du côté du reste du monde et nous considérons les exportations vers les BRICS d'un ensemble d'économies avec des niveaux de développement économique et financier différents. En d'autres termes, l'étude porte sur l'importance des contraintes de crédit au niveau des pays exportateurs comme déterminants de leurs exportations vers les cinq pays du BRICS (Brésil, Russie, Inde, Chine, Afrique du Sud) dans les secteurs manufacturiers. Cela nous permettra donc de voir si les prédictions de Manova (2013) sont valables quand on focalise l'intérêt sur ces pays émergents. L'étude porte sur la période 1997-2012, où les BRICS ont connu une croissance de leurs échanges internationaux et acquis une place importante dans le système productif mondial. De plus, ces pays ont relativement bien récupéré après la crise de 2008, ce qui fait d'eux une cible intéressante lors de l'étude des effets de la crise.

Pour mener cette étude, nous faisons appel à la base de données UN Comtrade - *United Nations Commodity Trade Statistics Database* - qui fournit les valeurs d'exportation au niveau sectoriel. L'intérêt d'utiliser cette base de données est de pouvoir exploiter les données sectorielles, selon la classification internationale ISIC. Cette caractéristique est particulièrement intéressante car nous utilisons les indicateurs de vulnérabilité financière issus de la littérature et qui sont fournis selon la Révision 2 de l'ISIC. Relativement à ce point, nous rappelons que malgré les critiques portées sur la pertinence des indicateurs de RZ dans la description des besoins en termes de finance externe des secteurs dans d'autres pays, ces indicateurs peuvent être considérés comme *benchmarks* surtout dans notre cas précis pour lequel la base de données comporte 154 pays exportateurs. D'autres mesures de la vulnérabilité financière proposées dans la littérature ont été utilisées. Cette étude est réalisée sur données de Panel et se base sur un modèle à effets-aléatoires<sup>5</sup>.

<sup>5</sup>Où nous introduisons un ensemble exhaustif d'effets fixes.

Les résultats de cette étude fournissent une confirmation empirique des prédictions de Manova (2013). Les exportations vers les pays du BRICS sont positivement affectées par le niveau de développement financier dans le pays exportateur, dans les secteurs financièrement vulnérables. Cependant, l'avantage lié au développement financier baisse pendant la crise de 2008. Ce résultat est en phase avec le canal financier de transmission de la crise. Certes, le développement financier permet une réduction du coût de capital et un meilleur accès à la finance externe. Il permet aux secteurs qui dépendent de la finance de trouver les financements nécessaires. Mais en période de crise, la contraction des crédits au niveau mondial semble davantage affecter les secteurs qui dépendent de la finance externe dans les pays avec des marchés financiers développés. Ce résultat conduit à penser qu'en facilitant l'accès au financement, le développement financier rend beaucoup plus dépendants des marchés financiers, les secteurs avec de forts besoins de finance externe. Cela peut avoir des conséquences négatives en période de crise.

Ces résultats sont globalement robustes à l'introduction des variables décrivant la qualité des institutions des pays exportateurs. D'autres résultats permettent de montrer que les effets des contraintes financières dépendent du niveau de développement économique du pays exportateur.

La particularité des effets de la crise financière sur le commerce international a aussi été testée dans une deuxième partie du chapitre, en exploitant une base de données récente sur les crises financières proposée par Laeven et Valencia (2012). Les résultats montrent que les effets des crises financières précédentes sur le rôle du développement financier sont similaires à ceux de la récente crise. Ce résultat pousse à relativiser l'effet du canal financier dans l'explication de l'ampleur de la baisse des échanges internationaux, suite à la crise de 2008.

Pour conclure, ce chapitre contribue à la littérature sur l'effet du développement financier sur le commerce international et à la littérature naissante sur les effets de la récente crise de 2008. Ce chapitre focalise l'attention surtout sur le canal financier de transmission de la crise au commerce international. Ce travail fournit aussi un éclairage sur les effets de la crise sur les pays émergents. L'intégration des pays du BRICS dans le système de production mondial a facilité la transmission de la crise vers ces pays, malgré leurs croissances et leurs performances durant la dernière décennie avant la crise. Il serait aussi intéressant d'explorer, dans des recherches futures, l'effet du choc de demande lié à la crise sur la baisse des importations de ces pays pendant la crise.

## Chapter 1

# Measuring Financial Constraints of Brazilian Manufacturing Industries: Rajan and Zingales Index Revisited

### Résumé

Ce chapitre s'intéresse à l'étude des besoins de financement externe des industries manufacturières brésiliennes pendant la récente période des années 2000. Rajan et Zingales (1998) furent les premiers à proposer des indicateurs de dépendance à la finance externe au niveau sectoriel, calculés à partir de données américaines sur la période des années 80. L'utilisation de ces indicateurs dans la littérature a été motivée par l'hypothèse de persistance des différences intersectorielles en termes de caractéristiques technologiques, *dans le temps* et *entre les pays*. Ce chapitre présente tout d'abord une discussion sur la pertinence de cette hypothèse de RZ (1998). La discussion confirme une certaine persistance des différences technologiques dans le temps et une certaine stabilité des caractéristiques sectorielles à travers les différents pays. L'analyse souligne par ailleurs qu'il est important de prendre en considération l'évolution non-monotone du niveau de développement financier des Etats-Unis dans le temps, et les différences technologiques entre les pays lors de l'étude des besoins de financement externe au niveau sectoriel. Ces résultats permettent de légitimer l'intérêt d'étudier les besoins de financements des secteurs brésiliens en utilisant des données spécifiques au Brésil et portant sur la période des années 2000. En se basant sur des données de firmes cotées à la BM&F Bovespa sur la période 2000-2012, ce chapitre montre que les secteurs dépendants de la finance externe ont tendance à présenter aussi une part importante d'actifs tangibles (Braun, 2003). Ce résultat suggère que des problèmes au niveau de l'*offre* de crédit existent au Brésil. Seuls les secteurs ayant une large part d'actifs tangibles peuvent accéder aux financements externes, et en être dépendants. Des analyses de corrélation permettent aussi de confirmer que les besoins de financement des secteurs brésiliens reflètent en quelque sorte leurs caractéristiques technologiques, approximées par les indicateurs de RZ (1998). Les différences entre les be-

soins des secteurs brésiliens et ceux donnés par leurs caractéristiques technologiques reflètent les distorsions sur le marché financier brésilien. Ce chapitre confirme particulièrement les effets du niveau de développement financier et ceux des crédits publics offerts par la banque brésilienne publique de développement BNDES, sur l'allocation intersectorielle du capital au Brésil.

**JEL Classification:** G21; H00; O16; O38; O54

**Keywords:** Financial Development, Sector-level External Finance Dependence, Resource Allocation, Brazil

## 1.1 Introduction

Financial development plays a crucial role in fostering economic growth. Beginning with Schumpeter (1911), a large body of literature has been interested in the study of the importance of the financial system's quality and the access to credit in boosting the development of economies. In this context, financial constraints are classified among the most important obstacles to the development and the competitiveness of the Brazilian economy. Of course, the Brazilian economy has witnessed a number of structural reforms over the last decades including the industrialization process, the trade liberalization and the financial sector strengthening. It seems however that the underdevelopment of the Brazilian financial system continues to present an obstacle to the productivity growth of the economy (Rodrick, 2004), notably in manufacturing industries. Moreover, the cost of capital<sup>1</sup> in Brazil remains high which negatively affects firms' investments. These effects would be sharper in sectors that highly depend on external finance, i.e. those that rely on funds provided by the financial and banking system. This idea has been first suggested by the pioneering work of Rajan and Zingales (1998, RZ hereafter).

In order to consider sector heterogeneity in terms of financial needs, RZ propose a sector-level index of dependence on external finance, based on data from the United States (US). Intersectoral differences in terms of external finance requirements are assumed to be driven by *technological* differences between manufacturing sectors. Even if RZ indexes are computed using US data over the 1980s, these intersectoral technological differences are assumed to persist *across countries* and *in time*. This is motivated by the fact that the US exhibits a well-developed financial system, which leads to an optimal allocation of capital across sectors. In relation to this idea, the Kumar et al (2004) stress the importance of deepening the financial market in improving resource allocation, and encouraging the optimization of scale, time frame and technology. Equivalently, US indexes are considered as *benchmarks* for sector-level needs of external capital. They are meant to reflect the *inherent needs* for external financing (Fisman and Love, 2004). Taking into account this idea, deviations from US levels can provide information on a misallocation of resources. That being said, in an evolutive world, a number of economic and technological factors would make intersectoral differences in terms of dependence on external finance, change in time and differ across countries. Moreover, a number of researchers are being adapting RZ indicators to the individuals of interest in their studies (Bricongne et al, 2010). These elements would put into perspective the pertinence of US indicators as benchmarks.

In the light of these elements, the primary aim of this paper is to analyze sector-level financing constraints in Brazil. Precisely, this chapter aims to assess *specific external finance* requirements of Brazilian manufacturing industries in the 2000s, based on RZ innovation. If we consider RZ indexes as benchmarks for sector-level outside capital needs, differences between Brazilian and US indicators would then give insight on the capital misallocation in

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<sup>1</sup>High interest rates.

the Brazilian market. In order to well discuss this point, this study proceeds as follows. It first contributes to the literature on the "financial development-growth nexus" by discussing the pertinence of RZ indexes. While a number of different measures have been proposed in the literature to proxy financing constraints (Kaplan and Zinagles, 1997; Hadlock and Pierce, 2010), RZ indexes are the most utilized in the literature studying the effects of financial development on real outcomes, notably trade performances (Manova et al, 2011; Manova, 2013). Particularly, I examine the persistence of intersectoral technological differences in time and across countries, based on arguments from the literature. This paper focuses then on the Brazilian case and provides Brazilian indicators of financial vulnerability<sup>2</sup> for manufacturing industries: indexes of external finance dependence (RZ, 1998) and of asset tangibility (Braun, 2003). The discussion of the differences between Brazilian and US indicators contributes to the literature on the link between financial development and intersectoral resource misallocation. To my knowledge, there are no works that analyze capital resource misallocation in Brazil, from a sector-level point of view.

Following RZ methodology, Brazilian indicators are calculated using data on Brazilian publicly-traded firms in BM&F Bovespa (São Paulo Stock Exchange) over 2000-2012. Data are provided by Thomson Reuters- Datastream database. Pearson and Spearman correlation tests are the main tools used in this paper to evaluate the similarities and differences between Brazilian indexes, and US indexes proposed in the literature.

A number of findings can be proposed by this study. First, the technological differences between manufacturing sectors seem to persist in time, for the US. Even if the literature proposes that countries with different levels of economic development would present different characteristics at sector-level (Fisman and Love, 2004), this present study suggests, through a review of arguments from the literature, that technological differences between sectors persist across countries. This idea is particularly motivated by the globalization phenomenon and the expansion of foreign investments which permit technological transfers between countries, susceptible to make different economies converge in terms of technological characteristics. Second, the correlation analysis suggests that Brazilian indicators are positively correlated with the US ones. This result supports the persistence of technological differences across countries. Despite this correlation, differences between both indicators exist, suggesting a misallocation of resources in the Brazilian market. Two potential sources of distortions are discussed: the level of Brazilian financial development and the role of the state-owned development bank (*Banco Nacional de Desenvolvimento Econômico e Social*, BNDES hereafter). The findings suggest that the underdevelopment of the financial system causes a misallocation of capital resource in the Brazilian market. In addition, it seems that BNDES public loans do not necessarily target financially vulnerable sectors, which results in a deviation of manufacturing sectors' financial needs from US benchmark levels. Bottom line, RZ indicators can be good predictors of financial needs inherent to sectors' technological characteristics. However,

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<sup>2</sup>I use interchangeably the terms "financial vulnerability" and "financing constraints" to describe the dependence on external funds, i.e. funds that are not provided by the internal cash flows of firms.

Brazilian specific indicators provide more precise information about financing problems of Brazilian manufacturing sectors.

The remainder of the paper is structured as follows. Section 2 presents an overview of the Brazilian context, notably the characteristics of the financial system. Section 3 presents a review of literature on the role of financial development and financing constraints on growth, and on resource misallocation. Section 4 discusses the pertinence of RZ indexes of external finance dependence as benchmarks. In this section, I examine the relevance of the assumption of the persistence of intersectoral technological differences in time and across countries. In Section 5, I present the Brazilian indicators of financial vulnerability. This section includes the description of RZ methodology and data, as well as the discussion of Brazilian *specific* sector-level needs of outside capital. This section also provides some robustness checks, to evaluate the quality of Brazilian indicators. Section 6 compares Brazilian indicators to US indexes and discusses the potential distortions in the Brazilian financial market. The last section concludes.

## 1.2 Brazilian context: In a nutshell

The industrialization process of Brazil has begun in the beginning of the past century and was particularly stimulated by the *import substitution strategy*. Industrial investments, which substitute imports, resulted in a need of financing. As a response to this need, the Brazilian government founded the Brazilian Development Bank BNDES in 1952. The role of this bank was crucial in the industrialization process. This bank first financed infrastructure projects. Later on, it expanded its financial support to capital goods and transformation industries, later. These government economic and financial policies have led the Brazilian economy to exhibit a well-organized industrial system, but protected<sup>3</sup> and poor in terms of technological development (Suzigan et al, 2007). A number of reforms were then required to boost the economy. First, a trade reform began in the late 1980s. Foreign trade liberalization includes the reduction of tariffs and was carried out in order to raise a shock of productivity and competitiveness in the domestic market. The 1990s were also characterized by a wave of privatizations, and by an increasing attraction of foreign investments, as well (Baumann, 2001). These reforms have been reshaping the industrial structure in Brazil, with a catching-up in terms of technological development. In this context, Nassif et al (2013) suggest that during 1970-2010, there has been a reallocation of resources from traditional industries based on natural resources and labor to sectors with high technological requirements. The manufacturing sector has been moving to more capital-intensive industries, although natural resource-based industries roughly maintained their participation. This question is of a particular relevance with regards to the aim of the present paper. On one hand, the reallocation of resources induced by Brazilian economic reforms could affect the characteristics of manufacturing in-

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<sup>3</sup>In terms of trade openness.

dustries notably in terms of financial needs. On the other hand, the trade liberalization together with the foreign capital inflows could have affected the technological characteristics of Brazilian industries, which then affects their needs in terms of financing. In fact, transfers of technology could be generated as a result of both reforms. While the Brazilian reforms in the 1990s were especially focusing on economic aspects, the 2000s were rather marked by reforms of the financial sector. These reforms include programs for private banks (PROER) aiming to enhance the solvency of these banks, and programs for state-owned banks (PROES) that focused on privatizing or closing banks in difficulty (McQuerry, 2011). Reforms also included the liberalization of foreign banks entry and the improvement of legislation regarding bankruptcy procedures (Ter-Minassian, 2012).

Despite the role of these reforms in deepening financial intermediation, Brazil continues to face challenges. The Brazilian financial system is still based on banks and on short-term financing. Long-term financing is still dependent on the role of BNDES. Given these elements, Brazil is still facing financing constraints (Rodrick, 2004). The *underdevelopment* of the Brazilian system (Pinheiro and Bonelli, 2011) can be illustrated by the high levels of lending interest rates as presented Table 1.1, compared with developed and other emerging countries. Particularly, Brazil lags behind China in terms of financial development.

This issue is of particular importance for the present study, since the relatively low-quality of financial institutions results in a misallocation of the resource of capital, which would affect the intersectoral differences in terms of needs of external finance and access to credit. Note however that despite these weaknesses, reforms over the last two decades have permitted to Brazil to stabilize its inflation level. Moreover, it is clear through Table 1.1 that Brazil, among other BRIC (Brazil, Russian Federation, India and China) countries, succeeds to ensure high growth rates, even if the situation turns less favorable from 2013. This may be related to the recent financial crisis effects. In fact, even if signs of recovery for emerging countries did appear, soon after the crisis, compared with developed countries (Banerjee and Vashisht, 2010), the literature is still debating the extent to which emerging countries were resilient to the crisis (Didier et al, 2011). Note that, with regards to the aim of this paper, the recent financial crisis could be considered as a source of distortion, that may have affected the allocation of capital between countries, sectors and firms due to the generalized credit shortage.



Table 1.1: Evolution of Economic and Financial indicators in BRIC and Advanced Countries

This table presents the evolution of a number of economic and financial indicators between the 1990s and the recent period, in BRIC countries and a number of advanced countries. Source: World Development Indicators, 2015.

	Brazil			China			India			Russian Fed.			Japan			US	
	1995	2010	1995	2010	1995	2010	1995	2010	1995	2010	1995	2010	1995	2010	1995	2010	
GDP (constant 2005 billion US\$)	696,51	1108,46	942,31	3867,42	448,72	1243,68	523,70	909,27	4132,18	4648,47	9359,51	13599,26					
GDP per capita (constant 2005 US\$)	4279,49	5580,97	782,09	2891,08	466,99	1010,31	3529,54	6365,20	32941,76	36296,32	35149,39	43961,17					
GDP growth (annual %)	4,4167	7,5721	10,9938	10,632	7,5745	10,26	-4,1435	4,50373	1,94234	4,65203	2,71901	2,53192					
FDI, net inflows (current billion US\$)	4,859	53,345	35,8492	272,99	2,1436	27,397	2,065	43,1678	0,03933	7,44098	57,8	259,344					
Manufacturing, VA (% of GDP)	18,62	14,96	33,47	31,87	17,30	14,80	-	14,82	22,20	19,70	-	12,55					
Inflation, GDP deflator (annual %)	93,52	8,57	13,65	6,94	9,06	8,98	144,00	14,19	-0,73	-2,16	2,09	1,22					
Lending interest rate (%)	-	39,99	12,06	5,81	15,46	8,33	320,31	10,82	3,51	1,60	8,83	3,25					
Financial Development Ranking	-	32,00	-	22,00	-	37,00	-	40,00	-	9,00	-	1,00					

### 1.3 Literature Review

As stated by Modigliani and Miller (1958), in a perfect financial market -where there is no frictions- the capital structure of a firm is irrelevant. In other words, financing investments with internal liquidity or funds from the banking system does not matter. In the real world, however, financial markets present a number of imperfections that make the cost of debt different from the cost of equity. These market imperfections can arise from the information asymmetries (Myers and Majluf's (1984) *pecking order theory*) as explained by Tirole (2006), the importance of taxes in the financial transactions (*trade-off theory*), as well as the *agency costs*. In this context, the wedge between the cost of external finance and the cost of internal funds defines the extent to which a firm is financially constrained (Kaplan and Zingales, 1997). Considering this idea, the development of financial markets is therefore expected to reduce the cost of external capital and then to relax firms' credit constraints.

Beginning with the seminal work of Schumpeter (1911), numerous studies have pointed out the relationship between the level of financial development in a country and its growth. King and Levine (1993), for example, suggest that financial development enhances the economic growth by improving productivities. Levine (2005) also demonstrates, through a large review of literature, that financial deepening plays a role in the development of economies. The positive effects of finance on economic growth channel through a number of mechanisms that, mostly, emerge at firm-level. Beck et al (2000) suggest that financial intermediaries produce information and allow firms to better allocate their capital. Similarly, Aghion et al (2010) stress the importance of financial systems in reducing firms' liquidity constraints, and consequently in enhancing corporate investments, which, *in fine*, positively affects the economic growth. While these works highlight the role of financial development in explaining growth, this relation has been subject to an endogeneity issue. As familiar with panel data, the reverse causality can be tested using instruments (Levine, 2005). In an influential paper, Rajan and Zingales (1998, henceforth RZ) attempt to answer this question by proposing an alternative approach. The authors analyze the channel through which the development of financial systems leads to economic growth. Specifically, they stress the importance of financial development in reducing the cost of external capital, especially in industries with high dependence on funds provided by the financial system, considered as *financially vulnerable* sectors. In order to assess the sector-level reliance on outside capital, RZ propose an index defined as the part of capital expenditures that are not financed by internal funds, namely operating cash-flows. Using firm-level data on US traded firms in the 1980s, the authors define this sector-level index by the firm-level *median* value of the index in the industry. This micro-founded index implicitly refers to the investment-cash-flow sensitivity, a variable that has long been considered as a measure for financial constraints at firm-level (Hubbard, 1998; Fazzari et al, 1998).

RZ's index assumes the existence of a *technological component* that makes industries rely differently on external funds. The technological component includes the scale of the initial

project, the gestation period, the factor intensity, etc. This technological component is linked to the needs of liquidity. Sectors with high technological intensity incur higher R&D expenses and thus, their needs for capital will be higher. In this way, the chemical industry which is a capital intensive one, has higher liquidity needs than clothing (labor intensive sector) and, than agriculture which is land intensive sector (Helpman, 2013). This idea reminds of the notion of *comparative advantage* of Heckscher-Ohlin neoclassical theory of trade (Von Furstenberg and Von Kalckreuth, 2006). Regarding this idea, it is noteworthy to mention that a growing number of works are making use of RZ's index as a measure of sector-level financial vulnerability, when analyzing the role of financial development in explaining international trade performances (Manova et al, 2011; Manova, 2013). Note that RZ assume that the technological component causing the sector heterogeneity in terms of dependence on external finance is stable *in time* and *across countries*. Based on this assumption, RZ's index has been used as a proxy for sector financial dependence in a number of countries such as India, in Ouro (2008) and China, in Manova et al (2011). This present work contributes to the literature by attempting to discuss the persistence of intersectoral technological differences across countries and over time. Finally, in line with RZ approach, Braun (2003) proposes an alternative measure that would describe the sector-level financial constraints. The author considers the part of tangible assets in total assets as a measure of credit constraints relaxation. The rationale behind this idea is that tangible assets can be presented to the financial system as collaterals when demanding a loan. Therefore, Braun's (2003) measure is supposed to be inversely correlated to financial vulnerability and RZ's index, as well.

As said before, the idea behind RZ's index is that financial development reduces the cost of capital and ensures a better allocation of capital between sectors. Based on the high quality of US financial system, RZ consider the US financial market as the *least distorted* and assume that their US-based index reflects sector-level *inherent* external finance needs. In fact, in presence of imperfect financial markets, industry financial characteristics are not independent of the quality of financial institutions. Ciccone and Papaioannou (2009) show for instance, through a cross-country analysis, that financial development has a positive effect on the intersectoral investment responsiveness. Specifically, the authors propose that financially developed countries better transfer capital to "growth" sectors. This result is in favor of a differentiated cross-sectoral need for finance across countries. In the same context, Fisman and Love (2004) find that countries with high levels of financial development have correlated growth rates across sectors, and that this correlation is stronger between country pairs with similar levels of economic development. This result suggests that differences in the financial needs and in the growth patterns may differ across countries, for one same sector. These results make it interesting to use Brazilian specific data when studying the financial vulnerability of Brazilian sectors.

Considering US sector financial characteristics as *benchmarks*, these differences could then reflect a problem in the allocation of resources. This question is even more interesting for

developing countries, which present different financial and economic characteristics, compared to advanced economies, particularly the US. Taking into account the gap between developing and developed countries, a number of studies seek evidence about the importance of resource misallocation in explaining the gap in terms of growth, namely the aggregate total factor productivity (TFP) growth. In this context, Hsiyeh and Klenow (2009) focus on the firm-level misallocation of resources. They consider a monopolistic framework with heterogeneous firms, in which the change in the marginal output of inputs across firms within sectors would measure the resource misallocation and its impact on aggregate TFP. Based on the quality of resource allocation in the US, the authors suggest that if the efficiency in the manufacturing sector in India and China had the same level of that in the US, the TFP growth would increase by 30-50% and 40-60%, respectively. This result attests of the importance of resource misallocation in explaining growth patterns in less developed countries. Using Hsiyeh and Klenow's (2009) methodology, Busso et al (2012) seek evidence about the reasons behind the low levels of productivity growth in Latino-American economies<sup>4</sup>, based on firm-level data. The authors find that the productivity heterogeneity and the magnitude of distortions are higher in these countries, compared with the US. Increasing resource allocation efficiency would raise manufacturing TFP in these countries by 45-127% depending on the country and year considered. The authors also suggest a number of potential sources of misallocation in Latin America. They particularly shed the light on the importance of financial market imperfections, tax collection systems and poor labor market institutions. In the same line, Vasconcelos (2015) focuses on the Brazilian manufacturing sector and shows that moving to the US efficiency would lead to an increase in aggregate growth in the manufacturing sector by 110-130%. Further results on the sources of distortions show that the effect of economic crises on resource allocation is particularly important for small firms. However, only very little evidence is found regarding the role of the Brazilian high tax burden in the resource misallocation. Instead of using *firm-level* data, this present paper contributes to this literature on the misallocation of resources through the application of *sector-level* RZ methodology for Brazilian manufacturing industries.

## 1.4 RZ index: A discussion

RZ index of sector-level dependence on external finance has been initially proposed to circumvent the potential endogeneity problem in the link finance-growth. This measure has been then long used to account for sector-level financial constraints in studies for different developed and developing countries and over periods different from the 1980s. This index is based on an important assumption related to the existence of *technological* differences between sectors that make one sector more reliant on outside capital than another. Moreover, these

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<sup>4</sup>These countries include: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, El Salvador, Mexico, Uruguay and Venezuela.

intersectoral differences are assumed to persist *across countries* and *in time*. In this section, I attempt to go deeper into the analysis of this assumption and provide elements to take into consideration when using RZ indexes.

### 1.4.1 Stability of intersectoral technological differences in time

RZ indicators of external finance dependence are computed using data on US traded firms over the 1980s. These US indexes have been then considered as *benchmarks* for industries in other countries, as they are assumed to reflect an optimal allocation of capital between firms and sectors. This assumption is motivated by the high quality of financial institutions in the US, and by the fact that the indexes are calculated using data on publicly traded firms. In fact, RZ consider that since the US financial system is one of the most advanced in the world, the amount of external funds raised by firms will tend to equal their desired amounts, as if we are in presence of perfect financial systems. This idea is even more suitable for publicly traded firms, which are considered to be facing the least financial constraints, and to have better access to finance. Given this, the amounts of external finance these large publicly traded firms use are likely to be reflecting their *needs* of external finance.

RZ assume that these differences in terms of needs for external financing are attributed to *technological* differences between sectors, which do not vary in time. In this way, pharmaceutical products which by nature, depend more on external finance due to high research and development requirements, will always exhibit higher external finance requirements compared with textile products. Taking into account the continual technological advances, this *stability* assumption needs to be verified. To do that, I perform a Pairwise (Pearson) correlation test between the original RZ indexes computed over 1980s (ExtFinUS 80s) and updated measures computed using data on the 1990s (ExtFinUS 90s). These updated values of RZ index are proposed by Kroszner et al (2007). The authors calculate indexes of external finance dependence for the period 1980-1999, using RZ approach (Appendix 1.1).

Correlation coefficients are displayed in Table 1.2. A strong correlation<sup>5</sup> of 82% (significant at 1% level) is found between indicators computed over 1980-1999 and the original ones. Sector-level external finance needs in the 1980s are positively related to the needs in the period 1980-1999. This finding is in a favor of stable intersectoral technological differences in time. A Spearman correlation test is also performed. This type of correlation tests the correlation between sectors' *rankings* in terms of financial dependence in both periods. A strong correlation of 72% is also found<sup>6</sup>, which provides evidence of the stability of the intersectoral differences in terms of dependence on outside funds, in time. These results can be supported by Figure 1.1. This figure presents a positive trend, attesting of a stability of intersectoral

<sup>5</sup>In order to interpret the magnitude of the Pearson (pairwise) correlation, I follow the rules and guidelines provided by Cohen (1988): a coefficient ranging between 0.1 and 0.3 (in absolute value) denotes a small correlation, a coefficient ranging between 0.3 and 0.5 denotes a medium correlation, and finally, a coefficient that exceeds 0.5 denotes of a strong correlation.

<sup>6</sup>Spearman's correlation coefficients are in general less than Pearson's correlation ones (Stata Tutorials).

technological differences in time. In particular, Pharmaceutical products arrive at the top of the list in terms of needs of external finance in both distributions (of 1980s and of 1990s), and Tobacco products, present the least needs of external finance.

Note however that since no perfect correlation exists (See Figure 1.1), there are some factors that may alter the sector-level external finance needs, even for one single country, exhibiting a well-developed financial system. McGuckin and Stiroh (1998) stress for example the fact that manufacturing sectors in the US have been differently affected by the technological developments in the late 1980s, namely the computer's revolution. In line with this idea, Stiroh (2001) suggests that large US investments in the early 1990s have resulted in intersectoral reallocation effects. This could have led to a reallocation of capital in the US economy, which in turn affects cross-sector dependence on external finance. This idea is in line with the results of Jovanovic and Rousseau (2005). The authors compare the US reaction to two technology revolutions: Electrification and Information Technology (IT). The authors find that the adoption of IT was less broadly adopted and that its effects were less uniform across sectors. The effect of technological advances on the reallocation of resources was also stressed in Kogan et al (2012). The authors study the response of US stock market after each innovation from 1926 to 2010 and find that technological advances are accompanied by resource reallocation, both within and between sectors. All these elements from the literature make it interesting to account for the effect of time evolution when analyzing intersectoral technological and external finance dependence differences.

One should also be cautious when considering the US financial market as a reference. In fact, Rajan and Zingales (2003) argue that the evolution of the level of financial development has not been monotonic over the twentieth century. The authors find that the level of financial development of 1913 has been surpassed only starting from the 1980s. They add that European advanced economies were more financially developed than the US in the beginning of the century and that the US has only been surpassing them from the 1990s, notably in terms of market capitalization. This result brings some doubts about the pertinence of the assumption related to the stability of intersectoral financial needs *in time*, based on the the quality of US financial market.

Table 1.2: Correlations Between Different US Indicators of Financial Vulnerability

In this Table, I display the results of correlation tests between different measures of sector-level financial vulnerability, proposed in the literature. All these indicators are computed using US data, except ExtFinUS No-Cr. ExtFinUS 80s corresponds to the original RZ indexes calculated over the 1980s. ExtFinUS 90s is an update of these indicators over 1980-1999, proposed by Kroszner et al (2007). The authors also propose ExtFinUS No-Cr which corresponds to an index of external finance dependence computed over data from a number of countries that have not experienced a crisis in the last decades, including the US. RDUS is the median value of the part of Research and Development expenses in total sales, computed over 1980-1999. TangUS is the median value of the part of tangible assets in total assets. Two correlation tests are proposed: Pearson (value) correlation and Spearman (rank) correlation. Pearson correlation is also denoted Pairwise correlation. \* denotes significance at 0.01 level.

	ExtFinUS 80s		ExtFinUS 90s		ExtFinUS No-Cr		RDUS		TangUS	
	Pairwise	Spearman	Pairwise	Spearman	Pairwise	Spearman	Pairwise	Spearman	Pairwise	Spearman
ExtFinUS 80s	1.0000	1.0000								
ExtFinUS 90s	0.8204*	0.7285*	1.0000	1.0000						
ExtFinUS No-Cr	0.7933*	0.6095*	0.6704*	0.6812*	1.0000	1.0000				
RDUS	0.6492*	0.7197*	0.8294*	0.5479*	0.6159*	0.4125	1.0000	1.0000		
TangUS	-0.2734	-0.1942	-0.1158	-0.0063	-0.1483	-0.1177	-0.2920	-0.7701*	1.0000	1.0000

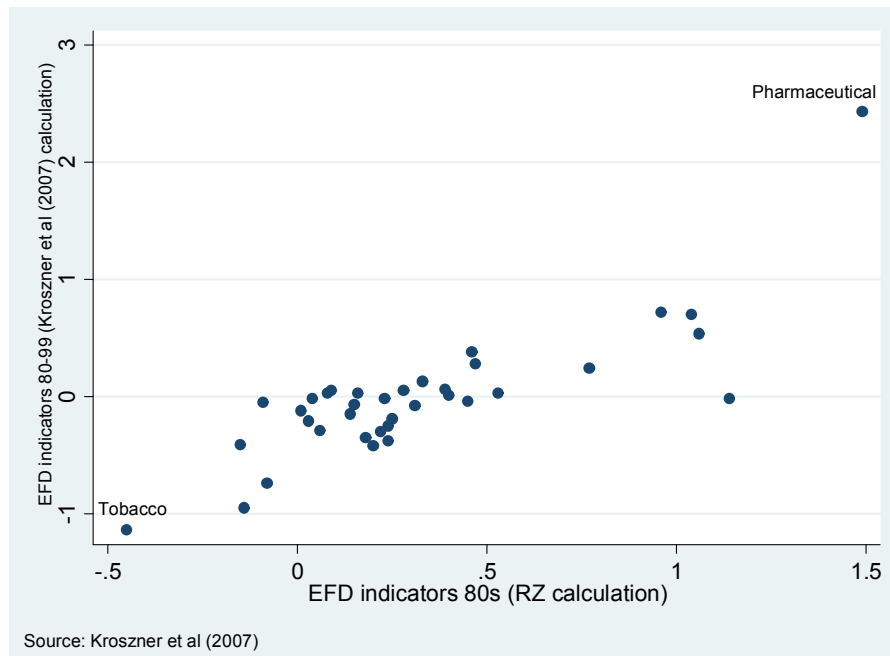


Figure 1.1: RZ indexes in 1980s and 1990s

Additional tests of correlation, between original RZ indexes and other measures of sector-level financial vulnerability proposed in the literature, are presented in Table 1.2. First, ExtFinUS No-Cr is a sector-level index of dependence on external finance, proposed by Kroszner et al (2007). Based on RZ methodology, the authors calculate a similar index using data from a number of countries that were not hit by a banking crisis during the period 1980-2000. An important correlation between original RZ indexes and Non-Crisis indexes is found (of 79%, significant at 1% level). This result suggests that intersectoral technological differences remain relatively stable *in time* when considering Non-crisis countries -and not only the US- as benchmarks. The following measure of financial vulnerability is R&D intensity (RDUS), proposed by Kroszner et al (2007). This measure is also computed using RZ methodology, and corresponds to median value of the ratio of R&D expenses over sales for the period 1980–1999. This measure is positively correlated with indexes of dependence on external funds. In fact, the higher the R&D expenses are, the higher the need for liquidity is. However, since the correlation between external finance dependence measures and R&D intensity measures are not close to 1, attributing intersectoral external finance dependence needs to technological differences may appear as a strong assumption. The correlation coefficients suggest that differences in external finance dependence between sectors are only partly driven by a technological component. This result puts into perspective the pertinence of RZ indicators as technological-based benchmarks. Finally, TangUS corresponds to asset tangibility measure. Initially proposed by Braun (2003), this measure is defined as the part of tangible assets in total assets, and calculated using RZ methodology. Kroszner et al (2007) compute this measure



over 1980-1999. Asset tangibility index is supposed to be inversely correlated to RZ indexes. Since hard assets can be proposed as collaterals when borrowing from the financial system, this measure is assumed to reflect easier access to credit. As predicted, Table 1.2 shows that there is a negative correlation between indexes of financial vulnerability and asset tangibility measures, albeit the correlation is not statistically significant at 1%.

In sum, the correlation analysis shows that intersectoral differences in terms of external finance needs, attributed to technological differences, globally persist in time. It is however interesting to consider the technological evolution that may differently affect sectors. Moreover, even if the US financial market can be considered as the least distorted, RZ indicators may capture *more than* technological differences.

#### 1.4.2 Persistence of intersectoral external finance needs' differences across countries

In this paragraph, I discuss the assumption behind the use of RZ indexes for studies on different countries, other than the US. Intersectoral differences in terms of external finance needs are attributed to technological differences assumed to be stable across countries. While this assumption can be plausible when considering developed countries, its pertinence is put into perspective when analyzing financial dependence of manufacturing sectors in less developed economies. Fisman and Love (2004) suggest for example that industry characteristics would be different in countries with different levels of development. They argue that countries with similar levels of economic development are more likely to have similar sectoral growth patterns. Tadesse (2005) also provides an interesting result with regards to the link between financial development and technological advances. The author suggests, through the analysis of a panel of industries in eight countries, that the effects of financial development on growth channels through technological innovation and shows that the realized technological progresses of industries rely on the level of development of the domestic financial sector. If we consider this result, the technological characteristics of one single industry could vary across countries, depending on the quality of the supporting financial sector. This idea may consequently bring researchers to doubt about the pertinence of RZ assumption concerning the persistence of intersectoral technological differences across countries.

This point of view can however be challenged when considering the effects of the globalization on the world economy. If the assumption of Heckscher-Ohlin-Samuleson (HOS) of homogenous production functions across countries holds, trade would not have particular effects on technological transfers. However, in the real context, differences exist and trade plays a role in technological transfers between countries. In the present context, Multi-National Companies (MNC) are playing a role in reducing the technological gap between developed and less developed countries (UNCTAD, 2010), even if differences in terms of R&D investments do persist<sup>7</sup> (See Figure 1.2). The expansion of Foreign Direct Investments (FDI, hereafter) is

<sup>7</sup>The catching-up of China is however clear.

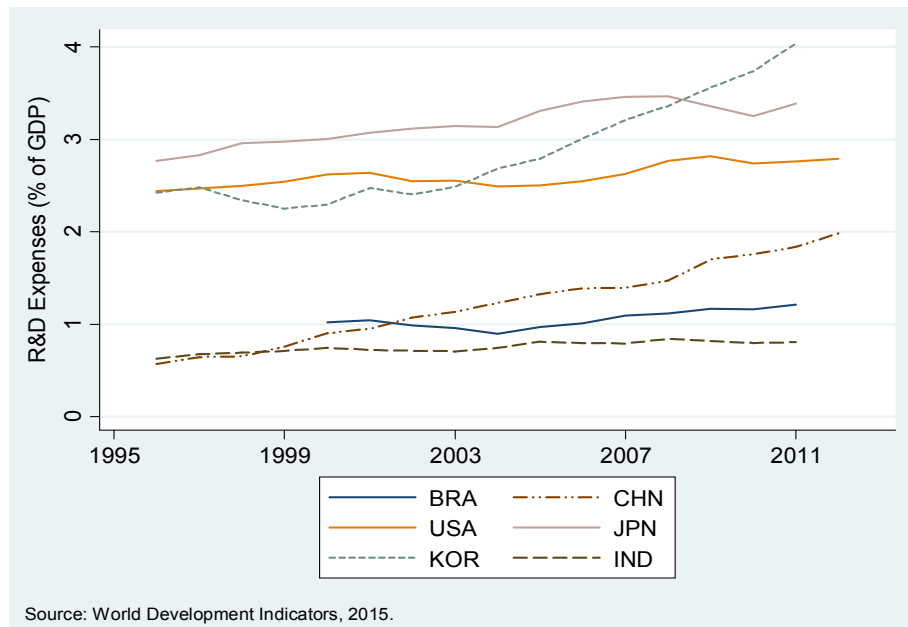


Figure 1.2: Evolution of R&D expenses 1996-2012

driving technology transfers particularly from advanced economies to developing (host) ones (Ju, 2009). Evidence about the positive effect of technological transfers on host countries' industries (notably in terms of productivity) was found for China (Liu and Wang, 2003), India (Pant and Mondal, 2010), and Vitenam (Newman et al, 2015) among other countries.

Therefore, considering the Global Value Chains (GVC) mechanisms, technological transfers lead emerging countries to move to new production functions (Cohen, 2003), close to those of advanced economies. In other words, due to all economic, technological and industrial linkages being developed, one can consider that developed and emerging economies -at least- present similar production functions. In this way, intersectoral differences in terms of factor intensity will be comparable across countries. This idea is supported by the findings of (Blalock and Gertler, 2008). The authors find that FDI spillovers rather occur among industries, than intra-industries. This finding is in favor of a reallocation of resources between sectors in host countries. This idea is also supported by Dervis (2012) who suggests that a new *convergence* is mapping between emerging and advanced countries. Taking all these effects into consideration, the international trade-related literature seems to be *supportive* of the assumption of RZ regarding the persistence of technological differences across countries. This result can also be defended by the relatively important correlation of RZ indexes with ExtFinUS No-Cr measures, calculated by Kroszner et al (2007) in Table 1.2. RZ indexes are found to be positively related to those computed using a sample of different non-crisis countries, which suggests the existence of an international trend regarding intersectoral technological differences. Note however that poor countries are not really concerned by this convergence

phenomenon (Dowrick and DeLong, 2003). These countries are less integrated in the global production system. Moreover, as argued by Tadesse (2005), the important gap in terms of financial development between advanced and poor countries is likely to affect industries' technological characteristics.

Since the present study focuses on Brazil which is an emerging market, it may be interesting to note that emerging countries have witnessed a number of structural changes over the past decades, which have affected their industrial systems' characteristics. For instance, South Korea has witnessed structural changes in its industrial structure in the 1990s. This economy shifted from an agrarian to an industrialized one (Singh, 2004). This has led to a reallocation of inputs within the manufacturing sector. Particularly, capital input is found to positively contribute to the reallocation effect, especially in non-crisis periods. The changes in the Korean production function is then associated with a capital reallocation in the manufacturing sector. Nassif et al (2013) suggest a similar pattern for the Brazilian economy in 1970-2010. The authors find that there is a reallocation of resources in the manufacturing industry, from labor intensive and natural resource-based sectors to more technologically sophisticated ones. These elements imply that the reliance of different manufacturing sectors on capital would be affected by the technological and industrial changes *in time*. Therefore, it is worthy to note that while RZ indexes could be considered as assessing sector-level inherent financial needs in emerging countries in the recent context of increasing interdependence, their pertinence could be lessened when considering the situation of manufacturing industries in emerging markets in past decades.

In sum, this section shows that intersectoral differences in terms of external finance needs, based on technological heterogeneity, are likely to persist *in time* for the US. The non-monotonic financial development evolution as well as the technological progresses need however to be considered, when using RZ indicators as reference. Based on the increased interconnection of domestic production systems in the context of global value chains, one can also consider that the intersectoral technological differences are relatively stable across countries. Despite that, technological differences between countries continue to exist, especially when comparing developed countries with poor ones.

As said before, in a world where market frictions do exist, the US financial market can be considered as the one with *least distortions*. In other words, the quality of the US financial market is considered as permitting an allocation of capital between firms and sectors, reflecting as much as possible their *inherent* external financial needs. However, as presented earlier, some factors would make the needs of external finance change in time (Rajan and Zingales, 2003) and between countries. In this context, Bena and Ondko (2012) consider that the demand of external finance at firm-level depends on the level of financial development of the country, the level of growth of the industry, as well as the industry technological characteristics. This suggests that intersectoral differences in terms of external finance needs do not only rely on technological characteristics. It would be therefore interesting to consider *time's*

and *country's* specificities when analyzing intersectoral differences in terms of dependence on external finance.

## 1.5 Dependence on external finance of Brazilian manufacturing sectors

The primary goal of this chapter is to assess the level of financial vulnerability of Brazilian manufacturing sectors in the recent period of the 2000s. As discussed earlier, the assumption that differences between sectors in terms of reliance on external capital do not vary across countries, may however appear strong (Demirguc-Kunt and Maksimovic, 1998; Ciccone and Papaioannou, 2010). Even if US indicators may capture intersectoral technological differences, a number of factors, mainly related to technological progresses and the disparities in terms of financial development in time and between countries, make it interesting to take into account the characteristics of the period of study and the country considered. Based on these elements, this section aims at presenting indicators of financial vulnerability *specific* to Brazilian manufacturing industries in the period 2000-2012. To this end, I compute sector-level indicators of external finance dependence, following RZ methodology and present alternative measures of financial vulnerability as proposed in the literature. In this section, I begin by recalling RZ methodology. I then present the Brazilian data, the Brazilian measures of financial vulnerability and a number of robustness checks.

### 1.5.1 Methodology

Using data on Compustat publicly traded US companies, RZ define an indicator of the level of reliance on external funds for a number of manufacturing industries. These sector-level indicators have been then used as reference levels for dependence on external finance, in the following literature on the impact of credit constraints on real outcomes. While these US indicators may reflect intersectoral technological differences, Brazilian sector-level indicators would better represent the *specific* financial needs given the Brazilian context. To compute these indicators, I use data on publicly traded firms in BM&F Bovespa (*São Paulo Stock Exchange*) over the period 2000-2012. The study is restricted to the industries of manufacturing and transformation, as defined by the second revision (2.0) of the Brazilian National Classification of Economic Activities CNAE (*Classificação Nacional de Atividades Econômicas*, henceforth CNAE). Since publicly traded companies are generally large companies, the sample may not be representative of all Brazilian firms. Nevertheless, as argued by RZ, one can consider that as an advantage. Restricting the sample to large companies is a way to only consider the *industry* effect on the needs of external capital. Empirical works have found that the firm size affects the access to credit and that larger firms present higher levels of sales and profits which make them less constrained (Kumar and Francisco, 2005). Hence, restricting our sample to large firms is a way to disentangle the effect of firm size from the *industry*

effect, with regards to the access to external funds (Love, 2003).

Based on RZ innovation, I propose three different measures of financial vulnerability for Brazilian manufacturing sectors. Firstly, I construct an index of dependence on external finance, as in RZ. The index is defined as the part of a firm's investments that are not financed with the internal cash flows generated by the firm. Precisely, the ratio of external finance dependence is defined as capital expenditures minus cash flow from operating activities divided by capital expenditures. Capital expenditures can be broadly defined as funds used by a company to acquire or upgrade physical assets such as property, industrial buildings or equipment. Cash flow from operations represents the cash flow generated by the main activity of the firm. I also add the changes in working capital -the increase in payables, the decrease in inventories and the decrease in receivables- as parts of the cash flow from operations. The construction of the Brazilian external finance dependence measures proceeds as follows. I compute the external capital needs of each firm in the sample over the 2000-2012<sup>8</sup>. In order to smooth temporal changes, I sum the amounts of capital needs over the period 2000-2012 and obtain then the index of external finance dependence over 2000-2012, for each firm in the sample<sup>9</sup>. I consider that the dependence on external finance at an industry-level is the *median* value of the index when considering all firms operating in a given industry. Recall that the literature has been more interested in sectoral outcomes and that, a sector is represented by a *representative* firm. The choice of the median firm as the representative firm in each industry alleviates the effect of outliers and thus, gives a more precise idea about sectoral needs of external funding.

Analogously, I construct a second measure that informs about the investment intensity of manufacturing industries. This measure is defined as the ratio of capital expenditures to the net property, plant and equipment. Investment intensity's measure gives interesting information regarding the external funding needs for the different sectors. In fact, as traditionally presented in the field of corporate finance, a firm which wants to invest has two means to finance it: internal funds based on retained profits and external funds. The more the firm invests, the higher its liquidity needs and the probability to ask for external funds will be. In this way, the investment intensity could serve as an indicator of the external financing needs of the firm. As for the first measure of financial vulnerability, the level of a sector's reliance on the external funds corresponds to the median value of the ratio of investment intensity.

In the same spirit of RZ, Braun (2003) defines a measure of asset tangibility based on US data in the 1980s. This indicator is supposed to be inversely correlated with the financial vulnerability and the level of dependence on external finance. In fact, tangible assets can be

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<sup>8</sup>Regarding firms for which data are not available for all the period 2000-2012, I sum the amounts of capital expenditures and of cash flows from operations for the available years, under the condition that for every considered year, I have data for all the variables necessary for the construction of the ratio of external capital needs.

<sup>9</sup>I sum the amounts of capital expenditures over the period 2000-2012. The same method is used to compute cash flow from operations over 2000-2012.

proposed as collaterals when demanding a loan from the financial sector. Therefore, they can be seen as a form of relaxation of credit constraints. Asset tangibility measure corresponds to the part of tangible assets in total assets. Specifically, the ratio of asset tangibility is defined as the part of property, plant, and equipment in the value of total assets of the firm. Property, plant and equipment can be defined as the firm's assets that cannot be easily liquidated. These measures are also computed using the same method of other indicators, over 2000-2012. These three different measures presented are intended to provide information about the financial constraints of Brazilian manufacturing sectors.

### 1.5.2 Data

In order to create financial vulnerability indicators for Brazilian sectors, I collect data on publicly traded firms in Brazil from Thomson Reuters Datastream database. This database contains data on large publicly traded firms all over the world. Data provided by this database include capital expenditures, cash flows from operating activities, changes in payables, receivables and inventories, total assets and the value of property, plant and equipment. Since the focus is on Brazil, I consider data on firms that are publicly traded in BM&F Bovespa over 2000-2012. Over this period, more than 2000 securities are traded in BM&F Bovespa. These equities correspond to 656 distinct firms. Most of publicly traded firms are operating in sectors of services, notably financial intermediaries. The matching between firms and their sectors of activity has been carried out using ISIN (*International Securities Identification Number*) codes of the traded securities and made possible through ORBIS database. This database, constructed by Bureau van Dijk for the OECD, matches ISIN codes with the tax identifiers (*Cadastro Nacional da Pessoa Jurídica*, henceforth CNPJ) of their related firms. These CNPJs are then required to get the information on the main activities of all firms established in Brazil. Data on the main activities are provided by the Brazilian Ministry of Finance (*Receita Federal do Brasil*), and are classified using CNAE 2.0. As the study only concerns manufacturing sectors, I drop all publicly traded firms that do not operate in industries of transformation. Only 160 of Brazilian traded firms operate in manufacturing sectors. After checking the availability of variables needed to compute different ratios of financial vulnerability, the final sample is reduced to 119 firms. The sector composition of the sample is detailed in Appendix 1.2. Food products and Textiles are the two sectors that are the best represented in the sample. Regarding Food products, this can be explained by the importance of the agriculture in the Brazilian economy. A number of sectors are only represented by single firms. Although this may affect the pertinence of Brazilian indicators, I consider that this composition provides information on the financing constraints in Brazil. I need also to precise that the sector classification of firms is only based on the *main* activity of the firm, as declared to the Ministry of Finance. A number of robustness checks, presented later, will verify the pertinence of Brazilian indicators.

### 1.5.3 Sector-level financial vulnerability: Brazilian indicators

#### Results

Brazilian indices of sector-level financial vulnerability in the 2000s are presented in Table 1.3. These indices are tabulated by CNAE 2.0 codes and ranked in an ascending order of the level of dependence on external finance. Beginning with the indicators of external finance dependence (Column 1), one can see that Tobacco and Leather products are among sectors that present low levels of dependence on external finance and that Pharmaceutical products appear as the industry that depends the most on external financing. The Pharmaceutical industry incurs higher levels of R&D expenses, which makes it more reliant on banking system's funds. These findings are almost in line with what one could predict, with regards to the existence of technological differences and requirements that make some industries more reliant on external finance than others. The results suggest however that "Other Transport Equipment" (CNAE 30) represents the sector that depends the less on outside capital, which contrasts the predictions. The negative value of the external finance index related to CNAE 30 shows that capital expenditures (investments) are largely inferior to value of revenues generated by firms in this sector. This result may be driven by the characteristics of firms in this sector over the period of study 2000-2012, particularly the presence of Embraer (*Empresa Brasileira de Aeronáutica*). Being launched by the Brazilian government in 1969, this manufacturer of planes is a leading company at the international level. Although Embraer was privatized in 1994, the state continues to control it through Previ, the pension fund of Brazilian Central Bank, and particularly through the BNDES (Lazzarini and Musacchio, 2014). In fact, the BNDES offers, through the BNDES-exim's programs<sup>10</sup>, support and direct financing for Embraer's foreign customers. Specifically, for every aircraft delivered to the buyers (importers), BNDES pays Embraer the value of the aircraft exported (BNDES, 2015). These funds have accounted for 28% of the total value of Embraer's exports between 1996 and 2008 (Embraer, 2009, p.13). BNDES has also recently (in 2014) approved the financing of an investment project in technological innovation for Embraer with a value of 1.4 billion R\$ (BNDES, 2015). These figures show that, despite the higher R&D expenses and the important capital expenditures, Embraer succeeds to have liquidity and not to be dramatically dependent on banking system funds<sup>11</sup>.

<sup>10</sup>BNDES-exim programs aim at facilitating the internationalization of Brazilian companies.

<sup>11</sup>Precisely, funds from private banks.

Table 1.3: Measures of Financial Vulnerability for Brazilian Manufacturing Sectors over 2000-2012

In this table, I display three measures of financial vulnerability computed using Brazilian data over 2000-2012. The first measure ExtFinBra 00-12 is the median value of capital expenditures that are not financed with internal funds, as proposed by RZ. Inv. Intensity 00-12 corresponds to the median value of capital expenditures over tangible assets. Finally, TangBra 00-12 gives information about the part of tangible assets in total assets.

CNAE 2.0	Industry	ExtFinBra 00-12	Inv. Intensity 00-12	TangBra 00-12
30	Other transport equipment	-6,94	0,14	0,11
15	Leather and Footwear	-6,60	0,18	0,12
12	Tobacco	-6,54	0,24	0,20
11	Beverages	-3,66	0,28	0,19
26	Computer, electronic and optical products	-3,20	0,26	0,03
22	Rubber and plastic products	-1,91	0,15	0,46
31	Furniture	-1,41	0,23	0,28
18	Printing and Publishing	-0,91	0,27	0,32
24	Metallurgy	-0,76	0,14	0,44
23	Non-metallic mineral products	-0,67	0,17	0,37
27	Electrical equipment	-0,41	0,14	0,25
20	Chemicals	-0,17	0,14	0,42
13	Textiles	-0,12	0,10	0,42
25	Fabricated metal products, except machinery and equipment	-0,11	0,13	0,33
17	Paper and paper products	-0,09	0,11	0,58
29	Motor vehicles, trailers and semi-trailers	-0,08	0,16	0,36
16	Wood products	-0,06	0,16	0,62
14	Wearing Apparel	-0,04	0,15	0,39
19	Coke and refined petroleum products	0,03	0,18	0,37
28	Machinery and equipment n.e.c	0,26	0,17	0,25
32	Other manufacturing	0,32	0,13	0,16
10	Food Products	0,37	0,13	0,39
21	Drugs	1,99	0,17	0,17



In order to finance capital expenses, Embraer relies notably on funds from operating activities, cash support from risk-sharing partners, advance payments from customers, as well as borrowings (Embraer, 2009, p. 60). In sum, export subsidies as well as the general support of Brazilian government led Embraer to influence the structure of the world market of aircrafts (Goldstein, 2002). In the light of these different details, it is clear that with the government support, Embraer does not seem to be credit constrained. This result may justify the negative value of the sector-level index of external finance dependence, for CNAE 30<sup>12</sup>.

Moving to investment intensity measures, Table 1.3 shows that over 2000-2012, Beverages and Printing industries exhibit the largest values. These sectors, with negative external finance needs, seem to have more important investment opportunities compared with other manufacturing industries. This negative relation between the dependence on external finance and the investment intensity is confirmed in a manner, by a negative Pairwise correlation of 41% (significant at 10%). This finding suggests that sectors that do not highly depend on external funds are those that succeed to invest more. This can be motivated by the weaknesses in the Brazilian financial system. Sectors that can finance their activities internally are less exposed to the credit shortage and the high cost of capital due to the underdevelopment of the Brazilian financial system, and they can therefore expand easier their activities. Finally, regarding asset tangibility measures, Table 1.3 shows that "Wood products" is the sector with the largest part of hard assets. Unsurprisingly, computer products' industry presents only few tangible assets. This sector is particularly based on software intangible assets. Recall that the degree of asset tangibility informs about the collateralizable assets that can be pledged by the banking system in case of default. This measure is then supposed to be inversely related to the level of dependence on external finance. Considering the Brazilian measures, the Pairwise correlation between measures of asset tangibility and external finance dependence indexes is however, found to be positive (of 51%, significant at 5%). This finding proposes that sectors with higher outside capital needs present also high levels of asset tangibility. This result can be supported by an alternative body of literature which argues that the access of firms to external finance is positively related to their capacities to provide collaterals, in other words the degree of their asset tangibility (Braun and Larrain, 2005; Almeida and Campello, 2007). It is noteworthy to mention that, in this context, the sector-level measure of reliance on outside capital will assess the *facility of accessing* to external finance, rather than the *needs* in terms of external finance. These results suggest that the level of dependence on external finance is *endogenous* and dependent on the availability of hard assets (Choi, 2015).

In sum, the calculation of Brazilian measures of sector-level financial vulnerability shows that while the *technological component* claimed by RZ globally persists for Brazilian industries, the behaviors of Brazilian firms and sectors may present some differences compared with what the literature suggests, notably in terms of the relation between the *need* for banking system's funds and the sector endowments of tangible assets. These differences are mainly related to

<sup>12</sup>The sector CNAE 30 is only represented by two firms: Embraer and Bicicletas Monark SA.

the Brazilian context, especially the level of financial development. Brazilian characteristics of the financial sector will be discussed later when comparing Brazilian indexes to US ones.

### Robustness checks

In this paragraph, I perform a number of robustness checks in order to confirm the stability of Brazilian measures of financial vulnerability. The attention particularly goes to indexes of external finance dependence. I begin by computing measures of external finance dependence by using different *constructions* of the ratios (Appendix Table A.1.3.1). Table 2.4 presents the correlation tests between the original Brazilian measures and the alternative constructions. I first limit the sample of firms to those for which, observations are available for at least two years over 2000-2012. One can see in Table 1.4, that the results (See ExtFinBra 00-12 No-1obs) found in the previous paragraph are robust to the changing of the restriction of sample<sup>13</sup>. I then compute ratios of external finance dependence *without* considering the changes in payables, receivables and inventories in the calculation of firms' cash flows of operating activities. The test of correlation between the original Brazilian measures and the modified ratios (ExtFinBra 00-12 No-Var) shows a strong correlation level (of 97%), in favor of stable Brazilian measures. Apart from Pairwise correlation tests, I also perform Spearman tests which inform about the sector rankings' (in terms of reliance on outside capital) correlation. Using this method, the correlation between both measures of external finance dependence remains high (92%) and significant at 1% level. Note that examining the rankings would be pertinent with regards to my analysis since it permits assessing the persistence of the technology intensity differences between sectors. I then compute external finance dependence measures by only considering firms for which data on *at least* two consecutive years exist. Once more, the correlation between the original measures and ExtFinBra 00-12 Consec is high and significant at 1% level. Finally, similar correlation levels are found when only considering firms with data on consecutive years, and without accounting for the variation in payables, receivables and inventories in the cash flows calculation (See ExtFinBra 00-12 Consec No-Var). Taking these results into account, the original Brazilian sector-level indexes (ExtFinBra 00-12) of external finance dependence over 2000-2012 are robust to the changing of the construction restrictions.

In addition to that, I compute Brazilian indicators of external finance dependence over different periods of time in order to check the stability of ExtFinBra 00-12 *in time*. The values of the indexes calculated over 1991-2010 (ExtFinBra 91-10) and 2000-2010 (ExtFinBra 00-10) are displayed in Appendix Table A.1.3.2. Note that for the sector of Drugs, the external finance dependence indicator turns negative. This is related to the changes in publicly-traded firms in the 1990s<sup>14</sup>. The results of the correlation between Brazilian indices of reliance on external funding computed over different periods of time are presented in Table 1.5.

<sup>13</sup> A perfect correlation is found in Table 1.4 because only very few firms in the initial sample have only one observation over 2000-2012.

<sup>14</sup> Biobras, S.A. for example was publicly-traded in BM&F Bovespa, only in the late 1990s.

Table 1.4: Robustness I: Correlations based on Different Constructions

In this table, I present correlation tests between Brazilian indicators of external finance dependence using different constructions. ExtFinBra 00-12 represents the original Brazilian measure computed over 2000-2012, using all available data for each firm in the sample. ExtFinBra 00-12 No-1obs is calculated based only on firms that are present for at least 2 years over 2000-2012. ExtFinBra 00-12 No-Var corresponds to the measure of external finance dependence in which internal funds are restricted to the cash flow from operating activities, i.e. without accounting for changes in payables, receivables and inventories. ExtFinBra 00-12 Consec is calculated by only considering firms with data for at least two consecutive years over 2000-2012. Finally, ExtFinBra 00-12 Consec No-Var is calculated by only considering firms with data for at least two consecutive years over 2000-2012, and only considering cash flows from operations as internal funds. I present Pairwise (Pearson) correlation results as well as Spearman (rank) results. \* denotes significance at 0.01 level.

	ExtFinBra 00-12		ExtFinBra 00-12 No-1obs		ExtFinBra 00-12 No-Var		ExtFinBra 00-12 Consec	
	Pairwise	Spearman	Pairwise	Spearman	Pairwise	Spearman	Pairwise	Spearman
ExtFinBra 00-12	1.0000	1.0000						
ExtFinBra 00-12 No-1obs	1.0000*	1.0000*	1.0000					
ExtFinBra 00-12 No-Var	0.9752*	0.9259*	0.9259*	1.0000	1.0000			
ExtFinBra 00-12 Consec	0.8767*	0.8261*	0.8261*	0.8261*	0.7510*	1.0000	1.0000	
ExtFinBra 00-12 Consec No-Var	0.9136*	0.7441*	0.9134*	0.7441*	0.9103*	0.8291*	0.9623*	0.8992*

Table 1.5: Robustness II: Correlations based on Different Periods of time

In this table, I present the results of correlation tests between Brazilian indicators of external finance dependence computed over different periods of time. ExtFinBra 00-12 represents the original Brazilian measure computed over 2000-2012, using all available data for each firm in the sample. ExtFinBra 91-10 represents the Brazilian measure computed over 1991-2010, based on firms with data for at least two consecutive years. ExtFinBra 91-10 represents the Brazilian measure computed over 2000-2010, based on firms with data for at least two consecutive years. I present Pairwise (Pearson) correlation results as well as Spearman (rank) results. \* denotes significance at 0.01 level.

	ExtFinBra 00-12		ExtFinBra 91-10		ExtFinBra 00-10	
	Pairwise	Spearman	Pairwise	Spearman	Pairwise	Spearman
ExtFinBra 00-12	1.0000	1.0000				
ExtFinBra 91-10	0.7399*	0.6789*	1.0000	1.0000		
ExtFinBra 00-10	0.8647*	0.7747*	0.8020*	0.8804*	1.0000	1.0000

Measures of external finance dependence computed over different periods of time seem to exhibit strong correlation levels (of 75-80%, significant at 1% level), in terms of values (Pairwise correlation) and in terms of rankings (Spearman correlation), as well. Figure 1.3 plots the values of the original indexes ExtFinBra 00-12 and those calculated over 1991-2010, ExtFinBra 91-10. It is clear that there exists a positive trend between measures of external finance dependence calculated over different periods of time. This finding is in favor of the existence of intersectoral technological differences that remain *globally stable* in time, for Brazil. Differences between both measures can be attributable to the Brazilian economy's mutation in the 1990s.

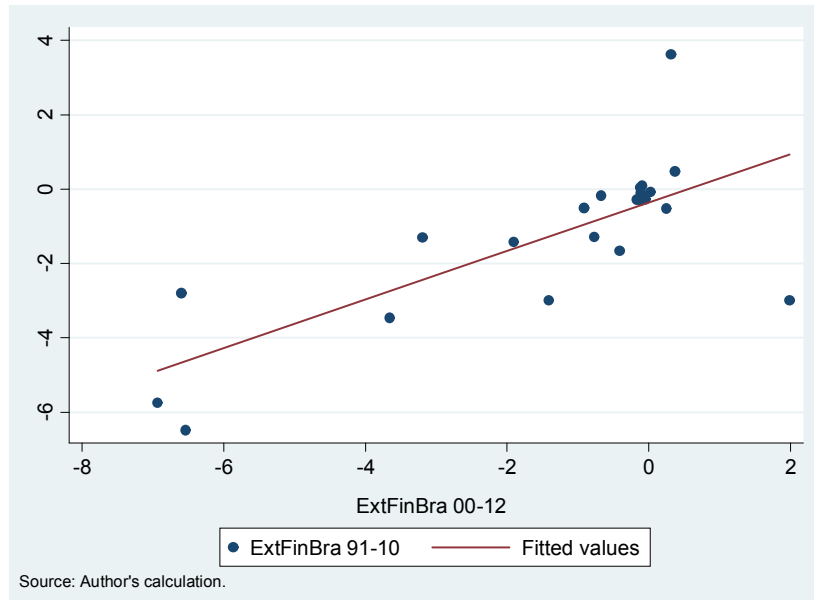


Figure 1.3: Brazilian Indexes over 00-12 and 91-10

According to Baumann (2001), the 1990s are considered as the “reform decade” in Brazil. This period was characterized by an attraction of foreign capital coupled with a privatization process. To illustrate this idea, Chudnovsky and López (1997) show for instance that in 1995, a large part of sales in Motor and Pharmaceutical industries (92% and 59%, respectively) are related to foreign investments. These changes, along with the financial sector restructuring during the 1990s could be a source of transition for Brazilian manufacturing sectors not only in terms of technological progress (through the transfers of technology induced by the presence of foreign companies) but also in terms of reliance on external funds. These changes can also be behind important entry and exit movements in the Brazilian stock market, which could affect the values of industry-level external finance dependence<sup>15</sup>.

Finally, moving to asset tangibility measures, high correlation levels (See Appendix Table A.1.3.3) can be observed between original indexes (TangBra 00-12), those calculated using

<sup>15</sup>Since the indices are computed over data on publicly traded companies.

consecutive data, those calculated over 1991-2010 (TangBra 91-10) and over 2000-2010 (TangBra 00-10 ). These results support the robustness of Brazilian financial vulnerability measures to the changes in ratios' construction, and their stability in time.

In sum, the Brazilian indicators calculated over 2000-2012 remain globally stable across different periods of time and when considering different constructions. This attests of a relatively stable pattern of intersectoral differences in terms of external finance needs. A number of differences however exist between different measures. They can be related to the changes of the Brazilian context over time. Continuous structural and industrial reforms in Brazil make the financial needs of different sectors vary in time. In line with this context, publicly-traded firms change in time; there are firms which enter the capital market; others rapidly quit. This can be behind the variation of Brazilian ratios of external finance dependence. These facts make it interesting to consider the time's characteristics when analyzing the financial vulnerability of Brazilian sectors.

All in all, these indicators are *endogenous* to the Brazilian context in the last decade. They consequently reflect the financial constraints of Brazilian manufacturing industries at a specific point of time rather than *exogenous* technology-related financial needs.

## 1.6 What do differences between RZ and Brazilian indexes reveal?

The calculation of Brazilian sector-level indicators of financial vulnerability has been based on RZ methodology. In this section, I provide a comparison between Brazilian manufacturing sectors' needs in terms of external finance during 2000-2012, and financial needs of US indicators. I first perform a correlation analysis in order to capture the differences between Brazilian and US industries. Next, a discussion on the possible causes of these differences is presented.

### 1.6.1 Correlation analysis

Based on the high quality of US financial system, RZ assume that amounts of external finance firms get from the financial sector, are likely to equal their demand of external capital defined by their technological characteristics. RZ indexes of external finance dependence are therefore likely to reflect financial needs' differences between sectors, based on their *inherent* technological differences. As discussed earlier, a number of factors may affect the stability of these differences in time and between sectors. In this paragraph, I consider that RZ indexes succeed to reflect as *exogenously* as possible intersectoral technological differences.

Table 1.6 presents the results of correlation tests between Brazilian indexes of financial vulnerability in the period 2000-2012 and the US ones. The results show that there exists a positive and significant correlation (of 71%, at 5% level) between Brazilian measures of external finance dependence (ExtFinBra 00-12) and RZ indicators (ExtFinUs 80s). Table 1.6

also shows a positive link between Brazilian indicators and US indicators calculated over the 1990s (ExtFinUs 90s) and those computed using data on a number of Non-crisis countries (ExtFinUs No-Cr). Globally, these results are in favor of the existence of a technological component that remains relatively stable across countries and in time. Figure 1.4 provides additional information. First, considering US and Brazilian distributions, Tobacco products is the sector that presents the lowest needs in terms of external capital. This sector presents negative external dependence. Second, Pharmaceutical products is the sector with the highest level of reliance on external capital. This sector exhibits higher R&D expenses, resulting in an important need of external liquidity. This finding suggests that Brazilian indicators capture, in a manner, *inherent* technological differences between sectors embodied by RZ indexes. However, Figure 1.4 does not show a clear positive trend between Brazilian and US indicators. This attests of the existence of factors that make the financial needs of Brazilian industries differ from their technology-driven financial needs.

I next move to the comparison between Brazilian and US measures of asset tangibility (Table 1.6). First, a positive and significant correlation exists between both measures (of 53%). This attests of a positive link between Brazilian and US sectors' endowments of hard assets. Recall that while US asset tangibility measures are negatively related to US external finance dependence indicators, Brazilian asset tangibility measures are found to be positively correlated with Brazilian indexes of dependence on external finance<sup>16</sup>. This finding suggests that there are differences between the Brazilian context, and the US context considered as a *benchmark*.

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<sup>16</sup>Albeit the coefficients are not precisely estimated.

Table 1.6: Correlations between Brazilian and US indexes of External Finance Dependence

This table presents the results of correlation tests between Brazilian indicators of financial vulnerability over 2000-2012, and indicators from the literature notbly RZ indicators denoted ExtFinUS 80s, their updated values by Kroszner et al (2007) ExtFinUS 90s, and indicators calculated over data on a number of countries that did not experienced crises in the last decades ExtFinUS No-Cr. \* denotes a significance at 0.05 level.

	ExtFinBra 00-12		ExtFinUS 80s		ExtFinUs 90s		ExtFinUS No-Cr		TangBra 00-12	
	Pairwise	Spearman	Pairwise	Spearman	Pairwise	Spearman	Pairwise	Spearman	Pairwise	Spearman
ExtFinBra 00-12	1.0000	1.0000								
ExtFinUS 80s	0.7178*	0.4039	1.0000	1.0000						
ExtFinUs 90s	0.6262*	0.5036	0.9329*	0.7364*	1.0000	1.0000				
ExtFinUS No-Cr	0.5920*	0.5742*	0.8946*	0.6464*	0.9586*	0.7478*	1.0000	1.0000		
TangBra 00-12	0.5139*	0.0929	-0.2281	-0.2788	-0.2570	-0.2857	-0.1819	0.0483	1.0000	1.0000
TangUS	-0.0735	-0.1776	-0.2808	-0.2442	-0.2521	-0.1345	-0.2775	-0.1563	0.5336*	0.5040



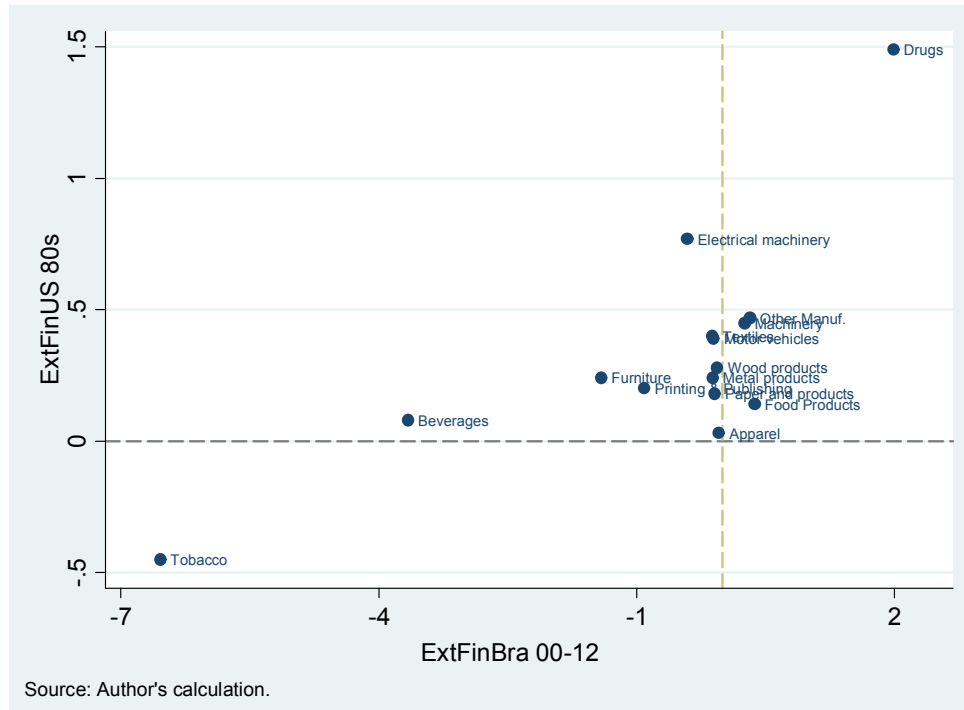


Figure 1.4: Correlation between Brazilian and RZ indicators

### 1.6.2 Discussion: Misallocation and policies

In this section, the focus is on the comparison between Brazilian and US measures of external finance dependence. Despite the apparent positive link between Brazilian and RZ indicators, a number of differences can be highlighted. In Figure 1.4, one can note that the US indexes are positive, in their majority. This suggests that US manufacturing industries exhibit positive external funding needs. Brazilian measures, however, are mainly negative, suggesting that Brazilian investments are mainly financed with internal funds.

It is stated that RZ measures reflect the *exogenous* component of external funding needs for manufacturing industries. Therefore, differences between US and Brazilian sector-level financial dependence indices can be attributed to the *endogenous* component of industries' financial conditions, related to the Brazilian context. In other words, since the US is assumed to have a *least distorted* financial market (See Table 1.1, financial development rankings), the *gap* between Brazilian and US indexes of financial vulnerability would inform about the *distortions*<sup>17</sup> related to the Brazilian context. In fact, the misallocation of resources is found to be more important in Latino-American countries, compared with US (Busso et al, 2012). Therefore, while RZ indexes reflect the inherent financial *needs* of manufacturing sectors,

<sup>17</sup>Here, I need to precise that a market is considered as distorted when the firms' demand of external capital do not rely on their *inherent* needs and when the amounts of external capital firms get are different from the amounts they demand.

Brazilian indexes would provide information about problems in *the supply* of credit. Two potential impediments to optimal allocation of credit are discussed below: the level of financial development and the role of government policies, through the Brazilian public bank BNDES.

### Financial development

The literature considers that the underdevelopment of financial systems is an important source of misallocation of resources. With regards to this source of distortion, Brazil exhibits a relatively underdeveloped financial system. Despite the efforts to facilitate access to credit in Brazil (Bittencourt, 2010), the Brazilian financial system continues to face challenges. These challenges include the prevalence of short-term indexation, the low liquidity in the secondary market as well as investors' risk aversion to long-term fixed rate bonds (Park, 2012). An enforcement of regulatory and legal frameworks is needed in order to facilitate the exchange of information between lenders and borrowers, and then ensure the efficiency of financial intermediation (Beck, 2000). Brazilian weaknesses in terms of financial development can be illustrated by the Financial Development Indexes provided by the World Economic Forum in Appendix 1.4. In 2012 for example, Brazil lags behind developed countries and behind China, as well. Brazil is ranked 32 in terms of overall financial development, while China is ranked 22. Note that the US is ranked on the top of the list, which may legitimate RZ's assumption about the quality of US financial sector, in the recent context.

The underdevelopment of the Brazilian financial system can be also assessed through the examination of the evolution of the domestic credit to the private sector<sup>18</sup> (as a % of GDP) in Figure 1.5. This measure has been traditionally used in the literature as a proxy of financial development. Figure 1.5 shows that despite the positive evolution of Brazilian domestic credit, the supply of credit remains low in Brazil, compared with China and the US. Although this measure may reflect monetary policy transmission (Garcia-Escribano, 2013), it shows at least that firms and investors in Brazil face greater challenges in the access to credit compared with China or advanced economies. These challenges can also be illustrated by high interest rates, denoting a high cost of external capital. Brazilian interest rates remain at very high levels, compared to Chinese and US interest rates, despite their decreasing trend. It is then clear that reducing the cost of capital in Brazil remains a challenge (Goldfajn et al, 2003). Considering these different elements, firms in Brazil, will be more likely to finance their activities *internally* as suggested by traditional finance theories. This can therefore explain the negative values of Brazilian indexes of external finance dependence.

Is the Brazilian financial underdevelopment behind the distortions in Brazilian indexes of external finance dependence? In order to answer this question, I first need to predict the possible effect of financial underdevelopment on the access to outside capital. If the misallocation of resources is induced by the quality of the financial system, the Brazilian

<sup>18</sup>One additional measure of financial development is market capitalization (Rajan and Zingales, 2003). The market capitalization in Brazil represents, in 2000 for example, 34% of the GDP, while it represents more than 145% in the US.

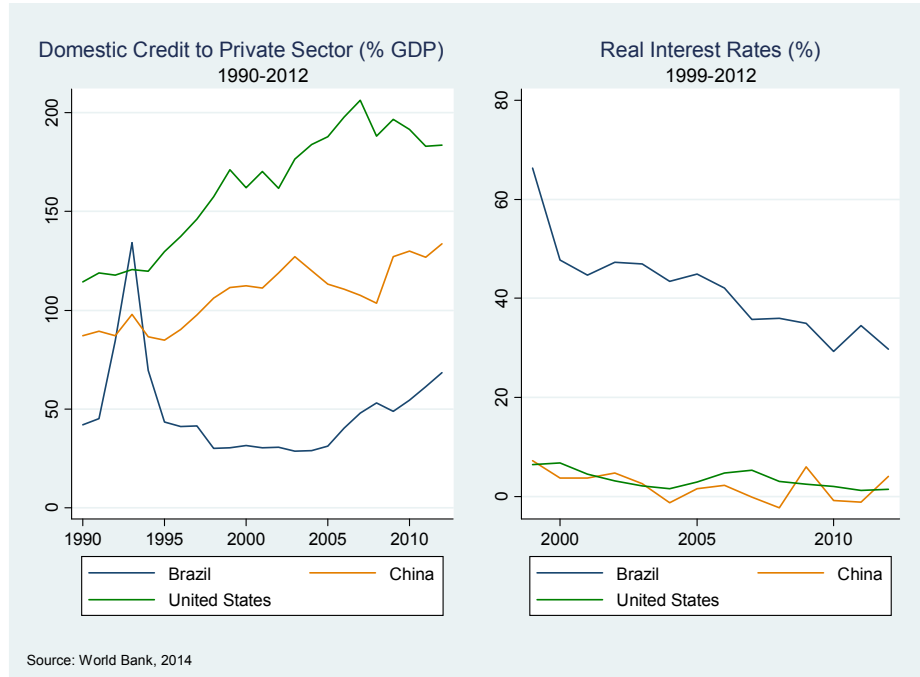


Figure 1.5: Financial Development in Brazil

financial underdevelopment would adversely affect sectors with higher *exogenous* needs in terms of external capital, more than those with low dependence. In presence of imperfections in the financial sector, sectors which are *by their nature* more reliant on external fundings, are more likely to be affected. By assuming that the financial sector should finance all sectors in the economy and if there is no lobbying, the external finance's demand of firms in these financially vulnerable sectors (based on their *inherent*<sup>19</sup> needs) will be less likely to be satisfied. Therefore, the correlation between RZ indicators (reflecting inherent needs) and Brazilian indicators (reflecting the Brazilian context) would be lower for sectors that highly rely on outside capital. This prediction is consistent with the predictions in the literature regarding the effects of financial development on real outcomes. Fisman and Love (2004) argue that in the long-run, the financial development is assumed to allocate capital towards sectors that are *by nature* more reliant on outside capital. This prediction is also line with the literature that considers the financial development as a source of *comparative advantage* in sectors with high reliance on external finance, with regards to growth (as in RZ) and exports (Manova, 2013). Given these elements, one could therefore assume that the financial *underdevelopment* would adversely hit these financially vulnerable sectors, more than those that do not highly rely on external finance. This would translate into a larger gap between *inherent* needs and *actual* financial constraints, for the sectors with high reliance on outside capital. Following the methodology of Busso et al (2012), I test this expectation through a correlation analysis

<sup>19</sup>based on their technological characteristics, as argued by RZ.

Table 1.7: Correlation Between Brazilian and US indicators depeding on the level of Exogenous financial needs

	ExtFinBra 00-12	
	Low Dep.	High Dep.
ExtFinUS 80s	0.8492*	0.8365*

between Brazilian indicators (ExtFinBra 00-12) and US indicators (ExtFinUS 80s), on two sub-samples of manufacturing sectors: *Low dependence* sectors and *High dependence* sectors<sup>20</sup>. Table 1.7<sup>21</sup> shows that the correlation coefficients between US and Brazilian indexes (positive and significant at 5% level) do not vary across the sub-samples. This does not permit to conclude about the impact of Brazilian underdevelopment as a source of distortion.

An alternative check is proposed. Recall that RZ indicators are considered as benchmarks for sector-level needs in terms of outside capital. One can then assume that departures from these benchmarks measure the magnitude of distortions. If the level of financial development is behind these distortions, one could expect that the gap in values between Brazilian and US indexes of external finance dependence would be larger for manufacturing sectors that present higher needs of outside financing. In fact, these sectors are more sensitive to the high cost of capital caused by the underdevelopment of the financial sector, *ceteris paribus*. The positive trend in Figure 1.6 shows that the magnitude of the difference<sup>22</sup> between the Brazilian and the US values of external finance dependence  $|(\text{ExtFinBra } 00-12) - (\text{ExtFinUS } 80s)|$  increases with the level of sector inherent needs in terms of outside capital (embodied by ExtFinUS 80s). This finding suggests that distortions in the Brazilian financial market affect more sectors which are highly dependent on external finance compared with other industries. Therefore, it seems that the financial underdevelopment in Brazil does affect the financial conditions of Brazilian manufacturing sectors. The distortions caused by the low quality of Brazilian financial institutions make the external finance amounts, which sectors get, different from their technological-based needs. This result can also justify the positive link between Brazilian measures of external finance dependence and those of asset tangibility. In a context where distortions create problems of financing for industries that highly rely on external finance, having many tangible assets to present to the financial sector would *relax* financing constraints. In fact, when the financial market is underdeveloped, problems of lack of confidence could arise, and in this context, lenders would prefer to lend money to firms that present lower risks of default and provide higher collaterals. In this case, firms operating in sectors with many hard assets would have bigger chances of getting external capital.

<sup>20</sup>Sectors with Low dependence on external finance are those presenting levels of dependence on external finance below the median value when considering RZ indexes (ExtFinUS 80s). The remaining sectors are considered to exhibit High levels of reliance on outside capital.

<sup>21</sup>I display the coefficients of Pearson correlation between Brazilian indicators computed over 2000-2012 and original RZ indicators based in US data in the 1980s, depending on the level of exogenous financial needs (Low/High). \* denotes a significance at 0.05 level.

<sup>22</sup>In terms of absolute values.

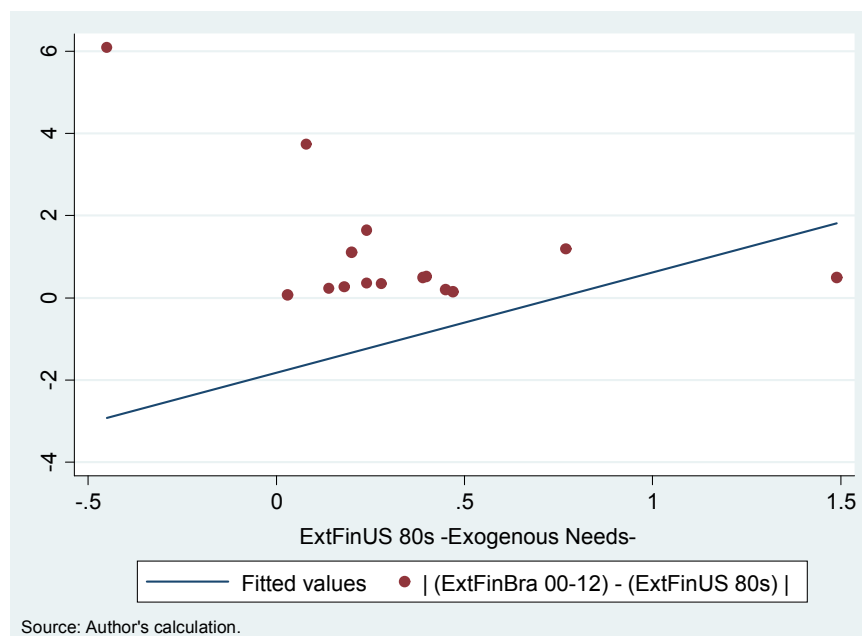


Figure 1.6: Gap between Brazilian and US indicators

### Government policies: BNDES

Another possible driver of resource misallocation is government policies. While these policies have generally precise objectives, they can represent a source of distortion. Focusing on the Brazilian context, the last two decades have been characterized by a number of public policies, particularly induced by the industrialization process. These actions include tax reforms as well as reforms of the financial sector (Ter-Minassian, 2012). Concerning the financial sector, the Brazilian government action channels particularly through the Brazilian Development Bank (BNDES). This bank is considered as the main financing agent for development in Brazil (IDFC, 2015). Specifically, the BNDES has been the institutional response to market failures embodied with a high cost of external capital (Colby, 2012). This bank aims also at enhancing the competitiveness of the Brazilian economy by providing subsidized credits to promote exporting activities, technological innovation and regional development. Overall, this state-owned bank plays an important role in boosting the production system in Brazil, by reducing the financial sector exposure to external funding shocks that have long characterized developing countries in the 1980s (Rezende, 2015). Since 2000, the disbursements of BNDES have grown to reach 168 billion R\$ in 2010 and 190 billion R\$ in 2013. Moreover, industrial sectors seem to be the largest beneficiaries of these loans, together with the infrastructure sector (See Appendix 1.5). In 2010 for example, the disbursements for industrial activities reached 78.8 billion R\$ which represents 48% of the total annual disbursements.

A number of studies have been interested in evaluating the role of BNDES public lending in relaxing credit constraints. Araujo et al (2011) argue that due to the developing capital market

in Brazil and to the credit supply restrictions by the commercial banks, BNDES appears as the major source of long-term financing. Ottaviano and Souza (2007) seek evidence about the effect of BNDES loans on firms' productivities. The authors find that BNDES loans do affect the performances of the granted firms, and that the positive impact on firm productivity needs three years to appear. These effects are however found to be asymmetric between large projects and small projects. In the same line, Ottaviano and Souza (2014) suggest that firms that receive BNDES loans are more credit constrained than non-granted firms, and that these loans help granted firms to realize similar performances compared with those of non-granted less constrained firms. Other works have put these effects into perspective, and criticized the pertinence of BNDES lending. Bolle (2015) argues that the Brazilian development bank negatively affects Brazilian productivity growth, and creates *distortions* by injecting cheap loans into the economy. Lazzarini and Musacchio (2014) propose, through the study of BNDES's equity investments BNDESPAR, that firms receiving these funds show higher levels of profitability but that these positive effects disappear starting from 2002. Focusing on large publicly-traded firms in 2002-2009, Lazzarini et al (2011) find that while BNDES subsidized credit is expected to go to constrained firms, it seems that BNDES is rather targeting more profitable firms capable of repaying loans. In line with this finding, Appendix Figure A.1.5.2 shows that a substantial share of BNDES releases goes to large firms. These disbursements may therefore create distortions with regards to the external finance needs of Brazilian industries, since Brazilian indicators of external finance dependence (ExtFinBra 00-12) are calculated using data on *large* publicly-traded firms.

In order to check the importance of BNDES in creating distortions, I go deeper into the examination of BNDES disbursements across manufacturing sectors. To begin with, only a positive correlation of 16% (significant at 5% level) is found between Brazilian indexes of external finance dependence ExtFinBra 00-12 and BNDES disbursements over 2000-2012. According to Colby (2012), BNDES disbursements are directed to *strategic*<sup>23</sup> sectors of the economy, rather than those facing financial constraints. Figure 1.7 shows that BNDES disbursements vary across sectors and in time, which is not in favor of an orientation of the subsidized credit towards sectors with higher needs in terms of external finance. Other transport equipment, Motor vehicles and Food products seem to receive the lion's share of BNDES loans. Recall that considering Brazilian measures proposed in this chapter, "Other transport equipment" was found to be the Brazilian sector that presents the lowest level of dependence on external finance (See Table 1.1). The important BNDES disbursements towards this sector are behind the negative dependence on external finance. Besides, Pharmaceutical products that exhibit the highest level of needs according to RZ indexes, does not seem to attract BNDES loans, as it can be shown in Figure 1.7. In the light of these elements, BNDES public lending seems to be indeed a source of distortion that makes the needs of Brazilian sectors in terms of outside capital divert from the sectors' *exogenous* needs. Figure 1.8 provides further evidence about

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<sup>23</sup>such as Transport (PwC, 2015).

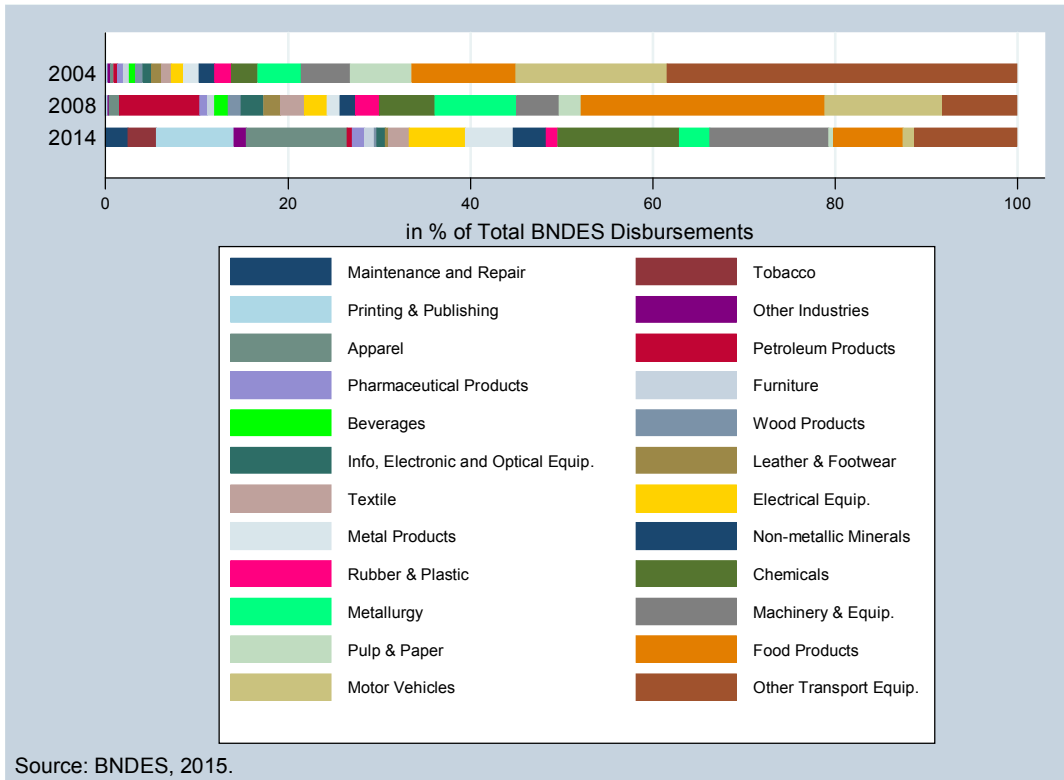


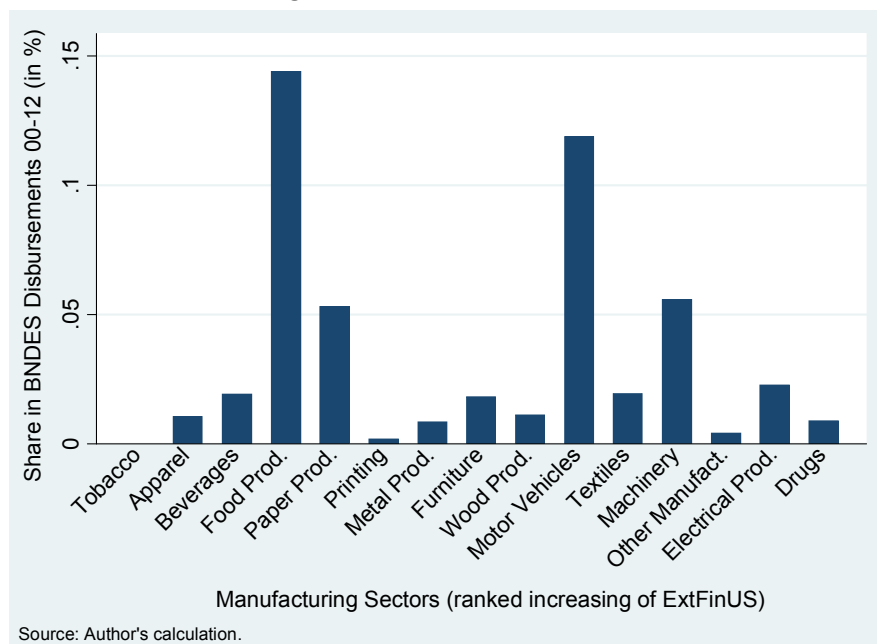
Figure 1.7: Evolution of BNDES disbursements to Manufacturing sectors in time

the importance of BNDES as a source of capital misallocation. This figure presents the share of each manufacturing sector in total BNDES disbursements over 2000-2012. Manufacturing sectors are ranked from the less dependent to the most dependent on external finance, depending on their *technological* characteristics (Increasing in ExtFinUS 80s). The share of the different sectors in BNDES disbursements over 2000-2012 do not seem to be positively correlated with the *exogenous* financial needs<sup>24</sup>. Based on the findings in Figures 1.7 and 1.8, BNDES disbursements do not seem to target sectors that are *by nature* in need of external finance. Similarly to Bolle (2015), this analysis suggests that BNDES public lending can be considered as a source of distortions in the Brazilian market. Since one objective of BNDES over 2000-2005 was to foster investments and to increase the technological content of Brazil's industrial production (BNDES Quarterly Report, 2001), the BNDES may therefore need to better target sectors in need of external finance, given their *technological* requirements.

Finally, two alternative factors could be behind the capital resource misallocation across Brazilian manufacturing sectors over 2000-2012. One, the economic crisis of 2008 has resulted in a global credit shortage that would negatively affect manufacturing sectors especially those with higher exogenous needs of outside capital. Second, since Brazil is known for the high tax burden, one can consider the tax collection system as a source of distortions. Vasconcelos

<sup>24</sup>There is no increasing trend.

Figure 1.8: Share of Manufacturing sectors in BNDES disbursements over 2000-2012



(2014) finds however that there is no evidence about the effects of these two factors on the misallocation of resources.

Bottom line, while RZ indexes reflect the financial needs *inherent* to the sectors, Brazilian indexes calculated over 2000-2012 reflect rather manufacturing sectors' needs *endogenous* to the Brazilian context. Policy and market failures do affect the allocation of resources across sectors.

## 1.7 Conclusion

This paper extends the literature on finance and development by assessing the needs in terms of outside capital of Brazilian manufacturing industries over the 2000s. Brazil has witnessed a number of structural reforms over the last decades, permitting this country to boost its economy and to acquire an important role in the international scene. In particular, Suzigan et al (2007) argue that the Brazilian industrial restructuring would distinguish Brazil from common perceptions about the specialization of developing countries in natural resources industries. Despite these efforts, Brazil continues to face challenges, especially with regards to the quality of the financial system. The cost of external capital remains high in Brazil which negatively affects investment and growth, by consequence. In this context, the present paper provides an insight of the effects of financial sector's imperfections on the manufacturing sectors' financial characteristics.

Particularly, this study adds to the literature on the effects of financial development by



revisiting the indexes of external finance dependence of Rajan and Zingales (1998). These indexes have been originally computed over US data in the 1980s. They have been then long used in the literature to account for the *inherent* financial needs of manufacturing sectors. RZ assume that the allocative choice of capital depends on a technological component, and that intersectoral differences in terms of financial dependence on external finance are stable *across countries* and *in time*.

Considering the different mutations in the world economy, and cross-country differences in terms of technological and economic development, this study checks in a first part the relevance of the RZ's assumption. While correlation tests suggest that RZ indexes are globally stable in time, this paper stresses the necessity to consider the non-monotonic evolution of financial development and of technological progresses *in time*. This paper also considers that due to the globalization process, technological characteristics are converging, which is in favor of a persistence of intersectoral technological differences *across countries*. It is however required to consider the impact of countries' characteristics on the intersectoral differences in terms of technology and access to finance.

Based on this discussion, the second part of the chapter properly examines financial constraints of Brazilian manufacturing sectors in the last decade by presenting indicators of financial vulnerability *specific* to the Brazilian industries. These indicators are computed using data on publicly-traded firms in BM&F Bovespa in the period 2000-2012. An examination of these indicators shows that the technological differences claimed by RZ are *in a manner* behind the differences in terms of financial needs between Brazilian manufacturing industries. The results also show that contrary to common perceptions, Brazilian sectors which highly depend on outside capital are also those with high endowments in terms of tangible assets. Indeed, these results can be explained by a problem at the *supply* side of credit.

The comparison between Brazilian and US indicators shows that in spite of a positive correlation, some differences can be depicted. Since US indexes are considered as reflecting *as best as possible* exogenous sector-level financial needs, the gap between Brazilian and US indexes can be attributed to *distortions* in the Brazilian market. These distortions are particularly related to the access to credit, and result in an intersectoral resource misallocation. As far as this study is concerned, two important sources of distortions are behind the capital misallocation in Brazil. First, the underdevelopment of the Brazilian financial system is found to cause a problem of financing, especially for industries that highly depend on external finance. Second, BNDES public loans do not necessarily go to financially constrained sectors, which is likely to create distortions in the needs of external capital and in the access to finance. This results in deviations of manufacturing sectors' financial needs from the US *exogenous* levels. Given these findings, Brazilian indicators would reflect the financial constraints faced by manufacturing industries in the recent period, rather than giving information on *inherent* needs of manufacturing sectors.

Finally, two ideas are worthy to mention. The first point is that due to the relatively less

developed Brazilian capital market, the number of Brazilian publicly-traded firms operating in manufacturing sectors is limited. This would affect the robustness of the Brazilian indicators, even if these indexes are found to be robust to different constructions and periods of time. Moreover, the rationale behind the focus on publicly traded firms is that these firms are generally large and less constrained. This idea has not been approved by Terra (2003) and Aldrighi and Bisinha (2010) who found that firms traded in BM&F Bovespa are credit constrained. This can be considered as a limit of Brazilian measures. An alternative solution would be to calculate indexes of external finance dependence based on Chinese data. In fact, China is an emerging country that clearly outperforms Brazil in terms of financial development, and presents a stronger manufacturing sector (Table 1.1). Therefore, this country can be considered as the benchmark for emerging countries, in the present context. The second remark is with regards to RZ indexes. This paper considers, in the second part, that RZ indicators reflect *exogenous* intersectoral differences in terms of dependence on external finance. However, it is important to mention that the intersectoral technological differences would be different in developing and poor countries. In fact, poor countries fail to converge in terms of technological development (Dowrick and DeLong, 2003).

Overall, this paper adds to the literature on the importance of financial development in ensuring efficient allocation of capital. The relatively weak quality of the Brazilian financial sector seems to be behind the financial constraints encountered by Brazilian manufacturing sectors. The Brazilian government needs to set up additional reforms in order to relax credit constraints. Moreover, while the aim of BNDES was initially to relax these constraints, the statistics show that Brazilian public loans do not target the most financially vulnerable sectors. The efficiency of BNDES loans can therefore be questioned. Of course, this orientation of BNDES loans can be explained by the government strategy to develop certain sectors notably aeronautical industries (and Embraer more precisely). It is however crucial that the public financial support goes to other *naturally capital-intensive* sectors, in order to permit the development of the industrial production system.

## 1.8 Appendix

### 1.1 Measures of Financial Vulnerability Based on US Data

ISIC CODE	Industry	ExtFinUS 80s	ExtFinUS 90s	ExtFin No-Cr	RDUS	TangUS
314	Tobacco	-0,45	-1,14	-0,25	0,00	0,19
361	Pottery	-0,15	-0,41	-0,17	0,02	0,28
323	Leather	-0,14	-0,95	-0,14	0,01	0,12
3211	Spinning	-0,09	-0,05	0,14	0,01	0,38
324	Footwear	-0,08	-0,74	-0,21	0,01	0,13
372	Non-ferrous metal	0,01	-0,12	0,18	0,01	0,32
322	Apparel	0,03	-0,21	0,07	0,00	0,15
353	Refineries	0,04	-0,02	-0,19	0,00	0,62
369	Non metal products	0,06	-0,29	0,00	0,01	0,48
313	Beverages	0,08	0,03	0,03	0,00	0,40
371	Iron and Steel	0,09	0,05	0,26	0,01	0,44
311	Food products	0,14	-0,15	0,05	0,01	0,37
3411	Pulp and Paper	0,15	-0,07	0,06	0,01	0,60
3513	Synthetic resins	0,16	0,03	0,07	0,03	0,40
341	Paper products	0,18	-0,35	0,04	0,01	0,42
342	Printing and Publishing	0,20	-0,42	-0,04	0,01	0,21
352	Other Chemical products	0,22	-0,30	-0,03	0,02	0,27
355	Rubber products	0,23	-0,02	-0,09	0,02	0,36
332	Furniture	0,24	-0,38	-0,02	0,01	0,28
381	Metal Products	0,24	-0,25	0,08	0,01	0,28
3511	Basic chemicals	0,25	-0,19	-0,01	0,03	0,43
331	Wood products	0,28	0,05	0,24	0,01	0,32
384	Transport Equipment	0,31	-0,08	-0,04	0,02	0,23
354	Petroleum and coal	0,33	0,13	-0,11	0,01	0,46
3843	Motor vehicles	0,39	0,06	0,04	0,02	0,28
321	Textiles	0,40	0,01	0,43	0,01	0,31
382	Machinery	0,45	-0,04	0,03	0,02	0,22
3841	Ship Building	0,46	0,38	0,19	0,02	0,28
390	Other manufacturing	0,47	0,28	0,31	0,02	0,18
362	Glass	0,53	0,03	0,02	0,02	0,42
383	Electrical machinery	0,77	0,24	0,25	0,07	0,21
385	Professional equipment	0,96	0,72	0,26	0,09	0,16
3832	Radio	1,04	0,70	0,33	0,09	0,14
3825	Office and computing	1,06	0,54	0,60	0,10	0,14
356	Plastic products	1,14	-0,02	1,55	0,02	0,38
3522	Drugs	1,49	2,43	1,36	0,58	0,16

## 1.2 Descriptive Data

In this table, I present the sector composition of the sample of publicly-traded firms in BM&F Bovespa over 2000-2012, used to compute Brazilian indicators of financial vulnerability. Industries are classified using the Brazilian national classification CNAE 2.0.

**Table A.1.2.** Sector Composition

CNAE 2.0	Industry	Nb. Firms	%
10	Food Products	16	13.45
11	Beverages	1	0.84
12	Tobacco	1	0.84
13	Textiles	17	14.29
14	Apparel	4	3.36
15	Leather+Footwear	1	0.84
16	Wood products	3	2.52
17	Paper and products	3	2.52
18	Printing and Publishing	1	0.84
19	Petroleum and Coal products	3	2.52
20	Chemicals	10	8.4
21	Drugs	2	1.68
22	Rubber and Plastic products	1	0.84
23	Non-metallic mineral products	5	4.2
24	Iron and Steel	10	8.4
25	Metal products	9	7.56
26	Computer, Electronic and Optical products	5	4.2
27	Electrical machinery	4	3.36
28	Machinery	4	3.36
29	Motor vehicles	11	9.24
30	Other transport equipment	2	1.68
31	Furniture	1	0.84
32	Other manufacturing	5	4.2
Total		119	100

### 1.3 Brazilian Measures of External Finance Dependence: Robustness Checks

**Table A.1.3.1.** Different Constructions of External Finance Dependence Measures

In this table, I present Brazilian indicators of external finance dependence using different constructions. ExtFinBra 00-12 represents the original Brazilian measure computed over 2000-2012, using all available data for each firm in the sample. ExtFinBra 00-12 No-1obs is calculated based only on firms that are present for at least 2 years over 2000-2012. ExtFinBra 00-12 No-Var corresponds to the measure of external finance dependence in which internal funds are restricted to the cash flow from operating activities, i.e. without accounting for changes in payables, receivables and inventories. ExtFinBra 00-12 Consec is calculated by only considering firms with data for at least two consecutive years over 2000-2012. Finally, ExtFinBra 00-12 Consec No-Var is calculated by only considering firms with data for at least two consecutive years over 2000-2012, and only considering cash flows from operations as internal funds.

CNAE	ExtFinBra 00-12	ExtFinBra 00-12 No-1obs	ExtFinBra 00-12 No-Var	ExtFinBra 00-12 Consec	ExtFinBra 00-12 Consec No-Var
30	-6,94	-6,94	-8,20	-3,71	-5,36
15	-6,60	-6,60	-6,48	-6,60	-6,48
12	-6,54	-6,54	-6,42	-6,54	-6,42
11	-3,66	-3,66	-3,39	-3,66	-3,39
26	-3,20	-3,20	-1,81	-1,72	-0,95
22	-1,91	-1,91	-1,33	-1,91	-1,33
31	-1,41	-1,41	-1,37	-1,41	-1,37
18	-0,91	-0,91	-0,80	-0,91	-0,80
24	-0,76	-0,76	-0,60	-0,76	-0,60
23	-0,67	-0,67	-0,29	-0,67	-0,29
27	-0,41	-0,41	-0,18	-0,41	-0,18
20	-0,17	-0,17	-0,12	-0,17	-0,12
13	-0,12	-0,12	-0,07	-0,12	-0,07
25	-0,11	-0,11	-1,22	-0,11	-1,22
29	-0,10	-0,10	-0,10	-0,08	0,03
17	-0,09	-0,09	-0,06	-0,07	-0,03
16	-0,06	-0,06	0,01	-0,06	0,01
14	-0,04	-0,04	-1,09	-0,04	-1,09
19	0,03	0,03	0,07	0,03	0,07
28	0,26	0,26	0,29	0,26	0,34
32	0,32	0,32	0,45	0,32	0,45
10	0,37	0,33	0,63	0,31	0,61
21	1,99	1,99	2,79	-2,19	-1,34

**Table A.1.3.2.** Brazilian indicators computed over different periods of time

In this table, I present Brazilian indicators of external finance dependence calculated over different periods of time. ExtFinBra 00-12 represents the original Brazilian measure computed over 2000-2012. ExtFinBra 91-10 represents the Brazilian measure computed over 1991-2010, based on firms with data for at least two consecutive years. ExtFinBra 00-10 represents the Brazilian measure computed over 2000-2010, based on firms with data for at least two consecutive years.

CNAE	ExtFinBra 00-12	ExtFinBra 91-10	ExtFinBra 00-10
30	-6,94	-5,75	-5,75
15	-6,60	-2,80	-9,02
12	-6,54	-6,48	-6,48
11	-3,66	-3,46	-3,60
26	-3,20	-1,30	-1,72
22	-1,91	-1,42	-1,91
31	-1,41	-3,00	-3,00
18	-0,91	-0,51	-0,51
24	-0,76	-1,29	-1,29
23	-0,67	-0,17	-0,17
27	-0,41	-1,66	-0,71
20	-0,17	-0,28	0,13
13	-0,12	0,03	0,03
25	-0,11	-0,11	-0,11
29	-0,10	-0,31	-0,29
17	-0,09	0,09	0,08
16	-0,06	-0,24	0,00
14	-0,04	-0,27	0,00
19	0,03	-0,08	-0,08
28	0,26	-0,52	0,15
32	0,32	3,62	0,17
10	0,37	0,48	0,65
21	1,99	-2,99	-2,99

**Table A.1.3.3.** Correlations between Different Brazilian Asset Tangibility Measures

In this table, I display the coefficients of correlation between different asset tangibility measures. TangBra 00-12 is calculated based on available data over 2000-2012. TangBra 00-12 consec is calculated by only considering firms with data for at least two consecutive years over 2000-2012. TangBra 91-10 and TangBra 00-10 are measures of asset tangibility calculated over 1991-2010 and 2000-2010, respectively. \* denotes significance at 0.01 level.

	TangBra 00-12		TangBra 00-12 consec		TangBra 91-10	
	Pairwise	Spearman	Pairwise	Spearman	Pairwise	Spearman
TangBra 00-12	1.0000	1.0000				
TangBra 00-12 consec	0.9939*	0.9921*	1.0000	1.0000		
TangBra 91-10	0.9475*	0.9417*	0.9509*	0.9377*	1.0000	1.0000
TangBra 00-10	0.9866*	0.9852*	0.9877*	0.9753*	0.9556*	0.9328*

## 1.4 Financial Development Indexes - Rankings 2012

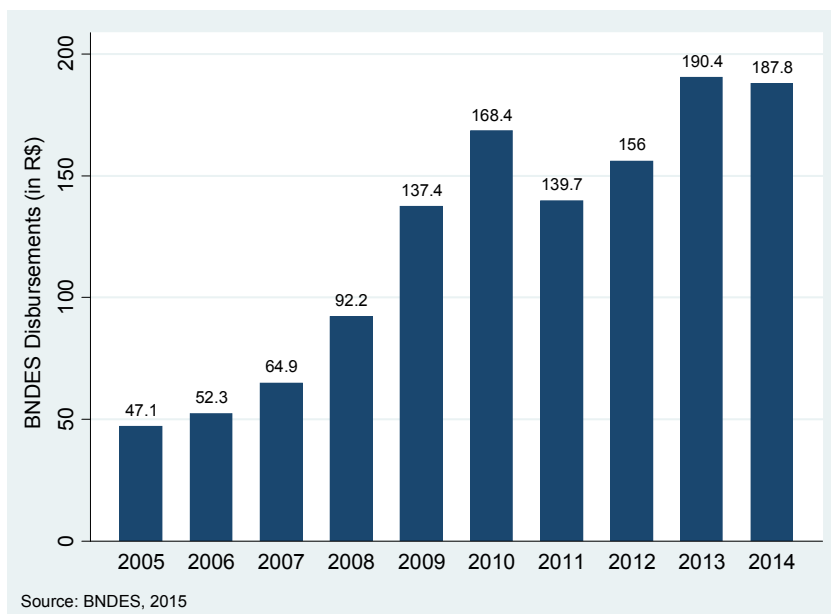
This ranking is based on countries' overall performances accounting for seven different pillars: institutional environment, business environment, financial stability, banking financial services, non-banking financial services, strength of financial markets and financial access.

Country / Economy	Rank 2012	Score (1-7)
Hong Kong SAR	1	5,31
United States	2	5,27
United Kingdom	3	5,21
Singapore	4	5,10
Australia	5	5,01
Canada	6	5,00
Japan	7	4,90
Switzerland	8	4,78
Netherlands	9	4,73
Sweden	10	4,71
France	14	4,43
Korea, Rep.	15	4,42
Malaysia	18	4,24
China	23	4,00
Saudi Arabia	31	3,68
Brazil	32	3,61
Jordan	33	3,56
Russian Federation	39	3,30
India	40	3,29
Peru	41	3,28
Turkey	42	3,27
Mexico	43	3,25

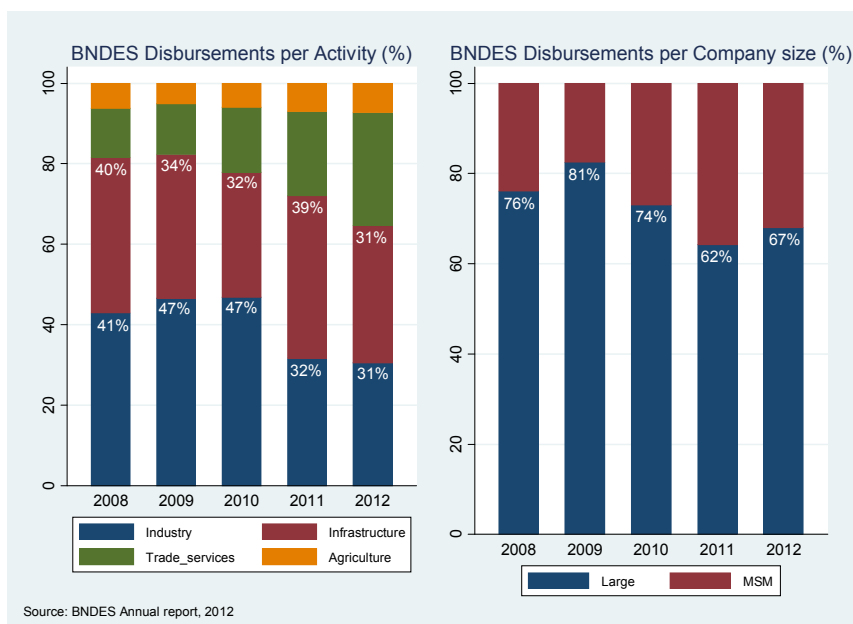


### 1.5 BNDES Disbursements

In this Appendix, I first present the evolution of BNDES disbursements in time. I then go into details by showing that BNDES disbursements target more infrastructure and manufacturing industries. These disbursements go particularly to large firms.



Appendix Figure A.1.5.1. BNDES Disbursements 2005-2014



Appendix Figure A.1.5.2. BNDES Disbursements per Activity and per Company Size (in %)



## Chapter 2

# Financial Constraints and Export Performances: Evidence from Brazilian Micro-Data

### Résumé

Malgré l'importance accrue du Brésil en tant qu'acteur mondial, les défis en termes d'exportation persistent. Alors que la littérature sur le commerce brésilien focalise l'attention sur les défis en termes de change, ce chapitre s'intéresse aux contraintes de financement. En se basant sur le cadre théorique de Manova (2013), ce chapitre fournit une étude empirique des effets des contraintes financières sur les exportations des firmes brésiliennes en 2010. Il s'agit plus précisément de revisiter l'effet de la taille de la firme sur les performances d'exportation, en présence de contraintes financières au niveau du secteur d'activité. Afin de prendre en compte les besoins de financement externe au niveau sectoriel, deux catégories de mesures ont été mobilisées: les mesures de l'hétérogénéité entre les secteurs *brésiliens* en termes d'accès au crédit, calculées dans le chapitre précédent, et les mesures de dépendance à la finance externe de Rajan et Zingales (1998) reflétant les différences *technologiques* intersectorielles. Les données douanières sur les exportations de firmes brésiliennes étant sur intervalles, la méthode d'estimation utilisée est donc la régression par intervalle (Conroy, 2005). Les résultats confirment l'effet positif de la taille, comme mesure de la facilité d'accès au crédit, sur les exportations des firmes brésiliennes. L'avantage lié à la taille baisse cependant lorsque les contraintes financières au niveau sectoriel sont prises en compte. Ces résultats confirment que les problèmes de financement affectent les performances d'exportation des firmes brésiliennes. D'autres résultats montrent que l'effet de la taille sur les exportations perd de son importance, surtout en considérant les *premiers* établissements de firmes installées au Brésil. Ce chapitre fournit aussi une idée sur l'importance des crédits publics fournis par le gouvernement brésilien, à travers la banque publique de développement BNDES, dans les performances d'exportation. Enfin, des résultats additionnels montrent que les contraintes de financement

*spécifiques* aux secteurs brésiliens ont eu moins d'effet sur le rôle de la taille des firmes dans l'explication de leurs exportations, pendant la crise financière de 2008.

**JEL Classification:** F10, F12, F14, G30, G32, L25

**Keywords:** Firm size, Sector-level External Finance Dependence, Exports, Brazil, Interval Regression

## 2.1 Introduction

Even with the growing role of Brazil as a global trader, it is widely recognized that export challenges persist. Gusso et al (2004) argue that the effects of export promotion policies, implemented in the 1990s, on exports did rarely last. Moreover, the appreciation of the currency is generally considered as a major factor that hampers Brazilian exporters. Compared to other emerging markets, Brazil has witnessed an important appreciation of the effective real exchange rate over the last decade, which translated into high export prices. A part from this factor, problems in access to finance also seem to impede Brazilian exporters' performances. Despite Brazilian reforms to restructure the financial system, financial intermediation in Brazil continues to lack efficiency. Precisely, Brazil falls behind other emerging and developed countries in terms of availability of private credit and liquid liabilities, and in terms of legal framework quality, as well (Beck et al, 2000). The underdevelopment of Brazilian financial system is particularly attributed to high inflation and real interest rates, resulting in a high cost of capital (Bittencourt, 2011). Besides, it seems that Brazilian government policies to reduce financing problems do not usually succeed. For instance, the efficiency of subsidized credit provided by the BNDES (Brazilian Bank of Development) remains a source of debate (Oliveira, 2014; Lazzarini et al, 2015). These factors result therefore in distortions in the allocation of capital between firms and between sectors, as well.

As argued in the literature, financial frictions affect firms' investments. Considering the exporting activity as a form of investment (Melitz, 2003), the aim of this paper is then to analyze the effects of financing constraints as determinants of Brazilian export performances. While the literature on Brazilian trade focuses on the effects of exchange rates (Bahmani-Oskooee et al, 2013; Chatterjee et al, 2013), this paper is one of the first works to be interested in the role of financing problems in explaining Brazilian trade.

As confirmed in the literature, the financial health of firms affects their investments (Aghion et al, 2010). In this regard, Bond et al (2007) argue that Brazilian firms are more likely to be credit constrained compared with Chinese ones. Moreover, a survey of Brazil's National Confederation of Industry (CNI) shows that large exporters do face constraints when dealing with their export activity. Based on these ideas, the present study analyzes Brazilian firm-level financial constraints by revisiting the role of firm size in export performances.

The literature on the determinants of international trade is marked by a growing interest in the role of finance and financing constraints. It has been particularly demonstrated that the financial underdevelopment in exporting countries impede export performances. Compared with domestic sellers, exporters are in a higher need for liquidity. This is particularly due to the additional fixed costs to be paid up-front when entering foreign markets and to the time gap between the production and the payment. The introduction of these financial constraints, in standard international trade models with heterogeneous firms (Melitz, 2003) leads the productivity cut-offs to be more restrictive, particularly in sectors with high external capital requirements (Manova, 2008; 2013; Rajan and Zingales, 1998). In other words, firms should be

more productive in order to remain profitable when entering the export market. In line with this context, a large empirical literature studying the peculiar characteristics of exporting firms has emerged. Firm size is generally considered to be associated with productivity, survival and profitability (Beck et al, 2005). Considering that, the positive link between firm size and export performances would be obvious (Calof, 1998; Williams, 2011). It is however not clear if in presence of financial weaknesses, large firms would perform better compared with smaller ones. On the one hand, large firms are assumed to have better performances which may make them less constrained (Beck et al, 2005). On the other hand, large firms are more likely to rely on external finance, and in this case, the underdevelopment of financial institutions would disproportionately hurt large firms. This paper attempts to provide an answer to this debate on the importance of firm size in a context of imperfect financial markets.

To summarize, this paper adds to the growing literature on the importance of financial frictions in explaining trade performances. Precisely, this paper considers the theoretical framework of Manova (2008; 2013) as reference, and analyzes the financial determinants of export performances of Brazilian exporters in 2010. This paper provides four main contributions. First, this paper is interested in the study of the Brazilian case. The gap between the Brazilian potential in terms of integration in the international market and the actual performances is puzzling. While the Brazilian economy was assumed to be one of the top economies, the performances during the last decades made some economists, such as Jim O'Neill (former Goldman Sachs economist), doubt about the legitimacy of Brazil's place in the BRICS group of emerging economies. As detailed before, the financial conditions in Brazil do not seem favorable to expanding investment activities, despite the efforts of Brazilian authorities to relax credit constraints over the last decades. Taking into account these Brazilian characteristics, I use measures of sector financial vulnerability<sup>1</sup> *specific* to the Brazilian manufacturing industries. These indexes are an adaptation of Rajan and Zingales' (1998, henceforth RZ) indicators of dependence on external finance, assumed to reflect sectors' differences in terms of external finance needs driven by their *technological* differences. Unlike RZ indicators, Brazilian measures calculated in a previous chapter would reflect the intersectoral differences in terms of external financing needs, taking into account the Brazilian context. In this way, the effects of the underdeveloped Brazilian financial sector would be reflected in the intersectoral heterogeneity in terms of needs of finance. This may lead the analysis to be subject to an endogeneity problem. In order to address this issue, I also make use of the original RZ indicators based on US data. The second contribution of this paper is to exploit firm-level data. Studies on the effects of credit constraints on exports at firm-level are rare, due to the difficulty of obtaining detailed firm data. In this regard, only data on *export ranges* are made available to the public, by the Brazilian customs service SECEX. This leads the econometric method to be based on Interval Regression (Conroy, 2005). Since this method is not familiar in the field of international trade, the third contribution of this paper would then be to use this method

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<sup>1</sup>By financial vulnerability, I refer to the need for external capital, i.e. the requirements in terms of funds provided by the financial and banking sector.

of estimation that copes with censored data. Finally, this paper revisits the link between firm size and export performances. In a framework à la Melitz, firm size would be a proxy of firm productivity. In a context of imperfect financial markets however, the relation between firm size and firm-productivity would be altered. Therefore, in this paper, firm size will be rather considered as a measure of firm-level financial constraints.

In this paper, I refer to export behavior in terms of export intensity, i.e. the intensive margin of trade<sup>2</sup>. I consider an exhaustive sample of Brazilian exporters in manufacturing industries in 2010. The choice of 2010 is motivated by the relatively fast recovery of emerging markets, after the financial crisis of 2008. Data on firm exports are provided by the SECEX. Data on firm size are mainly obtained from the Annual List of Social Information (Relação Anual de Informações Sociais, RAIS), a database of the Brazilian Ministry of Labor and Employment. In order to capture the sector-level financial vulnerability, I use Brazilian measures computed over the 2000s, which I proposed in the previous chapter of this thesis. These measures express the effects of the underdevelopment of Brazilian financial system on the intersectoral differences in terms of reliance on external capital. I also make use of US indicators which have been proposed by RZ and widely used in the literature. These measures would rather reflect the inherent needs of finance, i.e. those based on technological differences.

Using Interval Regression estimation method, the main findings of this paper confirm the importance of firm size as a predictor of export performances for Brazilian firms, and suggest that the advantage related to firm size loses of its importance when considering the financial constraints at sector-level. Large firms in Brazil perform less when accounting for the effects of Brazilian financial development on the allocation of capital resources between sectors. This result does confirm the role of the quality of financial systems in enhancing trade. These results remain globally robust to the control of firms' legal status and for the Brazilian regions' heterogeneity in terms of economic and financial development. The main conclusion remains also unchanged when considering the intersectoral differences in terms of *inherent* needs of external capital. Additional results show the importance of BNDES loans in boosting firms' exports, which suggests that these public loans can be considered as a source of distortion in the financial market. Finally, it seems that the worldwide credit shortage caused by the financial crisis of 2008 has led firm size to acquire greater importance with regards to exports, for firms operating in financially vulnerable sectors, compared to "tranquil" times (here the year 2010). Considering all these elements, the findings of this paper have important policy implications, notably with regards to the development of the Brazilian financial sector.

The remainder of the paper is organized as follows. The next section describes the Brazilian context with a focus on Brazilian exporters' constraints. The third section presents a comprehensive review of literature on the impact of financial frictions on international trade. In Section 4, I present the data. Section 5 presents the empirical analysis frameworks: theoretical background as well as methodological concerns. In Section 6, I properly study the

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<sup>2</sup>In terms of total trade values across different industries and destinations, for one exporting firm.

effects of firm size on Brazilian export performances with a focus on Brazilian sectors' *specific* financial characteristics. A number of robustness checks are then presented. Section 7 focuses rather on the manufacturing sectors *inherent* needs of external capital, and explores the effects of the recent financial crisis of 2008. The last section concludes.

## 2.2 Zoom on the Brazilian context

Brazil has experienced an industrialization process since the 1950s. This process has begun with an import substitution strategy which boosted the economy's productivity, and permitted to switch from a typical exporting country of primary products to a more diversified economy (Suzigan et al, 2007). This industrialization has been however accompanied with protectionist strategies, in order to enhance the development of domestic industrial structure. Beginning with the Real Plan<sup>3</sup> in the early 1990s, Brazil has moved towards a more opened economy, which has resulted in an expansion of Brazilian trade (Figure 2.1). While imports have benefited from a gradual reduction in tariffs, the expansion of exports was particularly supported by export subsidies.

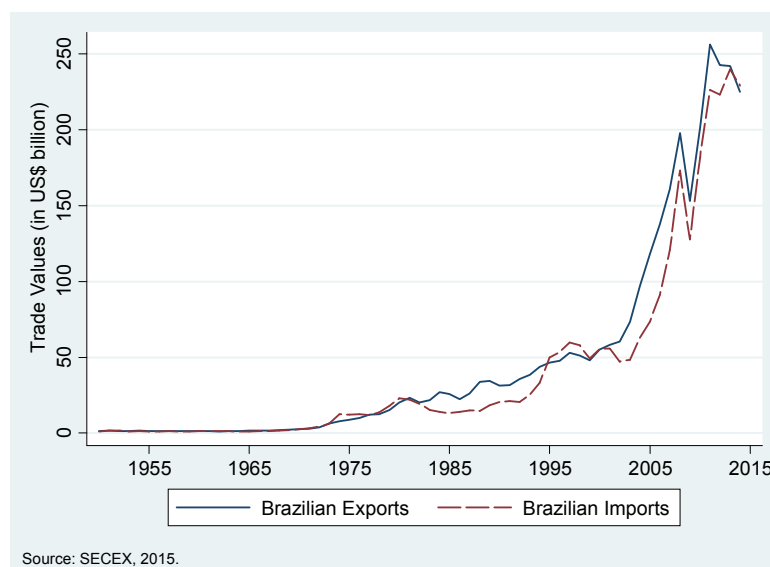


Figure 2.1: Evolution of Brazilian Trade 1950-2015

At the same time, a number of reforms have been undertaken in order to improve the economy's growth. Brazil has witnessed in this decade of reforms (Baumann, 2001) a wave of privatizations and a restructuring of the financial market in order to facilitate the access

<sup>3</sup>The plan "Real" consists in a financial program initiated by the Brazilian government in the mid-1990s. This plan introduced a new currency "the Real" and an exchange rate which was partially linked to the US dollar, limited government spending and made other fiscal reforms.



to credit and encourage the inflows of foreign capital. In the 2000s, Brazilian trade continues to grow as it can be shown in Figure 2.1. This was motivated by a favorable international environment and an increase in Brazil's export prices (Cardoso, 2009).

Focusing on the manufacturing sector, the development of the Brazilian industry has led to a shift of resources towards industrial activities. This can be illustrated by an increase in the share of manufacturing exports, to reach 60% of the total exports in 1993. The importance of manufactured goods has been however reduced in the last decade (Figure 2.2). In 2010, manufacturing goods account only for 39% of the total Brazilian exports. While the Brazilian economy represents the seventh economy in the world, it comes only at the 22<sup>th</sup> position in terms of exports, and at the 29<sup>th</sup> position when only considering manufacturing exports (CNI, 2014). It seems that despite the wave of reforms, Brazil does not well exploit its potential of international trade, compared to other BRICS countries (Canuto et al, 2013). Even if the Brazilian economy is mainly based on the domestic consumption, it is interesting to analyze the barriers behind the low expansion of Brazilian exports. The Brazilian domestic demand accounts only for 4% of the world demand. Expanding exports would then permit to the Brazilian economy to increase its role as a global supplier. According to Bonelli and Pinheiro (2012), the Brazilian economy is facing important competitiveness challenges. Brazil's National Confederation of Industry (CNI) conducts surveys on a number of Brazilian exporters in order to capture the main problems behind the low performances in terms of international trade. The results of the survey based on data for 2011-2012 are displayed in Figure 2.3.

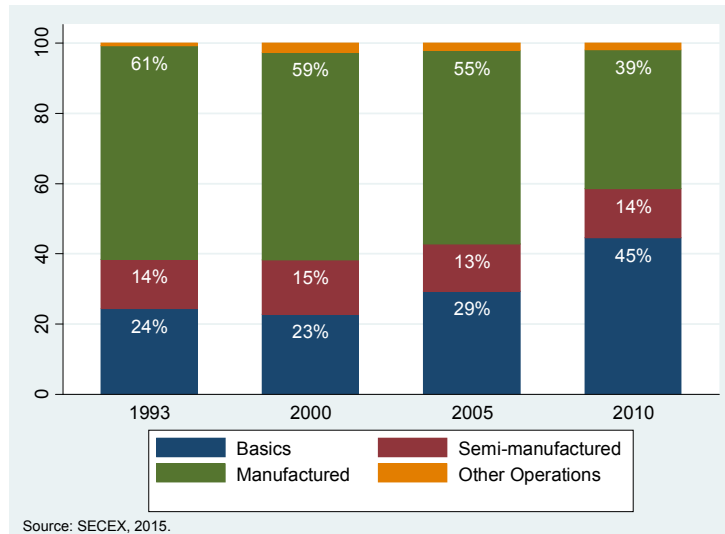


Figure 2.2: Share of Manufacturing in Brazilian Exports

Unsurprisingly, the appreciation of the Brazilian Real seems to be the main constraint to exports. The results also show that imperfections in the business environment present impediments to export expansion, as suggested by Canuto et al (2013). A part from bureau-

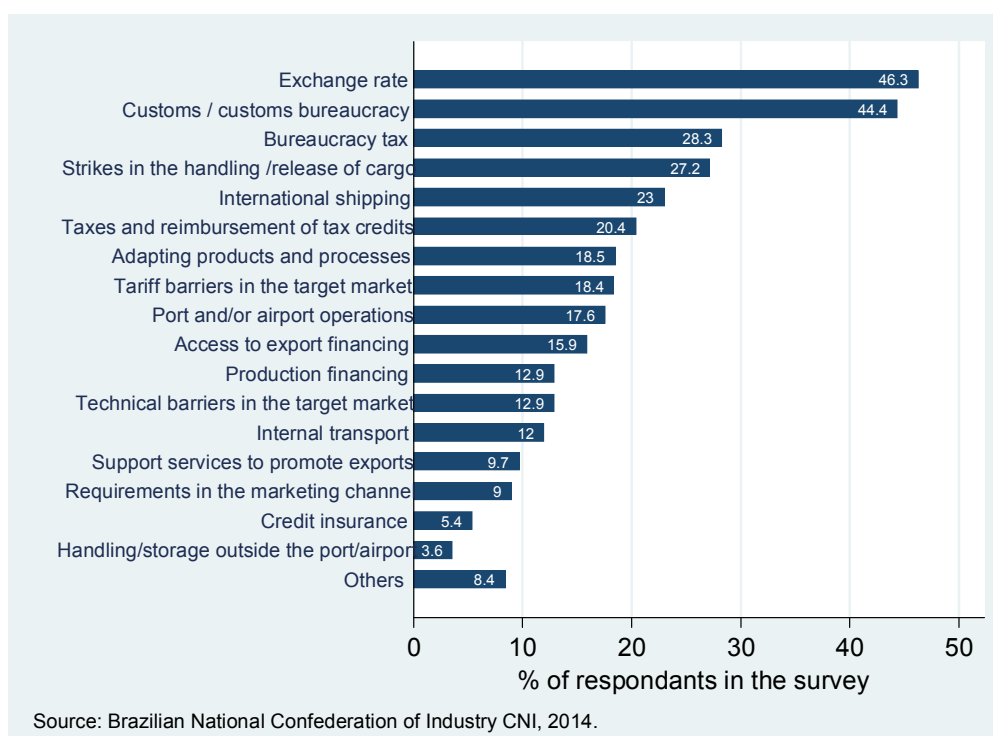


Figure 2.3: Main Barriers to Brazilian Exporters -2012

cacy, problems of financing emerge as an important constraint for exporters. On the one hand, 13% of the respondents consider that financing production activities is an important issue with regards to exporting activity. On the other hand, 16% of exporters in the survey declare having problems in the access to credit lines specific to the exporting activity. These problems of financing could be reflecting the Brazilian context characterized by a high cost of capital and underdeveloped financial institutions. Consistent with this fact, Araujo and Pianto (2010) argue that the novice exporting culture combined with the lack of credit, among other factors, can cause a firm to exit the export market.

Export financing problems are particularly surprising since the Brazilian economy has multiplied the incentives to promote exports, notably financial ones. Among these instruments, one can cite the Project for Export Financing (PROEX). This project is conducted by the Brazilian central bank and aims at providing credit to exporting firms, especially small ones. Moreover, since 1990s, financing exports has been of a major interest for the Brazilian development bank BNDES. This public bank, founded in 1952 to support the development of the Brazilian economy, offers different credit lines at lower interest rates, compared with market rates. In order to promote the industrial activity, the BNDES offers FINAME credit line (Agency for Industrial Financing) which finances the acquisition and the sale of equipment and machines, domestically and internationally. This bank also offers two BNDES-EXIM credit lines specific to the export activity. Pre-shipment lines finance the production of in-

ternationally competitive companies, established under Brazilian law, whereas post-shipment credits finance the trade of goods and services abroad by refinancing the Brazilian exporter, or by financing the corresponding importer. Although these different financing tools exist, the access to finance seems to constitute an obstacle when expanding activities to foreign markets. A number of the respondents in the CNI's survey argue that the access to these instruments is difficult due to the real guarantees required by the financing agencies; this would refer to the importance of tangible assets as collaterals when contracting a loan (Braun, 2003).

Another finding of the CNI's survey is that 73% of large exporting firms confirm encountering difficulties when exporting. This result puts into perspective the literature suggesting a positive link between firm size and firm's export performances. While the link between firm size and firm's exports seems to be evident, the distortions in the Brazilian market could alter this positive relation. As said before, the Brazilian context -characterized by a high cost of capital and underdeveloped financial institutions- results in a problem of credit availability, which negatively affects firms' investments, notably those related to exporting activities. These constraints could be even stressed after the recent crisis of 2008, due to controls of capital implemented by the Brazilian government (Alfaro et al, 2014).

The literature generally associates large firms with softer credit constraints. Using panel data for Brazilian firms for the period 1986-1997, Terra (2003) finds that investment decisions are affected by credit constraints, and that Brazilian firms are indeed liquidity constrained. The findings show also that these effects are softer for largest firms and for multinational companies. Besides, Crisostomo et al (2012) confirm, through a study on a panel of 289 nonfinancial firms over 1995-2006, that credit constraints impede firms' investments, especially for smaller firms. Investments of small firms are found to be more reliant on *internal* funds, compared with large firms. These results are confirmed in Kumar and Francisco (2005), who analyze the findings of the Investment Climate Assessment Survey conducted by the World Bank in 2003. If large Brazilian firms are less constrained, one would thus question about the efficiency of BNDES targeting. In fact, BNDES disbursements go especially for large firms and not small and medium ones (See Chapter 1, Appendix Figure A.1.5.2.). While these works associate the firm size with less credit constraints, Aldrighi and Bisinha (2010) propose an opposite view. The authors find that the sensitivity of investment to internal cash flows increases with the firm size, suggesting that credit constraints are higher for large companies. More recently, Faleiros (2013) proposes that while firm size, being listed and export capacity are associated with less credit constraints, small firms can also exhibit higher export revenues. These results make it interesting to *revisit* the link existing between, firm size, credit constraints and export performances of Brazilian firms.

## 2.3 Financial factors and Exports: Review of literature

The past two decades have witnessed an increasing interest in the study of the link between financial factors and real outcomes. A number of theoretical and empirical researches have shed the light on the role of financial development in the economic growth (King and Levine, 1993; Rajan and Zingales, 1998; Bas and Berthou, 2012). Similarly, a body of literature has been interested in the effects of financial development on export performances. In particular, it has been demonstrated that the quality of financial institutions presents a comparative advantage with regards to exports, especially in industries with higher external capital needs (Kletzer and Bardhan, 1987; Beck, 2003; Hur et al, 2006). The existent literature usually uses the amount of credit provided by the financial system to the private sector (as percentage of GDP) as proxy for financial development. This assumes similar access to the external finance for firms within a country (Minetti and Zhu, 2011).

More recently, a growing body of literature has been interested in the effects of financial constraints on *firm* export behavior. The importance of financial constraints for exporting companies can be assessed in different manners. Compared to domestic sellers, exporters face bigger liquidity constraints, as exports need generally a longer time lag between the production and the receipt of revenues. International activities incur also bigger risks. They are generally risks related to the lack of information on the foreign clients. Moreover, exporting activities require fixed costs before entering the international market. These costs include market exploration, creation of subsidies in the foreign markets, etc. Taking these elements into account, Melitz (2003) proposes a model of heterogeneous firms, in which entering the export market requires the payment of up-front costs that can be seen as an investment. This model suggests that, in a context of perfect financial markets, only *productive* firms can enter the export market. This model has been then extended to allow for imperfect financial markets. For instance, Manova (2013) assumes that exporters should borrow funds from the financial system to finance a part of their costs related to the export activity, and present collaterals. The financial frictions affect the export participation (extensive margin of trade) and the export performances (intensive margin of trade), as well. Their effects on productivity cut-offs are found to be more pronounced for firms in sectors with higher external financing needs, especially in countries with poor financial institutions. Similarly, Chaney (2013) considers credit frictions as determinants of exports at firm-level. The author argues that liquidity constraints are linked to the firm's productivity: more productive firms have larger profits and, they are consequently less constrained. Despite the differences in terms of financial constraints' assessment, both works have pointed the weight of firms' characteristics in the span of liquidity constraints they may face.

These theoretical contributions to the literature on international trade have been supported empirically. Using data on a panel of UK manufacturing firms over the period 1993-2003, Greenaway et al (2007) confirm that firms' financial health does matter for exporting decisions. Muûls (2008) shows that credit constraints do matter for the exports of the Belgian

manufacturing sector. The findings demonstrate that the firms which present higher productivity and less liquidity constraints are more likely to export. Berman and Héricourt (2010) provide evidence that liquidity constraints do affect exports in 9 emerging countries. To proxy liquidity constraints, the authors use some variables and ratios from firms' balance-sheets. Similar results are found by Minetti and Zhu (2011) who made a survey to get information on credit constraints and export volumes for small and medium Italian firms. The authors define two measures that reflect two different intensities of credit rationing. Their results also suggest that the effects of credit rationing on the participation to export and the overall sales, differ across firms and sectors. Bellone et al (2010) also analyze the importance of financial constraints in explaining firm export behavior using French data. The authors construct measures of firm-level financial constraints based on size, profitability, liquidity, cash flow generating ability, solvency, trade credit over total assets, and repaying ability, following Musso and Schiavo (2008). Their findings confirm the importance of better access to finance in explaining firms' export behaviors.

As proposed by Manova (2013), financial constraints are even sharper for firms operating in sectors with high external finance needs and/or few tangible assets. This innovation is initially suggested by Rajan and Zingales (1998, henceforth RZ) who define a sector-level index of external finance dependence, based on US firm-level data. This index has been then used to assess financial constraints at sector-level. Based on this innovation, Manova et al (2011) use detailed data on Chinese exporters in 2005 and find that multinational and joint venture companies export more than domestic firms, especially in sectors with high external finance needs. The importance of financial constraints with regards to international trade performances has been highlighted during the recent crisis of 2008. Bricongne et al (2010), for instance, show that during the global crisis, the exports of French firms in financially vulnerable sectors were more affected. Paravisini et al (2012) focus on the *supply* side of credit during the crisis, and show using data on Peruvian banks, that a shrink in credit supply by the Peruvian banking system causes a reduction in export volumes but does not significantly affect the extensive margin of trade. Their findings show however a constant elasticity of exports to credit across the different characteristics of firms, sectors or export flows. These different results make it interesting to consider the intersectoral heterogeneity in terms of needs of external finance when studying the effects of financial constraints on export performances.

Focusing on financial constraints at firm-level, a wide range of measures are proposed in the literature. The sensitivity of investment to cash flow has long been used as a proxy for liquidity constraints (Fazzari et al, 1988). The pertinence of this measure has however been questioned in the literature (Kaplan and Zingales, 1997; Bellone et al, 2010). Alternative firms' characteristics have been suggested as proxies for credit constraints. As detailed before, Manova et al (2011) consider firm ownership as a proxy of firm constraints. Multinational companies can be financed in the domestic market and in foreign market, which makes them

have better access to finance compared with domestic firms. Firm size has also been considered as a factor that affects firm's financing patterns (Hadlock and Pierce, 2010). Demirgüç-Kunt and Maksimovic (1999) find that large firms have more long-term debt as a proportion of their total assets, compared to small firms, which shows that they have better access to external finance. Using data on US small firms in the 1980s, Levenson and Willard (2000) suggest that credit constrained firms are smaller, younger and more likely to be owned by their founders. Large firms are thus generally associated with less credit constraints. Given the market failures that characterize Brazil, the link between financial constraints and firm size could be altered. This paper adds to the literature on financial constraints by considering firm size of Brazilian exporting firms as a measure of financial constraints.

Moving to the link between firm size and exports, the proposition that firm size is positively associated with export performances is often taken for granted. However, the literature does not definitively support this proposition. Based on a survey of Thai exporting firms, Archarungroj and Hoshino (1998) find that larger firms do not evidently perform better than smaller firms. Moreover, Verwaal and Dronks (2002) find that the positive link between firm size and export intensity is affected by the size of export relationship. More recently, Berthou and Vicard (2013) find, using French data, that the effect of firm size on the export growth of surviving exporters is non-monotonic. These results contradict the common perception about the link between firm size and export performances. This paper contributes to the literature on the effect of firm size on export performances, with a focus on Brazilian exporters. This question is particularly relevant for the Brazilian case, since an important number of large firms in the Brazilian CNI's survey declared encountering difficulties to export, as detailed in Section 2.

## 2.4 Data

### 2.4.1 A database on Brazilian exporters in 2010

I use data from two main sources. Data on Brazilian exporting firms come from the Brazilian Secretary of External Trade (*Secretaria de Comercio Exterior*, SECEX). Data on firm characteristics come from the Annual List of Social Information (*Relação Anual de Informações Sociais*, RAIS), a database of the Brazilian Ministry of Labor and Employment.

Data on annual firm-level exports in 2010 are provided by the SECEX. This secretariat records every legally registered export transaction from Brazilian firms. The SECEX provides information on all exporting firms. Data are provided at the plant-level<sup>4</sup>. Each establishment is identified by a unique 14-digit tax identifier CNPJ (*Cadastro Nacional de Pessoa Jurídica*). Detailed data on exports are confidential. I only make use of the publicly available data. These include the export value range in U.S. dollars (FOB) and the region in which the firm

<sup>4</sup>Different establishments of a same company are considered as distinct entities.

operates<sup>5</sup>. Five export ranges are defined by the SECEX: less than \$1 million, between \$1 million and \$10 million, between \$10 million and \$50 million, between \$50 million and \$100 million and more than \$100 million. Given that the coverage of export data is limited in the Worldscope data, access to data from the customs service SECEX is a key differentiator of this study (Alfaro et al, 2014). Using data on exporting firms in 2009, I also get information about the survivors in 2010, i.e. firms that remain present in the export market in 2010.

The present empirical study accounts for financial constraints at industry-level; therefore, I need to get information about the sectors in which exporting firms operate. To do that, I match the legal identifiers of the firms in my sample (CNPJs) with the sectors in which these firms *mainly* operate, using data from the Brazilian Ministry of Finance (*Receita Federal do Brasil*). This step required hand data collection from the website of the Ministry of Finance. Industries are classified following the Brazilian national classification of economic activities CNAE 2.0. I restrict my sample to exporting firms for which the main activity is in the manufacturing sector, i.e. in the subclasses ranging from 10 to 32. Note that a firm can export different products in different sectors. Here, due to data unavailability on the details of the different goods a firm exports, I assume that a firm's exports are of goods that correspond to its main economic activity. Although this assumption is restrictive, it is unlikely to bias my study concern which is to test how sector financial constraints affect the export performance of the firm. In general, the financial system only checks the main activity of a firm when deciding of the eligibility of the firm to get a loan. By exploiting the same source of data, I have also collected data on the legal status of the firm, i.e. whether the firm is the main establishment (*Matriz*) in Brazil or an affiliated establishment (*Filial*). I use these data in order to capture the differences between parent firms and affiliated companies in the access to external finance. Here, the term "parent" does not necessarily refer to the headquarter company; it rather refers to the first establishment of a company (Brazilian or foreign) in Brazil.

Data on firm size are provided by RAIS database. This database covers annual social information on Brazilian firms in the formal sector. Available data cover 2009-2011<sup>6</sup>. These data include the number of employees and the wage bill in Reais R\$, at plant-level. These variables are considered as proxies for firm size. Additional data on firm size are obtained from ORBIS database, provided by Bureau Van Dijk for the OECD and gathering firm level data for over 7 million firms all over the world. The data available include a size indicator with four levels: small, medium, large, and very large. The definition of the size is based on a number of proxies of size: the number of employees, firm turnover, total assets and being listed (See Appendix 2.1). This size indicator is used in the robustness checks section.

I then move to data on industry measures of financial constraints. In order to capture

<sup>5</sup>Information on regions will permit to control for the region heterogeneity in terms of economic and financial development, that characterize the Brazilian economy.

<sup>6</sup>I need to thank Marta dos Reis Castilho, Universidade Federal do Rio de Janeiro, for facilitating the access to this database.

intersectoral heterogeneity in terms of financial vulnerability, I use two measures of sector reliance on external funding, computed over Brazilian data and presented in a previous chapter (See Appendix Table A.2.2.1). The first measure is the external finance dependence ( $ExtFinBra_s$ ), defined as the share of capital expenditures that are not financed by the cash flows from operations. This measure is an adaptation for RZ index, of external finance dependence, to Brazilian sectors over the recent period of 2000-2012. The second measure is the level of asset tangibility (Braun, 2003) of Brazilian industries ( $TangBra_s$ ) computed over the same period. These measures are meant to reflect the financial constraints for Brazilian industries, taking into account the Brazilian context, notably the distortions in the financial market. These measures are found to be *positively* correlated, which suggests that sectors relying on external funds are those that present many tangible assets. Given the Brazilian context, this finding informs about the ease of access to credit in Brazil, rather than the *inherent* needs in terms of outside capital. In order to capture more characteristics of the Brazilian financial sector, I also make use of data on BNDES disbursements per sector in 2010, as a control variable. These data are provided at a monthly basis by the BNDES.

I finally consider the *inherent*<sup>7</sup> needs of industrial sectors by using US indicators of external finance dependence and of asset tangibility borrowed from the literature. These indicators have been originally proposed for US manufacturing sectors over the 1980-1989 by RZ and Braun (2003), respectively. In this study, I consider however their updated values from Kroszner et al (2007, See Appendix Table A.2.2.2). The authors computed these indicators denoted  $ExtFinUS_s$  and  $TangUS_s$  using US data, over 1980-1999. They also propose R&D intensity as a proxy for sector-level financial needs. This measure ( $RDUS_s$ ) is defined as the share of R&D expenses in the total sales, and also computed over 1980-1999. In fact, R&D expenditures are incurred at the beginning of the production process and are considered as up-front fixed costs, which are in general large costs especially when the product will be distributed in a foreign market (Manova, 2013). I focus on measures provided by Kroszner et al (2007) in order to guarantee the comparability between different measures of financial vulnerability<sup>8</sup>. In fact, while these indicators are supposed to reflect intersectoral heterogeneity in terms of financial needs, *stable in time*, there exist some factors that may affect the stability of intersectoral differences, in time (ref. Chapter 1).

### 2.4.2 A first glance at Data

Before going into the econometric analysis, I begin by presenting statistics of the database on Brazilian exporting firms in the manufacturing sector, in 2010. First, there are 20137 exporting firms recorded by the SECEX in 2010. Among them, 12964 companies operate in the manufacturing sector. Due to data unavailability, the final sample of exporting firms

<sup>7</sup>Based on the quality of financial institutions in the US, the US market is considered as the *least distorted* financial market. Therefore, intersectoral differences in terms of external finance needs in the US are considered as benchmarks and as reflecting as precisely as possible intersectoral *technological* differences.

<sup>8</sup>computed over the same period 1980-1999.



Table 2.1: Export Performances, Export Status and Legal Status

Interval of Exports in million US\$	New Exporters			Survivors			Total
	All	Parent	Affiliated	All	Parent	Affiliated	
Exp< 1	1983	1739	244	6844	6151	693	8827
1<Exp<10	115	53	62	2420	1849	571	2535
10<Exp<50	32	10	22	787	444	340	819
50<Exp<100	5	0	5	175	86	89	180
Exp>100	7	2	5	188	75	113	195
Nb. Obs.	2142	1804	338	10414	8605	1806	12556

considered in this study is of 12556 exporting firms, which represents a comprehensive sample of manufacturing Brazilian exporters in 2010. Focusing on the sector composition of exporting firms in 2010, Machinery and Equipment, Food products, and Chemicals are the most represented in the sample (Appendix Table A.2.3.1). Summary statistics on all variables in this study are displayed in Appendix Table A.2.3.2. In Table 2.1, I present some descriptive statistics for the whole sample and also for different classifications of firms. A first remark is that the majority of Brazilian exporters export less than 1 million US\$. The number of exporting firms decreases with the export ranges. These exporting firms are then classified depending on their export status into "New Exporters" for those that did not export in 2009 and "Survivors" for those which have already exported in 2009. The descriptive data show that exporters in 2010 are mainly survivors. This finding corroborates the low entry rate to the export market, which characterizes the Brazilian market (Cebeci et al, 2012; Canuto et al, 2013).

I also classify firms according to their legal status separating those corresponding to first establishments in Brazil (Parent) from affiliated establishments (Affiliated). Exporting firms in 2010 are mainly first establishments in Brazil.

In Table 2.2, I present some descriptive statistics on the exporters' characteristics, mainly those related to firm size. Consistently with the empirical literature on export performances, I find that Survivors tend to be significantly larger and to present higher wage bills and higher wages. Larger firms are more likely to generate revenues and to meet the financial needs related to the exporting activity, which makes them more likely to remain active in the exporting market. These statistics could also inform about the potential *learning by doing* effects, through which the exporting activity makes firms larger. Focusing on the legal status, it seems that Affiliated exporting companies are larger and pay higher wages, compared with main establishments. This finding could be explained by Brazilian firm strategies related to tax legislation.

I finally divide the sample of firms into firms operating in sectors with high *inherent* external finance requirements (High Dep.) and those operating in sectors with negative external finance dependence (Low Dep.)<sup>9</sup>. Appendix Table A.2.3.3 suggests that exporters operating

<sup>9</sup>Sectors with a positive value of ExtFinUS are considered as dependent on external finance. The remaining

Table 2.2: Firm Size, Export Status and Legal Status

Variable	All	Export status		Legal status	
		Survivors	New Exporters	Parent	Affiliated
Number of Employees	216.9817	582.1265	102.415	171.6208	437.2696
Wage Bill	508591.5	1836623	205744.7	394181.6	1064206
Wage Per Worker	2191.312	8895.562	1805.907	2103.427	2626.456
Nb. Obs.	12556	10414	2142	10412	2144

in sectors that are reliant on external capital tend to be slightly larger than those operating in sectors with low needs in terms of external capital. These statistics do not allow however to give precise conclusions about the importance of firm size depending on sector-level financial constraints. The importance of firm size coupled with sector-level financial vulnerability in explaining Brazilian exports will be properly discussed in the following sections.

## 2.5 Empirical Analysis

In this section, I begin by presenting a simplified framework of heterogeneous firms in a context of imperfect financial markets. I then present the main specification of the paper. Finally, I discuss the methodology of estimation which fits available data.

### 2.5.1 Theoretical framework

The literature has provided a number of theoretical frameworks in which credit constraints affect international trade patterns differently across sectors and countries. Here, I consider a simplified framework inspired from Manova (2013). This framework is based on the predictions of Melitz (2003) extended to account for financial market imperfections (Appendix 2.4).

Entering the foreign market requires the payment of up-front costs including lands, equipment, marketing adaptation, commercialization channel, in order to make the foreign activity possible. The exporting activity is generally associated with higher needs for liquidity, compared with domestic activities. Given these facts, assume that exporters need to borrow capital from the financial market, by pledging collateral. The probability for the contract between the exporting firm and the financial market to be enforced depends on the level of financial development in the exporting country. If the contract is enforced, the firm repays the investor; otherwise, the creditor claims collateral. The level of dependence on external finance and the availability of tangibles assets (*collateralizable* assets) differ however across sectors. This makes some exporters more credit constrained than others. In presence of these financial constraints, the productivity cut-off above which the exporting activity becomes efficient is higher than the threshold in the absence of financial frictions.

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sectors are considered to have negative external finance dependence.

If firms require external funds to finance a part of their fixed costs only, liquidity constraints will then only affect their selection into the export market. However, when firms require raising outside capital in order to finance a part of their fixed and variable costs, credit constraints will affect the selection into exporting and the value of their exports, as well. Unlike most productive exporters, less productive and more constrained firms will not be able to export at first-best and will be more likely to ship lower quantities. By lowering export volumes, these firms lower their variable costs which make them need less outside funds, depending on their sector of activity of course. Since the aim of this paper is to analyze the intensive margin of trade, I assume that firms need external capital to finance both their fixed and variable costs.

In a context of firm heterogeneity with perfect financial markets, the size of the exporting firm could be associated with higher productivity. Financial market frictions do however create distortions in the link between firm size and productivity. In presence of financial imperfections, firm size would be rather considered as a measure of liquidity constraints. Firm size is generally considered as a convenient approximation of firm resources, notably financial ones. Unlike small firms, large firms are supposed to generate larger cash-flows, which make them less credit constrained (Chaney, 2013). Moreover, in the presence of financial frictions, the literature proposes that the adverse effects engendered by information asymmetries can be reduced by the provision of collateral (Angelini et al, 1998). Since large firms tend to have more assets for collateral, their access to finance would be facilitated. Consistent with this idea, larger firms in Brazil are found to have better access to credit (Kumar and Francisco, 2005). Given these elements, firm size is considered to reflect the ability to access t

o finance. As said before, there are intersectoral differences in terms of external financial needs, which may stress firms' financial constraints. The common perception predicts that the advantage related to firm size is stressed in sectors with higher financial needs. However, when accounting for the Brazilian context, this relation would be altered. The Brazilian market is characterized by a high cost of capital which may hamper investment activities of those firms with higher needs of external capital, even if they are large firms.

To summarize, I consider that companies require external funds to finance both fixed and variable costs and I will be particularly interested in the study of the value of exports of Brazilian exporters. I expect that credit constraints, impede the intensive margin of trade. These effects should be reduced for larger firms. The importance of firm size in financially vulnerable sectors is however mitigated, given the Brazilian context.

### 2.5.2 Main specification

The purpose of this analysis is to assess the effects of financial constraints on export performances of Brazilian exporters. The estimation strategy is based on the idea that large firms are less credit constrained than smaller ones, and that the effect of sector level financial vulnerability on export performances varies across firm sizes.

I thus study the variation in trade flows depending on the firm size and the sector in which the exporting firm operates with the following specification (2.1):

$$LEXP_f = \beta_0 + \beta_1.Lsize_f + \beta_2.Lsize_f \times FinVul_s + \beta_3.Parent_f + \beta_4.Exp09_f + \varphi_s + \varepsilon_f \quad (2.1)$$

where  $LEXP_f$  is the (Log) value of exports in US\$ of firm  $f$  (in all industries and across all destinations) in 2010, which is an unobservable (latent) variable. As detailed in Section 4, the SECEX provides *rather* ranges of exports. The characteristics of this dependent variable will be dealt with in the methodological Subsection 5.3.  $Lsize_f$  is a variable indicating the size of the firm  $f$  in 2010<sup>10</sup>. Two proxies of firm size are considered: the (Log) number of employees  $lemployees_f$  and the (Log) value of wage bill  $lwageb_f$ . Considering that larger firms are less credit constrained,  $\beta_1$  is then predicted to be positive.  $FinVul_s$  measures the sector  $s$ 's level of financial vulnerability in Brazil. I use two proxies for the financial vulnerability: the external finance dependence indicators for Brazilian manufacturing industries computed over the period 2000-2012 ( $ExtFinBra_s$ ) and the level of asset tangibility for Brazilian sectors computed over the same period ( $TangBra_s$ ).  $Parent_f$  is a dummy variable that controls for the legal status of the exporting firm  $f$ . This dummy takes the value of 1 if the firm corresponds to the *first* plant of a given company (domestic or foreign) established in Brazil, and 0 otherwise.  $Exp09_f$  is a binary variable that controls for the export status of the firm  $f$ . This variable equals 1 when the exporting firm in 2010 has been already an exporter in 2009 (Survivor) and 0 if the firm is a new exporter. This variable may control for the entry rate to the foreign market and for the firm's financial constraints, as well. In fact, as proposed in the theoretical framework described above, entering the export market requires the payment of sunk fixed costs. Being already an exporter in 2009 could be then seen as a form of financial constraints' relaxation in 2010, since the exporter will have paid, in principal, the important part of export-related fixed costs in 2009 or earlier. Thus,  $\beta_4$  is expected to be positive. Finally, I include sector-level fixed effects  $\varphi_s$  that capture all the characteristics inherent to manufacturing sectors in Brazil, including the need for external finance. Since the study is in cross-section,  $\varphi_s$  would also capture information on the level of financial support obtained by the sector in 2010. Here, I particularly refer to the government intervention into the financial sector through BNDES public loans. Since data on exports are at plant-level, further firm groups effects would be interesting to add, in order to capture the managerial strategy of the company and the allocation of resources across different plants. However, due to technical constraints, these effects cannot be included<sup>11</sup>.

<sup>10</sup>One could use the value of firm size in 2009. This would however have engendered a loss of observations on exporting firms in 2010.

<sup>11</sup>Two problems would arise when including firm groups fixed effects. First, we could have a problem related to the number of degrees of freedom since among 12556 observations, there are more than 12000 distinct groups of firms. Second, the estimation of models with more than 12000 variables would require the use of a more powerful software program such as SAS. This step will be tackled in a future version of the paper.

The main coefficient of interest is the interaction term between firm size and the financial vulnerability of the sector.  $\beta_2$  reflects the allocation of capital resources in Brazil across sectors with different levels of reliance on external capital. Specifically,  $\beta_2$  quantifies the effects of credit constraints on firm exports. While a firm's access to finance may be endogenous to the trade activity, including the financial constraints at sector-level helps establishing the causality (Rajan and Zingales, 1998). If credit constraints impede trade, I then anticipate that financially vulnerable sectors export less. Considering the effect of firm size however, two interpretations could be presented. In principal, larger firms are less credit constrained compared with smaller ones and they are by consequence, supposed to be more performant in sectors that highly depend on external finance ( $\beta_2 > 0$ ). In fact, large firms are generally considered as more productive which make them favored by the financiers (Manova et al, 2011). However, considering the Brazilian context characterized by problems in credit supply, larger firms may encounter bigger problems in access credit compared with small firms, since they are by nature likely to demand higher amounts of external finance. Given that, their export performances may be restricted when they operate in financially vulnerable sectors, which will translate into a negative  $\beta_2$  ( $\beta_2 < 0$ ).

Given the nature of the dependent variable in this study, the estimation using standard strategies is not appropriate. The following paragraph will discuss the methodology that better fits this kind of dependent variable: Interval regression.

### 2.5.3 Methodology: Interval Regression

In this paper, the dependent variable takes the form of a range of exports (in million US\$) and not an exact value of exports. Given this, the use of standard estimation techniques in cross-section models, such as Ordinary Least Squares (OLS) and difference-in-difference (Manova et al, 2011), may become inappropriate. While the exact value of exports of firm  $f$  noted  $EXP_f$  is non-observable (latent), the SECEX provides export data using five ranges. These ranges of exports denoted  $ExportRange_j$  ( $j = 1, \dots, 5$ ) are defined (in million US\$) by two limits  $\{Inf, Sup\}$ :

$$\left\{ \begin{array}{l} ExportRange_1 \{-\infty, 1\} \text{ if } EXP_f < 1 \\ ExportRange_2 \{1, 10\} \text{ if } 1 \leq EXP_f < 10 \\ ExportRange_3 \{10, 50\} \text{ if } 10 \leq EXP_f < 50 \\ ExportRange_4 \{50, 100\} \text{ if } 50 \leq EXP_f < 100 \\ ExportRange_5 \{100, +\infty\} \text{ if } EXP_f \geq 100 \end{array} \right\}$$

Considering the characteristics of data, the estimation of an Interval Regression model would be appropriate. This methodology is an extension of the Tobit model, in which the dependent variable is censored. As in models with discrete choices, maximum likelihood estimation is employed.

The likelihood function is defined as follows:

$$\begin{aligned}
 L = & \prod_{EXP_f < a_1} \left[ \Phi \left( \frac{a_1 - X' \beta}{\sigma} \right) \right] \prod_{a_1 < EXP_f < a_2} \left[ \Phi \left( \frac{a_2 - X' \beta}{\sigma} \right) - \Phi \left( \frac{a_1 - X' \beta}{\sigma} \right) \right] \\
 & \times \prod_{a_2 < EXP_f < a_3} \left[ \Phi \left( \frac{a_3 - X' \beta}{\sigma} \right) - \Phi \left( \frac{a_2 - X' \beta}{\sigma} \right) \right] \times \\
 & \prod_{a_3 < EXP_f < a_4} \left[ \Phi \left( \frac{a_4 - X' \beta}{\sigma} \right) - \Phi \left( \frac{a_3 - X' \beta}{\sigma} \right) \right] \\
 & \times \prod_{EXP_f > a_4} \left[ 1 - \Phi \left( \frac{a_4 - X' \beta}{\sigma} \right) \right] \quad (2.2)
 \end{aligned}$$

where  $\Phi(c)$  is a normal cumulative function where  $\sigma$  will be estimated and has not to be normalized to 1, as in probit models, and  $a_1, a_2, a_3$  and  $a_4$  are *known* cut points corresponding to 1, 10, 50 and 100 million US\$, respectively. The model is then set up as follows:

$$Pr[a_j < EXP_f < a_{j+1}] = \Phi(a_{j+1}) - \Phi(a_j) \quad j = 0, \dots, 4; \quad a_0 = -\infty; a_5 = +\infty \quad (2.3)$$

In order to estimate this model, the dependent variable in Eq. (2.1) is then replaced by two variables: *Inf* and *Sup* (in Log). The estimated  $\beta$ 's can then be interpreted as in standard OLS in terms of elasticity (Conroy, 2005).

This model could have been estimated using an Ordered Probit model. The dependent variable would be a categorical variable noted *ExportClass<sub>j</sub>* ( $j = 1, \dots, 5$ ) and defined as follows:

$$\begin{aligned}
 ExportClass_1 &= 1 \text{ if } EXP_f < 1 \\
 ExportClass_2 &= 2 \text{ if } 1 \leq EXP_f < 10 \\
 ExportClass_3 &= 3 \text{ if } 10 \leq EXP_f < 50 \\
 ExportClass_4 &= 4 \text{ if } 50 \leq EXP_f < 100 \\
 ExportClass_5 &= 5 \text{ if } EXP_f \geq 100
 \end{aligned}$$

The conditional probability of exporting in a given *ExportClass<sub>j</sub>* will be defined as follows:

$$\begin{aligned}
 P(ExportClass_j \mid \text{Observed variables})_f = & \beta_0 + \beta_1.Lsize_f + \beta_2.Lsize_f \times FinVul_s \\
 & + \beta_3.Parent_f + \beta_4.Exp09_f + \varphi_s + \varepsilon_f \quad (2.4)
 \end{aligned}$$

In this case, the likelihood function to be estimated is:

$$\begin{aligned}
L = & \prod_{i=1}^{N_1} F(\mu_1 - X'_i \beta) \times \prod_{N_1+1}^{N_2} F(\mu_2 - X'_i \beta) - \Phi(\mu_1 - X'_i \beta) \times \prod_{N_2+1}^{N_3} F(\mu_3 - X'_i \beta) - F(\mu_2 - X'_i \beta) \\
& \times \prod_{N_3+1}^{N_4} F(\mu_4 - X'_i \beta) - F(\mu_3 - X'_i \beta) \times \prod_{N_4+1}^N 1 - F(\mu_4 - X'_i \beta)
\end{aligned} \tag{2.5}$$

where  $F(c)$  is the standard normal cumulative distribution function, the  $\mu$ 's are unobserved thresholds to be estimated with  $\beta$ 's. They are values of exports that make the difference between two different categories of *ExportClasses<sub>j</sub>*. Ordered Probit estimation assumes that the  $\varepsilon_f$  is normally distributed across observations and requires the mean and the variance of  $\varepsilon_f$  to be normalized, so that  $\varepsilon_f \rightsquigarrow N(0, 1)$ .

Considering that, two differences between interval regression and ordered probit can be highlighted. First, in Interval regression,  $\sigma$  is estimated and has not to be normalized to 1. Second, when considering intervals of exports, the cut points are known, whereas, in ordered probit model, they need to be estimated. The use of ordered probit model when having data on well-defined intervals would then result in a loss of information. Based on these two differences, the literature considers that interval regression estimators are more efficient than those of ordered probit model (Cameron and Huppert, 1991; Conroy, 2005). Note that Interval Regression estimation requires a normality assumption, here the log normality of exports  $EXP_f$ . In order to check this assumption, the performance of ordered probit estimation would be appropriate (Conroy, 2005). Thus, ordered probit estimations will be used as robustness checks.

Interval regression method is not a familiar method of estimation in the field of international economics. There are however a number of economic studies that have used this kind of method, especially when dealing with revenues or earnings. Yang et al (2012) study the consumers' willingness to pay for fair trade coffee in China. This study is based on a survey in which respondents are asked to choose an interval of prices they are willing to pay for fair trade coffee, among 16 price ranges proposed. Similarly, Yan et al (2014) use interval regression methodology to analyze Shanghai customers' willingness to pay for the safer baby cheese. More recently, Sim (2015) makes use of interval regression method in order to estimate the effects of university education on earnings in China. Data on earnings are provided in intervals by Chinese National Youth Survey. Given the relatively few papers using interval regression, the present paper would provide a methodological contribution to the literature on international economics.

## 2.6 Effects of firm size on Exports across Brazilian sectors

In this section, I present the results of the empirical analysis of the effects of financial constraints at firm level (firm size) and those specific to Brazilian manufacturing industries, on export performances of Brazilian exporters in 2010. A number of robustness checks will be then presented. I also test the impact of the characteristics of the Brazilian context, notably the tax incentives (based on the legal status of the firm) and the regional heterogeneity, on firm-level exports. Finally, I study the effects of financial constraints on the probability of exporting more in 2010, compared to 2009.

### 2.6.1 Main Results

I begin by presenting the main results using the interval regression estimation. Table 2.3 presents the baseline results using the main measure of firm size  $Lemployees_f$ . Columns 1-4 consider the level of external finance dependence of Brazilian sectors as a measure of financial constraints at sector-level. The remaining columns consider the level of asset tangibility specific to Brazilian industries. The results show that, consistent with the common perceptions, Brazilian larger firms export more than small firms. Large firms are generally considered as less credit constrained, which make them more likely to have better export performances compared with smaller firms. The advantage related to firm size is however found to be reduced when firms operate in sectors with higher needs of external capital. Although large firms are more likely to have access to credit due to their assumed productivity and performance, the importance of firm size in explaining trade declines in financially vulnerable sectors.

This finding can be attributed to the lack in the supply of credit in the Brazilian financial sector. In fact, since  $ExtFinBra_s$  is computed over Brazilian data, it is worthy to note that this measure would reflect, not only the *needs* of external capital (demand side), but also the ability to *access* to finance (supply side). Recall that the original indicators of external finance dependence proposed by RZ are computed over US data and are then assumed to reflect as precisely as possible an efficient allocation of capital between sectors, given the quality of US financial sector. This makes RZ indicators precisely inform about sector-level *needs* of external finance, mainly based on their *inherent* technological characteristics. In Brazil however, due to financial frictions, the allocation of capital resource could be oriented towards sectors that do not highly rely on outside capital. In other words, the amounts of external finance firms get from the financial sector could be different from those these firms demanded. This leads Brazilian indicators to reflect sector-level financing problems rather than their inherent financial needs. Financial frictions would be even more important in Brazil due to the large capital inflows to the Brazilian market over the 2000s, notably in 2000 and 2007 (Benigno et al, 2015). In the same context, Reis (2013) argues, through the analysis of the Portuguese market, that the weaknesses of financial systems result in a misallocation of capital inflows and a shift of capital resources out of sectors producing tradable products, and towards non-



tradables. Given these elements, problems of financing would arise in sectors with higher needs of external capital, even for firms that are in principal favored by the financiers. These different arguments support the idea that the export performances of large firms in Brazil are reduced when firms operate in sectors with a high reliance on external finance. Finally, note that these results are consistent with those of Bricongne et al (2012). The authors find that in the context of recent financial crisis, French large firms reduce their intensive margin of trade due to the credit shortage. Since the Brazilian market is characterized by lack of credit, the results of this paper would then be supported by those of Bricongne et al (2012). I then move to the interpretation of results based on the second measure of financial vulnerability:  $TangBra_s$ . Recall that this measure is supposed to be inversely correlated with the sector-level financial vulnerability, since tangible assets are *collateralizable* (Braun, 2003). Note however that this relation is found to be positive when considering Brazilian measures of financial vulnerability. This finding (discussed in Chapter 1) attests of *specific* characteristics of Brazilian industries in terms of financial vulnerability and access to finance. It seems that sectors that present high levels of asset tangibility are those which can be more reliant on external finance. In this regard, Claessens and Sakho (2013) point the importance of the availability of collateral in the access to credit for firms in Brazil. Focusing on Columns 5-8, the results show that the advantage related to the firm size decreases when firms operate in sectors with many tangible assets. This result is consistent with the predictions in the literature on financial constraints ( $\beta_2 < 0$ ). Large firms outperform smaller ones in terms of export performances, by less in sectors with many hard assets. The rationale is that in these sectors, the availability of tangible assets is considered as a form of credit constraints *relaxation*, which makes the importance of firms' characteristics lessened, with regards to the access to credit.

Table 2.3: Firm Size, Sector Financial Vulnerability and Firm Exports

This table presents the estimation results of the main specification using Interval Regression method. The latent dependent variable is the (Log) value of exports in 2010 and is replaced by two limits of intervals:  $\text{linf}$  which corresponds to the log of the value of the inferior limit of the interval and  $\text{lsup}$  which corresponds to the superior limit. Firm size is proxied with the number of employees. Brazilian measures of sector financial vulnerability are considered. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively.

Dep. Var:	ExtFinBra		TangBra					
	1	2	3	4	5	6	7	8
LEXP <sub>f</sub> ( $\text{linf}$ , $\text{lsup}$ )								
employees <sub>f</sub>	0.95827*** (0.02092)	0.89814*** (0.02059)	0.89814*** (0.02059)	0.84367*** (0.02016)	1.05618*** (0.05101)	1.01811*** (0.04996)	1.01811*** (0.04996)	0.95424*** (0.04917)
employees <sub>f</sub> x FinVul <sub>s</sub>	-0.01655* (0.00913)	-0.01617* (0.00893)	-0.01617* (0.00893)	-0.01646* (0.00880)	-0.25008* (0.13779)	-0.31722** (0.13500)	-0.31722** (0.13500)	-0.28794*** (0.13297)
Parent <sub>f</sub>		-0.92268*** (0.06164)	-0.92268*** (0.06164)	-1.00631*** (0.06103)	-0.92833*** (0.06172)	-0.92833*** (0.06172)	-0.92833*** (0.06172)	-1.01132*** (0.06111)
Exp09 <sub>f</sub>				1.90211*** (0.10025)				1.90239*** (0.10035)
Constant	8.09750*** (0.16876)	9.21425*** (0.17621)	9.21425*** (0.17621)	7.79010*** (0.19842)	7.83941*** (0.19503)	8.91562*** (0.19961)	8.91562*** (0.19961)	7.50911*** (0.21958)
Observations	12,343	12,343	12,343	12,343	12,343	12,343	12,343	12,343
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log Likelihood	-8491	-8380	-8380	-8156	-8491	-8379	-8379	-8155
Chi2	4632	4854	4854	5303	4632	4856	4856	5304
Sigma	2.060	2.016	2.016	1.965	2.061	2.017	2.017	1.966

To summarize, the main results suggest that the importance of firm size in explaining export performances decreases in sectors that rely on funds provided by the financial sector. These findings would inform about the problems of financing large firms and particularly large exporters encounter. This result corroborates the findings of the CNI's survey on Brazilian exporters concerning the difficulties faced by large firms with regards to their export activity. More generally, it seems that large firms do face financing constraints when dealing with their investments. Based on Investment Climate Assessment Survey in 2003, Kumar and Francisco (2005) show that Brazilian firms rely more on internal funds, rather than external capital when financing their projects, *regardless* of the firm size. Considering the common idea that associates investment-cash flow sensitivities to the degree of financial constraints (Fazzari et al, 1988), the results of the survey show then that large firms in Brazil do face constraints. Moreover, Claessens and Sakho (2013) argue, through the analysis of loans provided by the Brazilian central bank, that the access to finance for small firms has been improved over the last decade. These findings would support the results of this present analysis on the reduced importance of being a large firm in explaining trade performances, when operating in sectors with high reliance on outside capital.

In Eq. (2.1), I also include a number of control variables in order to well capture the effects of financial constraints on Brazilian exporters' performances. Results in Table 2.3 suggest that Parent plants, i.e. first establishments of firms in Brazil, seem to be less export performant compared with affiliated plants ( $\beta_3 < 0$ ). Due to data availability, I cannot properly make the difference between subsidiaries of foreign companies (headquarters abroad) and of Brazilian owned companies (headquarters in Brazil). I can however present some explanations for the fact that affiliated firms export more than the main establishments in Brazil. It is mainly related to federal incentive programs designated to promote the growth of Brazilian exports. A firm which decides to create a branch for export production benefits from government support (UHY Report, 2013). It would be interesting for example to create a plant in Export Processing Zones<sup>12</sup> (EPZ), and to export through this subordinated firm, rather than through the main establishment. EPZs are industrial areas intended for exports. In these EPZs, firms benefit from exemption of exports and imports and from special tax treatment. Firms in these zones must however produce only for exports (PwC, 2010). Moreover, the Brazilian law forbids the transfer of a factory already in operation in Brazil to an EPZ, which makes the creation of secondary establishments required. This form of export incentives would explain the fact that affiliated firms export more than main establishments. In this regard, it is worthy to note that Brazil is characterized by a high tax burden (more than 30% of GDP in 2010), that may create distortions in resource allocation in Brazil (Busso et al, 2012; Vasconcelos, 2015). Export incentives would be then a means for exporting companies to deal with tax collection distortions in the Brazilian market.

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<sup>12</sup> According to the Brazilian Ministry of Development, a number of EZP have been created in 2010. This may reinforce the relatively higher performances of affiliated firms compared with parent companies in this present study.

Finally, as predicted, the coefficient  $\beta_4$  is positive and significant and suggests that being an exporter in 2009 positively affects export performances in 2010. In other words, survivors outperform new exporters in 2010. Exporting in 2009 can be seen as a form of financial constraints' relaxation in 2010. As detailed in the theoretical framework, entering the export market requires the payment of sunk fixed costs. Survivors in 2010 are then supposed to have already paid these costs in 2009, or earlier. Therefore, these firms can be considered as less credit constrained in 2010, since they will only have to pay variable costs.

These results remain unchanged when considering the second proxy of firm size:  $Lwage_bf$  (See Appendix 2.5). Overall, the results do suggest that financial constraints hamper the export activity of Brazilian exporters in 2010. The firm size does not seem to prevent the effects of financial frictions on the exporting activity. This result can be driven by the Brazilian context, notably the problems in the supply of credit.

This analysis presents two important results. First, this study confirms the role of financial frictions in explaining international trade performances. Second, it provides evidence about the constraints faced by large exporters, in presence of distortions affecting intersectoral allocation of resources. To illustrate this idea, Embraer, a large Brazilian multinational company, confirms that due to the lack-well developed financial market, the support of Brazilian government was necessary to expand the activity to foreign markets (Parente et al, 2013).

## 2.6.2 Sensitivity Analysis

### Robustness Checks

**Further Controls** In order to verify the persistence of the effects of financial constraints on Brazilian export performances, I subject the main results to a number of robustness checks. In a world with perfect financial markets, firm size would be a good proxy of firm productivity. In the real world however, financial frictions alter this relation. In order to check if the effects of firm size on trade capture the effects of firm productivity, I include to Eq. (2.1), an additional control which is the wage per employee  $Lwage_f$ . In absence of data on total factor productivity (TFP), I use this variable which would capture the level of labor productivity. In fact, in the literature on export performances, exporters are generally found to be larger, more productive and to pay higher wages. The average wage is also considered as a measure of human capital (Bellone et al, 2010). The results displayed in Table 2.4 (columns 1-3-5-7), show that the results remain unchanged to the inclusion of this variable. Moreover, this variable has a positive expected sign. Consistent with the literature, this result suggests that more (labor) productive firms are more likely to be export performant.

Table 2.4: Robustness Checks I: Further Controls

This table presents the estimation results of the main specification using Interval Regression method. Two proxies of firm size are considered. Here, I use Brazilian measures of sector financial vulnerability. I also include control variables: region dummies and wage per worker. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively.

Dep. Var.	Number of Employees				Wage bill					
LEXP <sub>f</sub> (linf, lsup)	ExtFinBra	2	3	TangBra	4	5	ExtFinBra	6	7	8
Lsize <sub>f</sub>	0.79389*** (0.01967)	0.78516*** (0.01950)	0.95913*** (0.04811)	0.91412*** (0.04788)	0.79938*** (0.01951)	0.79043*** (0.01935)	0.91559*** (0.04563)	0.87361*** (0.04544)		
Lsize <sub>f</sub> xFinVul <sub>s</sub>	-0.02967*** (0.00864)	-0.02471*** (0.00857)	-0.41783*** (0.13046)	-0.32261** (0.13009)	-0.02485*** (0.00856)	-0.01967** (0.00847)	-0.28562** (0.12169)	-0.20040* (0.12143)		
Parent <sub>f</sub>	-0.83824*** (0.05903)	-0.79676*** (0.05880)	-0.84598*** (0.05910)	-0.80292*** (0.05886)	-0.83810*** (0.05905)	-0.79688*** (0.05882)	-0.84593*** (0.05913)	-0.80248*** (0.05888)		
Exp09 <sub>f</sub>	1.74925*** (0.09726)	1.75982*** (0.09726)	1.74940*** (0.09738)	1.75816*** (0.09733)	1.75033*** (0.09729)	1.76031*** (0.09728)	1.75069*** (0.09737)	1.75938*** (0.09730)		
Lwage <sub>f</sub>	1.02310*** (0.04723)	1.14540*** (0.04851)	1.02006*** (0.04721)	1.14257*** (0.04849)	0.20392*** (0.05052)	0.33872*** (0.05160)	0.19551*** (0.05040)	0.33240*** (0.05151)		
Constant	0.53694 (0.40635)	0.30735 (0.42506)	0.11799 (0.42587)	-0.03461 (0.44319)	0.71182* (0.41161)	0.43964 (0.43082)	-0.12918 (0.48957)	-0.18056 (0.50403)		
Observations	12,273	12,273	12,273	12,273	12,273	12,273	12,273	12,273	12,273	12,273
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Log Likelihood	-7854	-7791	-7855	-7792	-7856	-7792	-7857	-7794		
	Chi2	5812	5811	5936	5809	5936	5806	5933		
	Sigma	1.878	1.859	1.879	1.861	1.878	1.860	1.879	1.861	1.861

I also add region dummies in Eq. (2.1), to control for the region heterogeneity in terms of economic and financial development. In Brazil, there exists a *regional effect* that makes regions differ in terms of access to finance, which may affect firms' investments (Kumar et Francisco, 2005). According to The Brazilian Institute of Geography and Statistics (IBGE), Brazil is divided into five regions: Southeast, South, Central West, North and Northeast. Kumar et al (2004) argue that access to banks is easier in Southeast and South regions. Columns 2-4-6-8 in Table 2.4 show that the main results hold even after controlling for the regional heterogeneity in terms of access to finance.

The Brazilian government also affects the access to finance. As detailed in Section 2, the Brazilian government offers financial support to Brazilian firms in order to promote the growth of the industrial structure, through the BNDES. This Brazilian public bank offers in fact, low cost financing for investment projects. BNDES Public loans could then alter intersectoral heterogeneity in terms of access to finance, which may affect the results concerning  $\beta_2$  in Eq. (2.1). To check the robustness of my main results to the BNDES effect, I introduce the interaction term between firm size and sector-level BNDES disbursements in 2010<sup>13</sup> ( $Lsize_f \times BNDES_s$ ). Note that, it is found that BNDES loans go particularly to large firms (See Chapter 1, Appendix Figure A.1.5.2.). These loans can be considered as a form of credit constraints' *relaxation* since they are subsidized funds. Therefore, it is expected to find a positive impact of firm size when coupled with sector-level BNDES disbursements, on exports. The coefficient related to  $Lsize_f \times BNDES_s$  is then expected to be positive<sup>14</sup>. The results displayed in Table 2.5 confirm this prediction. Larger firms export more in sectors that receive higher BNDES financial support and less in sectors with higher financial needs. While the efficiency of BNDES disbursements has been recently debated (Ottaviano and Souza, 2014), this finding attests of the role of BNDES in helping firms better perform in terms of international trade. However, since the introduction of  $Lsize_f \times BNDES_s$  did not affect the significance of the coefficient  $\beta_2$ , one could think that sector-level BNDES disbursements are *independent* of the level of sector financial vulnerability. This finding suggests that despite the lack of finance in Brazil, Brazilian government support does not go to sectors that highly require external finance. Given that BNDES bank has been created to alleviate financial market failures and to promote industries (Suzigan et al, 2007), the results of this study may suggest the existence of a problem of *targeting* of BNDES public loans.

<sup>13</sup>The results remain unchanged when I consider BNDES disbursements of 2009.

<sup>14</sup>Since the present study is in cross-section, the sector-level BNDES disbursements are considered to be subsumed in sector fixed effects.

Table 2.5: Robustness Checks II: BNDES effects

This table presents the estimation results of the main specification using Interval Regression method. Two proxies of firm size are considered. Here, I use Brazilian measures of sector financial vulnerability. I also include control variables: region dummies and wage per worker. An interaction term between firm size and the amount of BNDES disbursements to the sector in which the firm operates is also included. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively.

Dep. Var:	Number of employees				Wage Bill			
	1	2	3	4	5	6	7	8
LEXP <sub>f</sub> (lnf, lsup)	ExtFinBra	ExtFinBra	TangBra	TangBra	ExtFinBra	TangBra	TangBra	TangBra
Lsize <sub>f</sub>	0.05685 (0.34059)	-0.14654 (0.33012)	0.54855* (0.30502)	0.33895 (0.29569)	0.03988 (0.31333)	-0.08714 (0.30340)	0.45647 (0.28278)	0.30476 (0.27373)
Lsize <sub>f</sub> × Fin Vul <sub>s</sub>	-0.03714*** (0.00989)	-0.03676*** (0.00960)	-0.38995*** (0.13854)	-0.39517*** (0.13438)	-0.03241*** (0.00969)	-0.03114*** (0.00938)	-0.24077* (0.12863)	-0.26824** (0.12481)
Parent <sub>f</sub>		-0.79661*** (0.05864)		-0.80444*** (0.05877)		-0.79596*** (0.05865)		-0.80393*** (0.05878)
Exp09 <sub>f</sub>		1.75716*** (0.09699)		1.75591*** (0.09717)		1.75499*** (0.09696)		1.75537*** (0.09711)
Lwage <sub>f</sub>	1.28769*** (0.04936)	1.14635*** (0.04835)	1.28383*** (0.04942)	1.14163*** (0.04838)	0.40014*** (0.05260)	0.34583*** (0.05148)	0.38858*** (0.05253)	0.33464*** (0.05140)
Lsize <sub>f</sub> × bnudes10 <sub>s</sub>	0.03721** (0.01557)	0.04261*** (0.01509)	0.02197 (0.01453)	0.02771** (0.01407)	0.03824*** (0.01432)	0.04014*** (0.01387)	0.02392* (0.01343)	0.02734** (0.01299)
Constant	0.12763 (0.44152)	0.70835 (0.44405)	-0.44523 (0.44894)	0.14900 (0.45065)	0.91883 (0.56016)	1.48706*** (0.55558)	-0.24870 (0.55645)	0.31660 (0.55182)
Observations	12,273	12,273	12,273	12,273	12,273	12,273	12,273	12,273
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log Likelihood	-8059	-7787	-8063	-7790	-8060	-7788	-8064	-7791
Chi2	5402	5947	5395	5940	5400	5944	5392	5937
Sigma	1.926	1.854	1.930	1.857	1.926	1.854	1.929	1.857

**Ordered Probit** This study uses a *non-common* method of estimation with regards to the field of international trade: Interval regression. This method better fits the characteristics of the main dependent variable in this study, provided in intervals. These intervals could be however coded into classes of exports. This allows to estimate an ordered probit model. As claimed by Conroy (2005), while less efficient than interval regression method, the estimation of ordered probit model permits to 1) validate the results provided by interval regression, and 2) verify the normality assumption of interval regression method. Given that, I estimate the augmented<sup>15</sup> Eq. (2.1) by considering  $P(ExportClass_j | Observed\ variables)_f$  as dependent variable. The results are displayed in Appendix 2.6. While one cannot directly interpret Ordered Probit coefficients<sup>16</sup>, it is clear that the signs and the significance of the coefficients remain unchanged when compared with those in Table 2.3. This finding confirms the efficiency of interval regression method.

**Firm Size Classifications** As robustness checks, I consider different firm size classifications. This permits to capture if there is a non-linear effect of firm size on export performances, across sectors with different levels of external finance dependence. First, I follow the classification of the IBGE (*ClassificationIBGE*) and consider four firm size classes: Small (*S*) for firms with a number of workers inferior to 20, Medium (*M*) for those with a number of workers inferior to 100, Large (*L*) for those having less than 500 workers and finally, Very Large (*VL*) for the remaining firms. I then consider the classification of ORBIS database which divides firms according to four size proxies: the number of employees, total revenues, total assets and the fact the firm is listed or not. This classification (*ClassificationORBIS*) is presented in Appendix 2.1. Considering these classifications, I estimate the following Eq. (2.1):

$$\begin{aligned} LEXP_f = & \beta_0 + \beta_1.M_f + \beta_2.L_f + \beta_3.VL_f + \beta_4.M_f \times FinVul_s + \beta_5.L_f \times FinVul_s \\ & + \beta_6.VL_f \times FinVul_s + \beta_7.Parent_f + \beta_8.Exp09_f + \varphi_s + \varepsilon_f \end{aligned} \quad (2.6)$$

where Small firms (*S*) are considered as reference firms. The results using both classifications are presented in Table 2.6. Larger firms do have better performances in terms of exports. The advantage related to firm size is however found to decrease when the firms operate in sectors that highly depend on external finance. This negative effect seems to be particularly marked for Large firms (*L*). The coefficients related to Very Large (*VL*) firms are globally less important and not usually precisely estimated. This result may be explained by the fact that very large firms are generally Brazilian firms with public participation such as Petrobras, or multinational firms. In both cases, these firms are less credit constrained and their export performances are then *less sensitive* to the general financial constraints of the sector in which they operate. In line with this idea, Manova et al (2011) find, through the analysis of Chinese exports, that multinational firms are more export performant than domestic firms, especially

<sup>15</sup>i.e. in which I include control variables presented above.

<sup>16</sup>One need to compute marginal effects.



in sectors with high financial needs. This result can corroborate the findings of this present study.

Finally, I consider *ClassificationORBIS* and estimate the effects of financial constraints on export performances in Brazil, based on an *alternative* sample of Brazilian exporters in 2010<sup>17</sup> (See Appendix 2.7). I consider two groups of firms: Large firms which correspond to those in groups ( $L, VL$ ) and Small & Medium firms which correspond to those in groups ( $S, M$ ). The results are displayed in Appendix Table 2.7.2 and Appendix Table 2.7.3, and are in consistent with the main findings of the present study. To summarize, the results remain globally robust to different firm size measures considered and different firm size classifications.

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<sup>17</sup>based on ORBIS data availability.

Table 2.6: Robustness Checks III: Alternative Firm Classifications

In this table, I consider two alternative firm classifications. The first one is the classification of IBGE, based on the number of employees. The second is provided in ORBIS database and classifies firms according to their revenues, total assets, number of employees and being listed or not. Interval Regression method is used. I also include control variables: region dummies and wage per worker. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively.

Dep. Var:	ClassificationIBGE							ClassificationORBIS			
	ExtFinBra	TangBra			ExtFinBra			TangBra			
LEXP <sub>f</sub> (linf, lsup)	1	2	3	4	5	6	7	8	9	10	
M <sub>f</sub>	0.89948*** (0.08813)	0.81608*** (0.08727)	0.82040*** (0.08705)	0.81399*** (0.21204)	0.65879*** (0.20914)	0.66747*** (0.20877)	-1.58775*** (0.08384)	-0.61740*** (0.08419)	-1.51541*** (0.21113)	-1.11229*** (0.19624)	
L <sub>f</sub>	2.27827*** (0.08857)	2.02100*** (0.08718)	2.00494*** (0.08683)	3.09086*** (0.20807)	2.78909*** (0.20434)	2.73118*** (0.20389)	0.60245*** (0.08042)	1.34202*** (0.08324)	1.67502*** (0.20767)	1.56944*** (0.19246)	
VL <sub>f</sub>	4.21294*** (0.10655)	3.78223*** (0.10427)	3.74460*** (0.10361)	4.58873*** (0.26270)	4.12673*** (0.25631)	3.93022*** (0.25563)	2.55178*** (0.13573)	3.25907*** (0.13046)	3.68752*** (0.38392)	3.45815*** (0.35080)	
M <sub>f</sub> xFinVul <sub>s</sub>	0.00103 (0.04450)	0.00226 (0.04382)	-0.00466 (0.04371)	0.25598 (0.57395)	0.47039 (0.56374)	0.47020 (0.56235)	0.05007 (0.04614)	0.08537*** (0.04266)	-0.30622 (0.56575)	1.27665*** (0.52753)	
L <sub>f</sub> xFinVul <sub>s</sub>	-0.17484*** (0.04121)	-0.16175*** (0.04043)	-0.15591*** (0.04026)	-1.98040*** (0.56343)	-1.88110*** (0.55242)	-1.77207*** (0.55174)	-0.12030*** (0.04240)	-0.02495 (0.03902)	-2.89608*** (0.57043)	-0.61825 (0.53018)	
VL <sub>f</sub> xFinVul <sub>s</sub>	-0.08722* (0.04845)	-0.08101* (0.04733)	-0.05838 (0.04717)	-0.90514 (0.71323)	-0.83482 (0.69560)	-0.42100 (0.69421)	-0.15228** (0.07218)	-0.04661 (0.06582)	-3.07394*** (1.06757)	-0.50525 (0.97569)	
Lwage <sub>f</sub>	1.14155*** (0.04783)	1.00865*** (0.04676)	1.12802*** (0.04811)	1.13301*** (0.04784)	1.00003*** (0.04675)	1.12058*** (0.04810)	1.12058*** (0.04810)	1.12058*** (0.04810)	1.12058*** (0.04810)	1.12058*** (0.04810)	
Parent <sub>f</sub>	-0.83039*** (0.05957)	-0.83039*** (0.05957)	-0.79344*** (0.05934)	-0.79344*** (0.05934)	-0.84304*** (0.05971)	-0.80417*** (0.05948)	-0.80417*** (0.05948)	-0.80417*** (0.05948)	-2.14083*** (0.07702)	-2.14295*** (0.07702)	
Exp09 <sub>f</sub>	1.77300*** (0.09729)	1.77300*** (0.09729)	1.77679*** (0.09719)	1.77679*** (0.09719)	1.78202*** (0.09756)	1.78380*** (0.09743)	1.78380*** (0.09743)	1.78380*** (0.09743)	2.24882*** (0.10525)	2.25057*** (0.10525)	
Constant	2.30586*** (0.38864)	2.59660*** (0.39774)	2.26859*** (0.41766)	2.20293*** (0.39968)	2.52281*** (0.40732)	2.19451*** (0.42723)	11.74765*** (0.15269)	11.67175*** (0.23196)	11.64739*** (0.15794)	11.75681*** (0.23637)	
Observations	12,273	12,273	12,273	12,273	12,273	12,273	12,556	12,556	12,556	12,556	
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Region FE	No	No	Yes	No	No	Yes	No	Yes	No	Yes	
Log Likelihood	-8211	-7930	-7869	-8214	-7930	-7870	-9599	-8873	-9591	-8871	
Chi2	5099	5661	5781	5091	5660	5781	2764	4217	2781	4220	

### Additional Evidence

In this paragraph, I provide further evidence about the effects of financial constraints on export performances of Brazilian exporters in 2010, by exploring the heterogeneity of exporting firms in terms of their legal status, as well as the region heterogeneity in terms of access to finance. I also analyze the effects of financial constraints on the probability to switch to higher ranges of export in 2010, compared with 2009.

**Main vs. Affiliated** I estimate the following Eq. (2.7) on two sub-samples of firms: Parent companies which are the main (first) establishments in Brazil, and Affiliated companies which are secondary establishments:

$$LEXP_f = \beta_0 + \beta_1.Lsize_f + \beta_2.Lsize_f \times FinVul_s + \beta_3.Lwage_f + \beta_4.Exp09_f + \varphi_s + \varepsilon_f \quad (2.7)$$

The results using the main measure of firm size  $Lemployees_f$  are displayed in Table 2.7. Considering both sub-samples of firms, larger firms tend to be more export performant. However, some differences arise when focusing on the advantage related to firm size in financially vulnerable sectors. While large main establishments perform less when they operate in financially vulnerable sectors, the advantage related to firm size is stressed when focusing on secondary establishments. It seems then that the main results of this paper are mainly driven by the behavior of Parent firms. These results provide precise information on the effects of financial constraints on export performances, since they result from a comparison of *similar* firms in terms of legal status. Focusing on affiliated firms, larger firms perform more in terms of exports when operating in sectors that highly rely on external finance. This result suggests that the firm size would constitute a source of advantage with regards to the access to capital. Affiliated firms are in principal firms that lack of decision-making power, compared with Parent companies. As familiar in the field of Management, strategic decisions are generally taken by headquarters which are likely to be Parent companies. These firms are also more likely to have a bargaining power, when it comes to the relation with the financial sector. If we set this advantage apart<sup>18</sup>, the size would reappear as a determinant variable with regards to the access to finance. Larger firms are more likely to be privileged by the financiers, especially given the Brazilian context of financial underdevelopment. Considering only Parent companies however, the advantage related to firm size is found to be reduced when the Parent company operates in a sector with high reliance on outside capital. A possible explanation would be that in sectors that present high financial constraints, Parent companies would be more incited to circumvent the financing constraints by creating affiliated firms which will benefit from tax and financial advantages, rather than expanding their exports themselves. This reasoning seems to be suitable to the characteristics of the sample in this study, since Affiliated exporters are found to be larger than Parent exporting companies (Table 2.2).

<sup>18</sup>This is the case when considering affiliated firms.

Table 2.7: Firm size and Firm exports: Does the Legal Status matter?

In this table, I present the estimation results of the main specification on two subsamples of companies: Main establishments and Affiliated firms. Interval Regression method is used. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively.

Dep. Var:	Affiliated			Main			
	ExtFinBra	TangBra	ExtFinBra	TangBra	ExtFinBra	TangBra	
LEXP <sub>f</sub> (linf, lsup)	1	2	3	4	5	6	7 8
Employees <sub>f</sub>	0.76068*** (0.03894)	0.76278*** (0.03802)	0.55706*** (0.11266)	0.61185*** (0.11020)	0.86811*** (0.02354)	0.78587*** (0.02269)	0.96131*** (0.05543)
Employees <sub>f</sub> xFinVul <sub>s</sub>	0.03627* (0.02018)	0.03239* (0.01948)	0.51025* (0.29749)	0.36951 (0.29044)	-0.02005** (0.01001)	-0.03632*** (0.00975)	-0.36178** (0.14751)
Exp09 <sub>f</sub>	1.75179*** (0.17129)	1.60432*** (0.16526)	1.75363*** (0.17117)	1.60757*** (0.16524)	2.01177*** (0.12861)	1.86055*** (0.12499)	2.01152*** (0.12868)
Lwage <sub>f</sub>		1.08672*** (0.10332)		1.08316*** (0.10342)		1.14459*** (0.05471)	1.13537*** (0.05458)
Constant	9.11988*** (0.51979)	1.48292 (0.90252)	9.74773*** (0.57741)	1.99091** (0.94927)	6.70874*** (0.30151)	-0.85095* (0.49336)	-1.23787** (0.51392)
Observations	2,074	2,059	2,074	2,059	10,269	10,214	10,214
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log Likelihood	-2331	-2264	-2331	-2265	-5738	-5457	-5461
Chi2	830.2	934.6	829.9	933.4	3667	4155	4146
Sigma	2.103	2.016	2.102	2.017	1.871	1.761	1.764

**Southeast vs. Less Developed Regions** Here, I pay particular attention the regional effect in terms of access to finance. There exists, in fact, a regional inequality in Brazil in terms of financial endowments. Lima and Resende (2008) argue that richer regions (notably Southeast) are better endowed of private banks and that the situation reverses when focusing on public banks. Crocco et al (2014) stress however the gap in terms of credit availability between the Southeast and the other regions. Based on this finding, I consider two groups of firms: those established in the region of the Southeast, and those established in other regions. Considering that credit is more available in the Southeast<sup>19</sup>, one would expect Southeast large firms to have better performances in sectors with high financial needs.

The results presented in Table 2.8 confirm that large firms are more export performant compared with smaller ones. They show however that the comparative advantage of firm size decreases in sectors with high outside capital needs, more for firms operating in the Southeast in comparison with those in other regions. For "Other regions", the effects of sector-level financial constraints on the importance of firm size are not precisely estimated. While contrary to the expectations, this result can be explained by a couple of ideas. First, in financially less developed regions, the access to credit is considered to be harder compared with the Southeast. In this context, large firms would be favored by the financiers. Large firms are generally assumed to be more performant and more productive and present less risks of default. Their access to credit would then be easier compared with smaller firms. Second, the last decade has been marked with a real effort of the government to improve financing conditions in the less endowed regions notably the North and the Northeast. These efforts are embodied by a number of tax incentives offered by the Development agencies of Northeastern States (*Superintendência de Desenvolvimento do Nordeste*, SUDENE) and of the Amazon (*Superintendência de Desenvolvimento da Amazônia*, SUDAM). The aim of this tax incentive mechanism is to enhance investments in the less developed regions. These incentives could be considered as a form of *relaxation* of the financial constraints in these less developed regions, and may make the gap between regions in terms of financing opportunities reduced. Overall, the results stress the problems related to credit availability in Brazilian regions. Although the Southeast is considered as relatively well-endowed in terms of capital, firms in this region do face problems when financing their exports, especially in sectors with high needs of external capital.

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<sup>19</sup>This region is composed of four states: São Paulo, Rio de Janeiro, Minas Gerais and Espírito Santo.

Table 2.8: Firm size and Firm exports: Exploring Region Heterogeneity

In this table, I present the estimation results of the main specification on two sub-samples of companies: those operating in Southeast and those operating in other regions: South, North, Northeast and Central West. Interval Regression method is used. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively.

Dep. Var:	South East						Other Regions					
	Number of Employees			Wage Bill			Number of Employees			Wage Bill		
	ExtFinBra	TangBra	1	ExtFinBra	TangBra	4	ExtFinBra	TangBra	6	ExtFinBra	TangBra	8
Lsize <sub>f</sub>	0.84796*** (0.02781)	1.10757*** (0.07653)	1	0.85624*** (0.02764)	1.00283*** (0.07007)	4	0.72584*** (0.02727)	0.81137*** (0.06181)	6	0.73249*** (0.02710)	0.80466*** (0.06005)	8
Lsize <sub>f</sub> xFinVul <sub>s</sub>	-0.05989*** (0.01641)	-0.67540*** (0.21108)	2	-0.04826*** (0.01576)	-0.35919* (0.19008)	3	-0.02046** (0.01025)	-0.18778 (0.16431)	5	-0.01487 (0.01019)	-0.16671 (0.15734)	7
Parent <sub>f</sub>	-0.82694*** (0.08059)	-0.84089*** (0.08070)	3	-0.82738*** (0.08063)	-0.84165*** (0.08074)	4	-0.77542*** (0.08549)	-0.77911*** (0.08560)	5	-0.77538*** (0.08553)	-0.77949*** (0.08564)	6
Exp09 <sub>f</sub>	1.78024*** (0.14129)	1.77292*** (0.14121)	4	1.77917*** (0.14124)	1.77253*** (0.14104)	5	1.66552*** (0.13229)	1.66613*** (0.13243)	6	1.66694*** (0.13235)	1.66772*** (0.13247)	7
Lwage <sub>f</sub>	1.07921*** (0.06363)	1.07731*** (0.06364)	5	0.19345*** (0.06883)	0.18200*** (0.06880)	6	1.23022*** (0.07673)	1.22472*** (0.07666)	7	0.48037*** (0.07965)	0.47869*** (0.07970)	8
Constant	-0.32970 (0.55677)	-1.02150* (0.59325)	7,272	-0.04307 (0.56519)	-1.16757* (0.68836)	8	-0.11711 (0.63878)	-0.32492 (0.65857)	9	0.00751 (0.64671)	-0.54615 (0.74349)	10
Observations	7,272	7,272	7,272	7,272	7,272	7,272	5,001	5,001	5,001	5,001	5,001	5,001
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log Likelihood	-4255	-4257	-4257	-4257	-4260	-4260	-3493	-3494	-3494	-3494	-3494	-3494
Chi2	3461	3457	3457	3456	3450	3450	2487	2484	2484	2485	2484	2484
Sigma	1.891	1.894	1.894	1.891	1.894	1.894	1.800	1.801	1.801	1.801	1.801	1.801

**Switchers: Exporting more in 2010** As detailed earlier, firms that have already been exporters in 2009 are more likely to have better export performances in 2010. For these firms, fixed costs related to the exporting activity should have been paid before 2010. Among these survivors, there are those which switch to higher classes of exports, those which switch lower and those for which the export range remains in the same (See Appendix 2.3.4). In this paragraph, I focus on survivors in 2010 and explore differences between them in terms of export behavior in 2010, compared with 2009. In particular, the aim of this analysis is to check how financial constraints affect firms which export more in 2010 compared with 2009. Since exact values of exports are not available, I consider that exporting higher values in 2010 coincides with switching to a higher class of exports in 2010. To do that, I consider a probability model defined as follows:

$$P(ExportRange_f^{10} > ExportRange_f^9) = \begin{cases} 0 & \text{if } ExportRange_f^{10} \leq ExportRange_f^9 \\ 1 & \text{if } ExportRange_f^{10} > ExportRange_f^9 \end{cases}$$

and

$$P(ExportRange_f^{10} > ExportRange_f^9) = \beta_0 + \beta_1.Lsize_f^9 + \beta_2.Lsize_f^9 \times FinVul_s + \beta_3.Lwage_f^9 + \varphi_s + \varepsilon_f \quad (2.8)$$

where  $Lsize_f^9$  is the (Log) value of firm size in 2009 and  $ExportRange_f^{10}$  and  $ExportRange_f^9$  are the ranges of exports to which firm  $f$  belongs in 2010 and 2009, respectively. I then estimate Eq. (2.8) using a probit model. The results displayed in Table 2.9<sup>20</sup> show that the firm size positively affects the probability for an exporter in 2009 to switch to a higher range of exports in 2010. Consistent with the main results of this paper, the advantage related to firm size decreases when the firm operates in sectors with many tangible assets. The results are less conclusive when considering sectors with higher needs in terms of external capital<sup>21</sup>.

Overall, the magnitude of these effects does not seem to be strong, which suggests that financial constraints at sector-level matter less for firms that have already been exporters.

## 2.7 Firm size and Inherent sector needs of external capital

One contribution of this present study is that I consider measures of sector financial vulnerability, *specific* to Brazilian industries in the last decade. Instead of representing intersectoral technological differences (Rajan and Zingales, 1998), Brazilian measures reflect rather intersectoral differences after accounting for distortions in the Brazilian market, notably fi-

<sup>20</sup>I display the marginal effects at mean sample. Note however that the interpretation of the marginal effects on interaction terms from the table can be misleading. Norton et al (2004) argue that the use of *margins* command does not provide the correct interaction effects. They recommend the use of *inteff*. This issue is unfortunately not properly discussed in this chapter.

<sup>21</sup>This result can be also explained by the weak number of exporting firms in 2009 that exported in higher ranges in 2010, compared with 2009 (Appendix 2.3.4).

Table 2.9: Additional Evidence: Firm Size and Probability to Export more in 2010

This table presents the estimation results of the specification (2.8) using a Probit model. The dependent variable is the probability for an exporter in 2009 to export in a higher export range in 2010. Two proxies of firm size are considered: the number of employees and the wage bill. To capture sector-level financial constraints, I use the Brazilian measures. Displayed coefficients correspond to *marginal effects at mean sample*. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively. .

Dep. Var:	Number of Employees		Wage Bill	
P (ExportRange10>ExportRange10) <sub>f</sub>	ExtFinBra	TangBra	ExtFinBra	TangBra
Lsize09 <sub>f</sub>	0.017*** (0.000)	0 .0361*** (0.000)	0.014*** (0.000)	0.033*** (0.000)
Lsize09 <sub>f</sub> xFinVul <sub>s</sub>	-0.002 (0.137)	-0.050*** (0.001)	-0.002* (0.064)	-0.050*** (0.000)
Parent <sub>f</sub>	-0.024*** (0.001)	-0.026*** (0.001)	-0.027*** (0.001)	-0.028*** (0.000)
Lwage <sub>f</sub>	0.024*** (0.000)	0.024*** (0.000)	0.011* (0.073)	0.011 (0.102)
Observations	7,543	7,543	7,543	7,543
Sector FE	Yes	Yes	Yes	Yes
Log Likelihood	-1955	-1951	-1963	-1957
Chi2	268.9	277.1	253.9	265.7

nancial ones. Although Brazilian measures are calculated over data on listed companies<sup>22</sup> and smoothed over 2000-2012, intersectoral differences in terms of financial vulnerability are considered to be *endogenous* to the Brazilian overall level of economic and financial development. While these measures are possibly endogenous, the literature proposes a number of studies where the indicators of sector-level financial needs are computed using data *on* the individuals of interest. Bricongne et al (2012) for instance, study the effects of financial constraints of French firms on their exports during the crisis of 2008 and compute measures of sector financial vulnerability using data on the same firms of interest in the study. Similarly, Alfaro (2014) analyze the effects of capital controls on Brazilian exports and to do so, they compute measures of external finance dependence based on Brazilian data.

That being said, it remains interesting to consider the *inherent* needs of different manufacturing sectors as defined by Rajan and Zingales (1998). Measures of financial vulnerability computed over US data are assumed to capture the precise needs of manufacturing sectors in terms of outside capital with only relying on their *inherent heterogeneity* based on technological characteristics. Three indicators of financial vulnerability (*FinVulUS<sub>s</sub>*) are considered: the external finance dependence (*ExtFinUS*), R&D intensity (*RDUS*) as well the level of asset tangibility (*TangUS*). As described earlier, the first two ones are supposed to be inversely correlated with asset tangibility measure. I need also to recall that the main results of this

<sup>22</sup> Assumed to be less credit constrained.



study have shown that large firms perform less in sectors with high outside capital needs, as well as those with many tangible assets. As explained, this result could be attributed to the lack of credit in Brazil. In this paragraph, the use of US indicators will therefore permit to check if these results are driven by the endogeneity of measures of financial vulnerability to the Brazilian context.

### 2.7.1 Main Results

In Table 2.10, I present the estimation results of Eq. (2.1), considering intersectoral differences in terms of inherent external finance needs. Accounting for the quality of financial institutions in the US, US indicators are considered to be *benchmarks*. In line with the main results of this study, Table 2.10 shows that large firms are more likely to be export performant compared to smaller ones. The importance of firm size in explaining Brazilian firms' exports decreases however in sectors that highly depend on external finance and in those with high R&D intensity. Firm size does not secure better export performances in financially vulnerable sectors. This result confirms the main findings regarding financing problems that face large firms when they operate in sectors with high outside capital requirements. In other words, problems in the access of credit do impede export performances of large firms. Similar results are found when considering the measure (*TangUS*). The advantage of being a large firm, with regards to export performances, is reduced when firms operate in industries with many tangible assets. This result suggests that for these sectors, the access to credit does not heavily rely on the size of the firm. Firms in these sectors have less financial problems when demanding financial support from the banking sector, since they have the ability to present their hard assets as collaterals.

To summarize, while the firm size is considered as a good predictor of export performances for Brazilian firms, the role of firm size in enhancing the export activity decreases when considering the financial constraints at sector-level. Even though large firms are less likely to be credit constrained, requiring external funds to finance the export activity (fixed and variable costs) make them less performant when operating in sectors that highly rely on external capital. This finding can be attributed to the underdeveloped Brazilian financial system. Despite the waves of reforms over the last decades, Brazilian firms suffer from a lack of credit that hampers their investments, notably their activity in the foreign market. While the use of Brazilian data-based indicators of financial vulnerability could drive an endogenous effect to the link between firm size and firm performances, the results of this section confirm the effects of sector-level financial dependence on export performances of Brazilian large exporters.

Table 2.10: Firm Size, Sector Inherent Financial needs and Firm Exports

This table presents the estimation results of the main specification using Interval Regression method. Here, I consider US indicators of sector financial vulnerability proposed by Kroszner et al (2007). Firm size is proxied with the number of employees. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively.

Dep. Var:	ExtFinUS			RDUS			TangUS		
LEXP <sub>f</sub> (linf, lsup)	1	2	3	4	5	6	7	8	9
Lemployees <sub>f</sub>	0.95661*** (0.02432)	0.85032*** (0.02347)	0.81329*** (0.02292)	0.98038*** (0.02561)	0.87211*** (0.02474)	0.83772*** (0.02418)	1.27645*** (0.09351)	1.12132*** (0.09059)	1.00918*** (0.08876)
Lemployees <sub>f</sub> xFinVulUS <sub>s</sub>	-0.15395*** (0.04739)	-0.14149*** (0.04609)	-0.17685*** (0.04446)	-0.74969*** (0.23108)	-0.68602*** (0.22516)	-0.76037*** (0.21691)	-1.09722*** (0.30644)	-0.93035*** (0.29756)	-0.67267*** (0.29232)
Parent <sub>f</sub>		-0.92469*** (0.07743)	-0.83091*** (0.07458)		-0.92234*** (0.07747)	-0.82953*** (0.07465)		-0.93533*** (0.07771)	-0.84368*** (0.07486)
Exp09 <sub>f</sub>		1.97754*** (0.12925)	1.84052*** (0.12532)		1.98021*** (0.12930)	1.84451*** (0.12540)		1.97714*** (0.12988)	1.84326*** (0.12591)
Lwage <sub>f</sub>			0.97545*** (0.05858)			0.96832*** (0.05856)			0.96729*** (0.05890)
Constant	10.57994*** (0.60578)	9.95918*** (0.60505)	2.80280*** (0.73804)	10.76085*** (0.65713)	10.11336*** (0.65360)	2.79017*** (0.78594)	7.98984*** (0.31509)	7.63483*** (0.33525)	0.27997 (0.58438)
Observations	8,090	8,090	8,037	8,090	8,090	8,037	8,090	8,090	8,037
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log Likelihood	-5391	-5184	-4991	-5391	-5184	-4993	-5390	-5183	-4996
Chi2	3086	3501	3811	3086	3501	3808	3089	3502	3801
Sigma	2.045	1.956	1.869	2.046	1.957	1.870	2.055	1.964	1.878

### 2.7.2 Any crisis effect ?

This study focuses on Brazilian exporters in 2010. In this paragraph, I explore the effects of the recent financial crisis of 2008 on the role of financial constraints in explaining Brazilian export performances. The recent financial crisis has led to a worldwide credit tightening. Considering this effect, the importance of financial constraints at firm- and sector- levels would be reinforced by the widespread problems of financing caused by the crisis. This question would be particularly interesting for the Brazilian case since the Brazilian government has implemented capital controls in order to limit the crisis effects. These controls are found to increase the cost of capital in the Brazilian market and to negatively affect firms' investments (Alfaro, 2014). In order to check the importance of credit tightening in the aftermath of the crisis, I estimate Eq. (2.1) using data on Brazilian exporters in 2009. The results in Table 2.11 show two different results when considering Brazilian measures of sector financial vulnerability and US benchmarks. Beginning with the *inherent* financial needs of manufacturing sectors, the results remain unchanged when considering the crisis effect. The importance of firm size in explaining trade decreases when accounting for technological-based financial constraints at sector-level. These results would be explained by the fact that US indicators are meant to only reflect intersectoral *technological* differences that are not likely to be affected by the crisis. Less precise effects of the crisis are however found when considering Brazilian measures of sector-level financial constraints. Results show that there is no evidence of a change in the importance of the firm size during the crisis, with regards to export performances when the firm operates in a sector that encounter problems in access to finance given the Brazilian context. This result suggests that during the crisis, being a large firm presents a good element in favor of higher export performances, independent of the sector of activity in which the firm operates. An alternative explanation would be behind these results. In the context of external funds shortage, large firms can be considered as less credit constraints compared with other firms, since these firms can make use of their abundant internal funds. Consistent with the literature on finance and investments, firms have to arbitrate between external and internal sources of funding. These explanations are consistent with the findings of Alfaro et al (2014), which suggest a less negative effect of Brazilian capital controls on the export performances of large Brazilian firms.

Overall, the crisis of 2008 does not seem to affect the *inherent* financial needs of manufacturing sectors in Brazil. This crisis has however made the financial conditions of Brazilian sectors harder. In this context, firm size matters more with reference to export performances.

Table 2.11: Firm size and Firm Exports in 2009: Is there any Crisis Effect?

This table presents the estimation results of the main specification using Interval Regression method, for the year 2009. I consider Brazilian measures of financial vulnerability as well as US indicators proposed by Kroszner et al (2007). Firm size is proxied with the number of employees. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively.

Dep. Var:	ExtFinBra		TangBra		ExtFinUS		RDUS		TangUS	
LEXP <sub>f</sub> (linf, lsup)	1	2	3	4	5	6	7	8	9	10
Lemployees <sub>f</sub>	0.80021*** (0.02380)	0.73772*** (0.02278)	0.80793*** (0.05673)	0.76180*** (0.05465)	0.78832*** (0.02695)	0.74051*** (0.02580)	0.80760*** (0.02837)	0.77659*** (0.02750)	1.19364*** (0.10753)	0.93941*** (0.10397)
Lemployees <sub>f</sub> × FinVuls	0.01234 (0.00988)	0.00233 (0.00963)	-0.05300 (0.15203)	-0.07588 (0.14629)	-0.10552** (0.05216)	-0.17665*** (0.05069)	-0.46990* (0.26061)	-0.62776** (0.25993)	-1.37798*** (0.34979)	-0.66832** (0.33923)
Parent <sub>f</sub>	-0.99681*** (0.07208)	-0.74962*** (0.06890)	-0.99855*** (0.07221)	-0.75140*** (0.06900)	-0.92272*** (0.08991)	-0.74358*** (0.08563)	-0.94179*** (0.08966)	-0.80264*** (0.08627)	-0.94307*** (0.09024)	-0.76295*** (0.08596)
Exp08 <sub>f</sub>	1.56612*** (0.12411)	1.48413*** (0.11954)	1.56812*** (0.12428)	1.48578*** (0.11964)	1.68544*** (0.15641)	1.62503*** (0.15164)	1.67594*** (0.15536)	1.63648*** (0.15151)	1.69091*** (0.15710)	1.62453*** (0.15202)
Lwage <sub>f</sub>		1.24206*** (0.05764)		1.24292*** (0.05763)		1.30289*** (0.07310)		1.07955*** (0.06940)		1.27384*** (0.07340)
Constant	9.00206*** (0.27033)	0.41781 (0.49852)	9.02258*** (0.28949)	0.36510 (0.51148)	10.87793*** (0.71947)	1.83289** (0.87423)	10.41824*** (0.77871)	2.36720** (0.94118)	8.62993*** (0.41747)	-0.61989 (0.70213)
Observations	7,760	7,742	7,760	7,742	5,062	5,049	5,062	5,049	5,062	5,049
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log Likelihood	-5397	-5139	-5398	-5139	-3421	-3246	-3434	-3300	-3415	-3250
Chi2	3280	3760	3278	3760	2244	2568	2218	2460	2255	2560
Sigma	1.854	1.742	1.855	1.742	1.812	1.700	1.816	1.729	1.819	1.708

## 2.8 Conclusion

This paper places itself in the growing literature on the impact of financial frictions on trade patterns. The aim of this paper is particularly to provide micro-level evidence on the role of financial constraints at firm- and industry-levels in impeding export performances in Brazil. The focus on the Brazilian case is motivated by the fact that Brazil has not exploited its potential of international trade (Canuto et al, 2013) and by the problems in credit availability that make financial constraints persist in Brazil, despite the continuous public efforts to enhance the efficiency of the financial system.

This study contributes to the field of international trade by at least two elements. To begin with, this paper exploits the Interval Regression method of estimation (Conroy, 2005). To my knowledge, this method has never been used in the field of international trade. Interval Regression method allows to estimate the export performances when data is censored, here provided in ranges of exports. The second contribution of this paper is the use of Brazilian measures to proxy the external financial needs of Brazilian manufacturing industries. The indicators better assess the *specific* financial conditions of Brazilian industries, compared with US indicators that have been widely used in the literature. Indeed, these measures capture the effects of the low development of the Brazilian financial system on the allocation of capital between manufacturing sectors and on their access to finance, by consequence.

The findings of this paper provide strong evidence that larger firms are more likely to be export performant, and that the advantage related to firm size decreases however when accounting for the financial needs of the manufacturing sectors in which they operate. Particularly, I found that the importance of firm size is reduced in sectors that present high levels of external financial needs and in those with many tangible assets, as well. This result is in contrast with the traditional predictions in the literature. In fact, the dependence on external finance is supposed to be inversely correlated with the level of asset tangibility. Therefore, one would predict that the effects of these two sector-measures, on the advantage related to firm size, are in opposite signs. Considering Brazilian characteristics, this result can be explained. In fact, due to the problems in credit availability, sectors that highly depend on external finance are those that present many tangible assets. In other words, only industries that can provide collaterals when demanding credit are able to rely on external capital. Due to financial market imperfections, sectors with few tangible assets find it better to search for alternative sources of funding, different from funds from the banking system. This idea can be supported by the results of the Brazilian Investment Climate Survey, which suggest that 67% of loans proposed to Brazilian firms require collaterals (Kumar and Francisco, 2005). Another explanation can be provided. In sectors with high needs in terms of external capital, even large firms would be negatively affected. Due to their size, these firms are by nature in need of more external finance compared with smaller ones. Taking into account the high cost of capital, large firms would be brought to search for other sources of financing, notably internal funds. This idea is also supported by the results of the survey mentioned above. 32% of large

firms declare not applying for loans due to the high interest rates (against 36.5, 33.2 and 33% for micro, small and medium-sized firms). The main finding of this paper remains valid when considering the intersectoral differences in terms of *inherent* needs of external finance. The use of US indicators permits in fact to circumvent the possible *endogeneity* problem that can be related to the Brazilian sector-level measures of external financial needs.

Additional results suggest that main establishments perform less compared with affiliated firms. This finding is consistent with Brazilian tax incentives to promote exports. As said before, it is for example more interesting for a company to export through an affiliated firm in the Brazilian Export Processing Zone (EPZ), rather than exporting itself the goods. Further estimations have shown that large firms present more export performances when they operate in sectors that have received higher BNDES loans in 2010. This finding attests of the export promotion effects of these public loans. It shows also that BNDES loans may distort the financial needs and access to finance of different manufacturing sectors.

Given all these elements, this paper has a number of policy implications. First, as suggested by this study, large firms do face constraints when financing their investments. The high cost of capital and the low quality of legal frameworks hamper Brazilian firms' activities. Therefore, additional efforts by the Brazilian government would be needed to improve the efficiency of financial intermediation. In this regard, the results suggest that BNDES loans would be a form of credit relaxation when exporting. A possible policy would be then to target sectors that are *by nature* reliant on external finance. Recall that the Brazilian government has created the BNDES bank in order to enhance the development of the economy and the industrial production (Suzigan et al, 2007), among other objectives. In this context, this paper suggests that more actions are needed to ensure the growth of the industrial sector, notably in terms of financial support. Given that BNDES loans particularly go to large firms and to manufacturing sectors, it seems that the problem with BNDES loans is mainly an *efficiency* issue (Lazzarini et al, 2015).

Focusing on trade, the present study confirms that financial market imperfections hamper international trade performances. This finding may explain the relatively low performances of Brazil in terms of manufacturing exports. Given the resource endowment of Brazil and the international fragmentation of the production system, public policies can be called to help the economy better exploit its export potential in the manufacturing sector. By checking the Brazilian history, one can notice that inflation rates remain high, which leads to a high cost of capital. In the absence of remedy to high inflation, well targeted subsidized credits<sup>23</sup> and tax incentives would be part of the solution, to expand exports. Note that the low performances of Brazil in terms of exports can also demonstrate of a Brazilian *culture* oriented towards domestic consumption, given the size of the Brazilian market. The consumption in Brazil does however only represent 4% of the world demand. This would be an additional factor that boosts the Brazilian government to act in favor of a facilitation of the exporting activity,

<sup>23</sup>In fact, BNDES subsidized credit mainly go for firms that have higher capacities to repay loans, rather than those in higher needs of financial support.

in order to ensure high levels of economic development.

Finally, a number of limitations can be associated to this present study. First, while the method of estimation in this paper presents a contribution to the field of international trade, the use of exact values of exports would be more precise. Second, it would be interesting to have information about the ownership of exporting firms. Multinational companies for example are found to be less credit constrained compared with domestic companies (Manova et al, 2011). It would be then interesting to control for firm ownership when studying the effects of financial constraints at firm-level. This question is even more important with regards to trade given the increasing role of multinational companies in determining international trade patterns. Moreover, this study has focused on the intensive margin of trade. It would be also interesting to study the effects of financial constraints on the extensive margin of trade, i.e. the decision to enter the export market. This question is particularly interesting for Brazil, since the entry rate in Brazil is particularly low (Canuto et al, 2013). This analysis will be possible through a matching exercise between exporters and non-exporters for which data are available in RAIS list. In addition, since the financial crisis has resulted in a worldwide credit shortage, further research is needed to disentangle the effects of the financial crisis from those related to the domestic financial market's imperfections, when explaining firms' export performances. This idea is relevant for the Brazilian case since the Brazilian government has implemented, as in a number of emerging markets, capital controls in the aftermath of the crisis, resulting in an increase in the cost of capital (Alfaro et al, 2014). Finally, it would be also interesting to go deeper into the study the effects of precise *export incentives* on Brazilian firms' export performances. While the efficiency of BNDES loans has been treated in the literature (Ottaviano and Souza, 2007; 2014), there are no works that focus on the effects of BNDES loans *specific* to the exporting activity on Brazilian firms' export performances. Similarly, Export Processing Zones (EPZ) are supposed to boost exports, through a range of fiscal, financial and currency incentives. It would be therefore interesting to evaluate their role in enhancing Brazilian export performances.

## 2.9 Appendix

### 2.1 Firm Size Indicators -ORBIS

This table presents the classification of firm size provided by ORBIS database (Accessed in 2012).

Size	Operating Revenue	Total Assets	Employees	Other
VL	>= 130 million US \$	>= 260 million US \$	>=1000	Listed
L	>= 13 million US \$	>= 26 million US \$	>=150	Not VL
M	>= 1.3 million US \$	>= 2.6 million US \$	>=15	Not L, VL
S	Firms not included in other categories			

## 2.2 Measures of Sector-Level Financial Vulnerability

**Table A.2.2.1.** Brazilian measures of Financial Vulnerability

In this table, I display two measures of financial vulnerability computed using Brazilian data over 2000-2012. ExtFinBra is the median value of capital expenditures that are not financed with internal funds, as proposed by RZ. TangBra informs about the part of tangible assets in total assets.

CNAE 2.0	Industry	ExtFinBra	TangBra
30	Other transport equipment	-6,94	0.11
15	Leather and Footwear	-6,60	0.12
12	Tobacco	-6,54	0.20
11	Beverages	-3,66	0.19
26	Computer, electronic and optical products	-3,20	0.03
22	Rubber and plastic products	-1,91	0.46
31	Furniture	-1,41	0.28
18	Printing and Publishing	-0,91	0.32
24	Metallurgy	-0,76	0.44
23	Non-metallic mineral products	-0,67	0.37
27	Electrical equipment	-0,41	0.25
20	Chemicals	-0,17	0.42
13	Textiles	-0,12	0.42
25	Fabricated metal products, except machinery and equipment	-0,11	0.33
17	Paper and paper products	-0,09	0.58
29	Motor vehicles, trailers and semi-trailers	-0,08	0.36
16	Wood products	-0,06	0.62
14	Wearing Apparel	-0,04	0.39
19	Coke and refined petroleum products	0,03	0.37
28	Machinery and equipment n.e.c	0,26	0.25
32	Other manufacturing	0,32	0.16
10	Food Products	0,37	0.39
21	Drugs	1,99	0.17



**Table A.2.2.2.** US measures of Financial Vulnerability (Kroszner et al, 2007)

ISIC CODE	Industry	ExtFinUS	RDUS	TangUS
314	Tobacco	-1,14	0,00	0,19
361	Pottery	-0,41	0,02	0,28
323	Leather	-0,95	0,01	0,12
3211	Spinning	-0,05	0,01	0,38
324	Footwear	-0,74	0,01	0,13
372	Non-ferrous metal	-0,12	0,01	0,32
322	Apparel	-0,21	0,00	0,15
353	Refineries	-0,02	0,00	0,62
369	Non metal products	-0,29	0,01	0,48
313	Beverages	0,03	0,00	0,40
371	Iron and Steel	0,05	0,01	0,44
311	Food products	-0,15	0,01	0,37
3411	Pulp and Paper	-0,07	0,01	0,60
3513	Synthetic resins	0,03	0,03	0,40
341	Paper products	-0,35	0,01	0,42
342	Printing and Publishing	-0,42	0,01	0,21
352	Other Chemical products	-0,30	0,02	0,27
355	Rubber products	-0,02	0,02	0,36
332	Furniture	-0,38	0,01	0,28
381	Metal Products	-0,25	0,01	0,28
3511	Basic chemicals	-0,19	0,03	0,43
331	Wood products	0,05	0,01	0,32
384	Transport Equipment	-0,08	0,02	0,23
354	Petroleum and coal	0,13	0,01	0,46
3843	Motor vehicles	0,06	0,02	0,28
321	Textiles	0,01	0,01	0,31
382	Machinery	-0,04	0,02	0,22
3841	Ship Building	0,38	0,02	0,28
390	Other manufacturing	0,28	0,02	0,18
362	Glass	0,03	0,02	0,42
383	Electrical machinery	0,24	0,07	0,21
385	Professional equipment	0,72	0,09	0,16
3832	Radio	0,70	0,09	0,14
3825	Office and computing	0,54	0,10	0,14
356	Plastic products	-0,02	0,02	0,38
3522	Drugs	2,43	0,58	0,16

### 2..3 Descriptive Statistics

**Table A.2.3.1.** Sector composition of Exporting Firms in 2010

CNAE Class	Industry	% of firms
10	Food Products	9.36
11	Beverages	0.80
12	Tobacco	0.31
13	Textiles	3.53
14	Apparel	4.87
15	Leather and Footwear	5.42
16	Wood products	4.20
17	Paper and products	1.84
18	Printing and Publishing	0.67
19	Petroleum and Coal products	0.59
20	Chemicals	8.34
21	Drugs	1.38
22	Rubber and Plastic products	7.99
23	Non-metallic mineral products	4.02
24	Iron and Steel	2.99
25	Metal products	6.08
26	Computer, Electronic and Optical	4.45
27	Electrical machinery	4.43
28	Machinery	13.81
29	Motor vehicles	5.93
30	Other transport equipment	0.69
31	Furniture	2.99
32	Other manufacturing	5.32
Total		100.00

**Table A.2.3.2.** Summary statistics

Variable	Nb. Obs.	Mean	Std. Dev.	Min	Max
linf	3729	14.75088	1.462138	13.81551	18.42068
lsup	12361	14.61398	1.331433	13.81551	18.42068
Number of Employees	12556	216.9817	582.1265	0	19247
Wage Bill	12556	508591.5	1836623	0	8.16e+07
Wage Per Worker	12343	2191.312	8895.562	0	945551.5
Parent	12556	.829245	.3763097	0	1
bn-des10	12556	3.18e+09	3.86e+09	4924120	2.87e+10

**Table A.2.3.3.** Firm Size and Dependence on External Finance

This table displays the mean values of variables of firm size considering the level of dependence on external finance of the sector in which firms operate. Two categories are considered: sectors with Low Dependence ( $\text{ExtFinUS} < 0$ ) and those with High Dependence ( $\text{ExtFinUS} > 0$ ).

Variable	Low Dep.	High Dep.
Number of Employees	207.8308	223.0612
Wage Bill	414439.5	571143.2
Wage Per Worker	2072.206	2270.31
Nb. Obs.	5012	7544

**Table A.2.3.4.** Export Behavior of the Survivors in 2010

Status in 2010	Number of firms
$\text{ExportRange10} > \text{ExportRange9}$	829
$\text{ExportRange10} = \text{ExportRange9}$	9069
$\text{ExportRange10} < \text{ExportRange9}$	516
Total	10414

## 2.4 A model of heterogeneous firms with credit constraints à la Manova (2013)

The theoretical framework of this paper follows Manova (2008;2013) which presents a model of heterogeneous firms in the presence of credit constraints. Since available data only cover the value of exports of Brazilian exporters (*intensive* margin of trade), we present the theoretical framework in which firms need to raise outside capital in order to finance a part of their fixed and variable costs.

Manova (2008) considers a framework with  $N$  countries and  $S$  sectors. Within each sector  $s$ , heterogeneous firms produce varieties in country  $i$  different from those in country  $j$ . Consumers love varieties and share the same CES utility function so that the utility function in country  $j$  is:

$$U_j = \prod_s \left[ \left( \int_{w \in \Omega_s} q_{js}(w)^{\frac{\varepsilon-1}{\varepsilon}} dw \right)^{\frac{\varepsilon}{\varepsilon-1}} \right]^{\eta_s}$$

Where  $q_{js}(w)$  is the consumption demand of the variety  $w$  of the sector  $s$  in country  $j$ ,  $\Omega_s$  is the set of varieties of differentiated products in sector  $s$  and  $\varepsilon > 1$  is the elasticity of substitution across varieties of the sector  $s$ .  $\eta_s$  is a parameter that indicates the share of the sector  $s$  in the total expenditure in country  $j$  and satisfies  $0 < \eta_s < 1$  and  $\sum_s \eta_s = 1$ . The price index in country  $j$  takes the following form:

$$P_{js} = \left( \int_{w \in \Omega_s} p_{js}(w)^{1-\varepsilon} dw \right)^{\frac{1}{1-\varepsilon}}$$

with  $p_{js}(w)$  is the price of the variety  $w$  of the sector  $s$ . If  $Y_j$  is the total expenditure in country  $j$ , then, the demand for variety  $w$  of the sector  $s$  is:

$$q_{js}(w) = \frac{p_{js}(w)^{-\varepsilon} \cdot \eta_s Y_j}{P_{js}^{1-\varepsilon}}$$

Firms produce their products and sell them at the domestic market and can export them to other countries. The model assumes that the cost of producing one unit in the home market in sector  $s$  with productivity level  $a_{is}$  is  $c_{is}/a_{is}$  where  $c_{is}$  is a parameter that captures the differences in terms of factor intensities between sectors and across countries. The fixed cost of entry in the domestic market is denoted  $c_{is} \cdot f_i$ . For simplicity, firms are supposed to finance their domestic activities by the cash flows of their operations. Consequently, only exporting activities require external liquidity.

As familiar with traditional trade models, it exists an iceberg trade cost  $\tau_{ij} > 1$ ; it follows that an exporter should export  $\tau_{ij} \cdot q_{ij}(a)$  so that  $q_{ij}(a)$  arrives at the importing country. Moreover, exporting from country  $i$  to country  $j$  require a fixed cost  $f_{ij} \geq 0$  where  $i \neq j$ .  $\tau_{ij}$

and  $f_{ij}$  are country-pair specific and the subscript  $i$  indicates the exporting country while  $j$  indicates the destination market.

Firms are heterogeneous by their productivity level  $a_{is}$  which can be represented by the cumulative distribution function  $g(a)$  with support  $[a_L, a_H]$  with  $0 < a_L < a_H$ . The total costs to export,  $q_{ij}(a)$  are:

$$C_{ijs}(a) = q_{ij} \cdot \left( \frac{\tau_{ij} \cdot c_{is}}{a_{is}} \right) + c_{is} \cdot f_i$$

The model assumes that exporters are credit constrained. A firm cannot finance all its export costs internally; it needs to borrow a fraction  $d_s$  of its total costs related to the exporting activity. A firm borrows the capital from the financial system. Depending on the level of development of the financial system in the exporting country  $i$ , there exists a probability  $0 < \delta_i < 1$  that the contract is reinforced and that the borrower pays the repayment amount  $D(a)$ . In the opposite case, the financial system claims collateral.

The sectors in the economy are heterogeneous in terms of reliance on external capital. The more the sector depends on external liquidity, the more it is *financially vulnerable*. In a given sector, all firms have the same needs in terms of external capital and the same collateralizable assets. The model assumes that only a fraction  $z_s$  of the up-front costs goes to tangible assets (equipment, machines, lands, plants...) and can be collateralizable.

In the case of perfect financial systems, the firms, with a productivity level above a determined cut-off  $1/a'_{ijs}$ , can export as predicted by Melitz (2003). Here, the model adds financial constraints as determinants of the exporting decision. It is assumed that the productivity cut-off in the case of *imperfect* financial systems noted  $1/a^*_{ijs}$  is higher than  $1/a'_{ijs}$  so that  $1/a'_{ijs} < 1/a^*_{ijs}$ . Considering these assumptions, exporting firms from country  $i$  and operating in sector  $s$  will maximize their export profits by solving the following function:

$$\begin{aligned} \underset{p(a), q(a), D(a)}{\text{Max}} \pi_{ijs} = & p_{ijs}(a) \cdot q_{ijs}(a) - (1 - d_s) \cdot q_{ijs}(a) \cdot \tau_{ij} \cdot c_{is} \cdot a - (1 - d_s) \cdot f_{ij} \cdot c_{is} \\ & - \delta_i \cdot D(a) - (1 - \delta_i) \cdot z_s \cdot c_{is} \cdot f_i \end{aligned}$$

Subject to:

$$(1) \quad q_{ijs}(a) = \frac{p_{ijs}^{1-\varepsilon}(a) \cdot \theta_s \cdot Y_j}{P_{js}^{1-\varepsilon}}$$

Where  $\theta_s$  is the share of each sector in the total expenditure of the country,  $Y_j$  is the total income of the country  $j$  and  $P_{js}$  is price index in sector  $s$  in the country  $j$ .

$$(2) \quad A_{ijs}(a) = p_{ijs}(a) \cdot q_{ijs}(a) - (1 - d_s) \cdot q_{ijs}(a) \cdot \tau_{ij} \cdot c_{is} - (1 - d_s) \cdot f_{ij} \cdot c_{is} \geq D(a)$$

$$(3) \quad B_{ijs}(a) = -d_s \cdot [q_{ijs}(a) \cdot \tau_{ij} \cdot c_{is} + f_{ij} \cdot c_{is}] + (1 - \delta_i) \cdot D(a) + \delta_i \cdot z_s \cdot c_{is} \cdot f_i \geq 0$$

In a context of financial constraints, the firms need external funds to invest in the exporting market. They borrow capital from the financial system. If the contract is enforced, the firms

can offer at most the total amount of their net revenues to the creditor,  $A_{ijs}(a)$ . Similarly, the creditors will not provide firms with external funds unless their net returns  $B_{ijs}(a)$  are positive. With competitive credit markets, the bankers break even and in equilibrium  $B_{ijs}(a) = 0$ . Hence, the maximization problem of the firm is reduced to the firm's problem in the absence of credit constraints, but with one condition: the repayment amount  $D(a)$  cannot exceed the net revenue of the firm. More productive firms can sell larger quantities and have larger net revenues; however, since the repayment amount  $D(a)$  depends on the quantity, this will lead more productive firms to require larger amounts of external finance and then, larger  $D(a)$ . As a consequence, the export participation of the firms is characterized by two different cut-offs  $1/a^H$  and  $1/a^L$ . All firms with a productivity higher than  $1/a^L$  can export, but only those with a productivity higher than  $1/a^H$  will export at first-best, i.e. with quantities and prices of the maximization problem in the absence of credit constraints.  $1/a^H$  can be defined by  $A_{ijs}(a^H) = D(a^H)$ . Thus,  $1/a^H$  is the solution for:

$$\left[ 1 - (1 - d_s)\alpha - \frac{d_s\alpha}{\delta_i} \right] \cdot \left( \frac{\tau_{ij}c_{is}a_{ijs}^H}{\alpha P_{js}} \right)^{1-\varepsilon} \theta_s Y_j = \left( 1 - d_s + \frac{d_s}{\delta_i} \right) \cdot f_{ij} \cdot c_{is} - \frac{1 - \delta_i}{\delta_i} \cdot z_s \cdot c_{is} \cdot f_i$$

I recall that exporting larger quantities implies larger revenues and higher costs and thus, greater payments to the investor  $D(a)$ , as well. It follows that firms with productivities lower than  $1/a^H$  will be interested in exporting lower volumes than the unconstrained first-best level, at greater prices, to guarantee the same revenues  $A_{ijs}(a) = D(a)$ . The greatest price  $p^L(a)$  that firms can charge on their exports is the solution of maximization for the following equation:

$$\frac{p^{1-\varepsilon} \theta_s Y_j}{P_{js}^{1-\varepsilon}} \times \left[ 1 - (1 - d_s)\alpha + \frac{d_s\alpha}{\delta_i} \right] = \left( 1 - d_s + \frac{d_s}{\delta_i} \right) \cdot f_{ij} \cdot c_{is} - \frac{1 - \delta_i}{\delta_i} \cdot z_s \cdot c_{is} \cdot f_i$$

Exporters can then charge a price on their exports that can range from  $p^H(a) = \frac{\tau_{ij}c_{is}a_{ijs}}{\alpha}$  to  $p^L(a) = \frac{\tau_{ij}c_{is}a_{ijs}}{\alpha} \times \left( 1 - d_s + \frac{d_s}{\delta_i} \right)$  which is the price that maximizes the equation above. Using the expression of  $p^L(a)$ , the productivity cut-off  $1/a^L$  is defined by the following equation:

$$\left( 1 - d_s + \frac{d_s}{\delta_i} \right)^{1-\varepsilon} \cdot \left( \frac{\tau_{ij}c_{is}a_{ijs}^L}{\alpha P_{js}} \right)^{1-\varepsilon} \theta_s Y_j = \varepsilon \left[ \left( 1 - d_s + \frac{d_s}{\delta_i} \right) \cdot f_{ij} \cdot c_{is} - \frac{1 - \delta_i}{\delta_i} \cdot z_s \cdot c_{is} \cdot f_i \right]$$

Note that these productivity cut-offs  $1/a^H$  and  $1/a^L$  define the proportion of the firms that can enter the exporting market in the presence of credit constraints, which is called the *extensive* margin of trade.

Manova (2013) shows that, under some assumptions<sup>24</sup>, the productivity cut-off  $1/a$  is higher in countries with low level of financial development  $\delta_i$  and in sectors with high financial dependence on external finance  $d_s$ , so that:

<sup>24</sup>See Manova (2013) for more details.

$$\text{Proposition 1 (cutoff)} \quad \frac{\partial a_{ijs}}{\partial \delta_i} > 0; \frac{\partial a_{ijs}}{\partial d_s} > 0; \frac{\partial a_{ijs}}{\partial t_s} > 0$$

Regarding the intensive margin of trade, Manova (2013) also predicts that financial development increases the level of firms' exports from country  $i$  to country  $j$  relatively more in sectors with higher needs of external capital, so that:

$$\text{Proposition 2 (firm exports)} \quad \frac{\partial^2 r_{ijs}}{\partial \delta_i d_s} > 0; \frac{\partial^2 r_{ijs}}{\partial \delta_i t_s} < 0 \text{ where } r_{ijs} \text{ are the firm's export revenues.}$$

Since I am interested in the value of exports of the individual firms, i.e. the *intensive* margin of trade, the value of exports of firm  $f$  from country  $i$  to country  $j$  in sector  $s$  can be summarized as follows:

$$\left\{ \begin{array}{l} \left( \frac{\tau_{ij} c_{is} a_{ijs}}{\alpha P_{js}} \right)^{1-\varepsilon} \theta_s Y_j \quad \text{for firms with } 1/a \succeq 1/a^H \\ p(a).q(a) \text{ for firms with } 1/a^L \preceq 1/a \preceq 1/a^H \\ \text{where } \frac{\tau_{ij} c_{is} a_{ijs}}{\alpha} \prec p(a) \preceq \frac{\tau_{ij} c_{is} a_{ijs}}{\alpha} \times \left( 1 - d_s + \frac{d_s}{\delta_i} \right) \\ \text{and } q(a) \prec \left( \frac{\tau_{ij} c_{is} a_{ijs}}{\alpha} \right)^{-\varepsilon} \frac{\theta_s Y_j}{P_{js}^{1-\varepsilon}} \text{ and that verifies } A_{ijs}(a) = D(a) \\ 0 \text{ otherwise} \end{array} \right\}$$

## 2.5 Wage Bill, Sector Financial Vulnerability and Firm Exports

In this table, I display the estimation results of Eq. (2.1) using the wage bill as a measure of firm size. In order to capture sector-level financial vulnerability, I use Brazilian measures computed over the 2000s. The estimation is based on Interval Regression method. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively.

Dep. Var:	ExtFinBra			TangBra				
LEXP <sub>f</sub> (linf, lsup)	1	2	3	4	5	6	7	8
Lwageb <sub>f</sub>	0.92611*** (0.01867)	0.87716*** (0.01852)	0.87716*** (0.01852)	0.82778*** (0.01816)	1.01739*** (0.04658)	0.98629*** (0.04587)	0.98629*** (0.04587)	0.93067*** (0.04518)
Lwageb <sub>f</sub> xFinVul <sub>s</sub>	-0.02354*** (0.00879)	-0.02197** (0.00863)	-0.02197** (0.00863)	-0.02195*** (0.00850)	-0.21840* (0.12491)	-0.27511** (0.12307)	-0.27511** (0.12307)	-0.25608** (0.12133)
Parent <sub>f</sub>		-0.76570*** (0.05956)	-0.76570*** (0.05956)	-0.85495*** (0.05909)	-0.77282*** (0.05964)	-0.77282*** (0.05964)	-0.77282*** (0.05964)	-0.86151*** (0.05917)
Exp09 <sub>f</sub>				1.76008*** (0.09744)				1.76033*** (0.09751)
Constant	1.56192*** (0.27179)	2.83750*** (0.27846)	2.83750*** (0.27846)	1.88800*** (0.28847)	0.82188** (0.37113)	2.00777*** (0.37169)	2.00777*** (0.37169)	1.09448*** (0.37808)
Observations	12,294	12,294	12,294	12,294	12,294	12,294	12,294	12,294
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log Likelihood	-8160	-8078	-8078	-7878	-8162	-8079	-8079	-7879
Chi2	5228	5392	5392	5792	5224	5390	5390	5789
Sigma	1.958	1.927	1.927	1.882	1.960	1.928	1.928	1.884



## 2.6 Robustness Checks: Ordered Probit

In this Table, I present the estimation results of Eq. (1) using Ordered Probit model. Note that the coefficients displayed cannot be directly interpreted. One should compute marginal effects. However, these coefficients can inform the reader about the sign and the significance of the effects. Here, firm size is proxied with the number of employees. In order to capture sector level financial constraints, I use Brazilian measures computed over the 2000s. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively.

Dep. Var:	ExtFinBra			TangBra		
LEXP <sub>f</sub> (linf, lsup)	1	2	3	4	5	6
Lemployees <sub>f</sub>	0.46559*** (0.00982)	0.44576*** (0.00992)	0.42949*** (0.01007)	0.51208*** (0.02439)	0.50423*** (0.02442)	0.48487*** (0.02472)
Lemployees <sub>f</sub> × FinVul <sub>s</sub>	-0.00797* (0.00443)	-0.00796* (0.00443)	-0.00831* (0.00448)	-0.11920* (0.06685)	-0.15515** (0.06689)	-0.14471** (0.06758)
Parent <sub>f</sub>		-0.45809*** (0.03056)	-0.51223*** (0.03103)		-0.46060*** (0.03057)	-0.51448*** (0.03104)
Exp09 <sub>f</sub>			0.96615*** (0.05030)			0.96580*** (0.05033)
Constant cut1	2.78106*** (0.07661)	2.28667*** (0.08338)	3.06822*** (0.09548)	2.90309*** (0.08905)	2.43176*** (0.09458)	3.20811*** (0.10581)
Constant cut2	3.86750*** (0.08051)	3.39518*** (0.08652)	4.20989*** (0.09903)	3.98912*** (0.09238)	3.53987*** (0.09733)	4.34933*** (0.10899)
Constant cut3	4.69088*** (0.08572)	4.23871*** (0.09105)	5.06766*** (0.10348)	4.81192*** (0.09668)	4.38262*** (0.10116)	5.20647*** (0.11284)
Constant cut4	5.07564*** (0.08959)	4.63207*** (0.09464)	5.46499*** (0.10679)	5.19629*** (0.10004)	4.77551*** (0.10432)	5.60337*** (0.11583)
Observations	12,343	12,343	12,343	12,343	12,343	12,343
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	No	No	No	No	No	No
Log Likelihood	-8487	-8376	-8152	-8487	-8375	-8152
Chi2	4636	4858	5305	4636	4860	5306

## 2..7 Robustness Checks: Alternative Sample

As robustness check, I present the estimation results based on an alternative sample of exporting firms in 2010. This sample is got by matching data on exports with data on firm size from the ORBIS database. Two categories of firm size are considered: Large firms are those in Large and Very Large classes according to ORBIS classification and other firms (Small and Medium firms). Details of the classification are presented in Appendix 2.1. Appendix Table 2.7.1 presents descriptive statistics of the database. The following tables present Interval Regression results using Brazilian measures of financial vulnerability: ExtFinBra and TangBra. \*\*\*,\*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively.

**Table A.2.7.1.** Descriptive Statistics

Interval of Exports in million US\$	Legal Status		Export Status	
	Affiliated	Main	New Exporters	Survivors
Exp< 1	860	6427	1831	5456
1<Exp<10	555	1421	98	1878
10<Exp<50	324	366	34	656
50<Exp<100	82	66	2	146
Exp>100	105	60	17	148
Nb. Obs.	1926	8340	1982	8284

**Table A.2.7.2.** ORBIS Firm Size, Dependence on External Finance and Firm Exports

Dep. Var:	1	2	3	4	5	6	7
LEXP <sub>f</sub> (linf, lsup)							
L <sub>f</sub>	1.707***	1.709***	1.461***	2.773***	2.771***	2.537***	2.535***
L <sub>f</sub> xExtFinBra <sub>s</sub>	-0.107**	-0.096**	-0.068*	-0.047	-0.036	-0.023	-0.011*
Exp09 <sub>f</sub>			2.264***			2.112***	2.118***
Parent <sub>f</sub>				-2.968***	-2.960***	-2.907***	-2.897***
Constant	12.437***	12.386***	10.505***	14.184***	14.149***	12.381***	12.332***
Controls:				Sector F.E.			
Region FE	No	Yes	Yes	No	Yes	No	Yes
lnsigma_cons	0.939***	0.935***	0.906***	0.827***	0.825***	0.796***	0.794***
Log Likelihood	-7966.036	-7947.370	-7717.772	-7305.978	-7293.141	-7089.306	-7075.426
Observations	10266	10262	10262	10266	10262	10266	10262

**Table A.2.7.3.** ORBIS Firm Size, Asset Tangibility and Firm Exports

Dep. Var:	1	2	3	4	5	6	7
LEXP <sub>f</sub> (linf, lsup)							
L <sub>f</sub>	2.940***	2.890***	2.488***	3.280***	3.232***	2.935***	2.876***
L <sub>f</sub> xTangBra <sub>s</sub>	-3.388***	-3.259***	-2.861***	-1.406***	-1.293**	-1.132**	-0.989*
Exp09 <sub>f</sub>			2.257***			2.110***	2.115***
Parent <sub>f</sub>				-2.952***	-2.944***	-2.893***	-2.884***
Constant	12.047***	12.020***	10.206***	14.004***	13.993***	12.253***	12.233***
Controls:				Sector F.E.			
Region FE	No	Yes	Yes	No	Yes	No	Yes
lnsigma_cons	0.938***	0.934***	0.905***	0.827***	0.825***	0.796***	0.794***
Log Likelihood	-7951.955	-7933.888	-7706.296	-7303.166	-7290.576	-7087.101	-7073.649
Observations	10266	10262	10262	10266	10262	10266	10262



## Chapter 3

# Financial Development and Sector-Level Exports to BRICS: Is there any Crisis Effect ?

### Résumé

La crise financière de 2008 a ressuscité l'intérêt de l'étude du lien entre la finance, les contraintes de financement et le commerce international. En effet, la littérature confirme que les exportations sont positivement impactées par le niveau de développement financier domestique. Le développement financier permet la réduction des contraintes de financement, particulièrement pour les secteurs dépendants du financement par le système bancaire. Motivé par la réduction sans précédent des flux de commerce international, ce chapitre étudie le rôle du développement financier dans l'explication des flux d'exportation vers les pays du groupe BRICS, en se focalisant sur l'effet de la crise. Le choix des exportations vers les différents pays du groupe BRICS (Brésil, Russie, Inde, Chine, Afrique du Sud) est justifié par le rôle grandissant de ce groupe de pays émergents dans l'économie mondiale et par le rétablissement assez rapide de la croissance de ces pays peu après la crise. Afin de capter les différences sectorielles en termes de vulnérabilité financière, nous considérons les exportations au niveau sectoriel d'un large panel de pays exportateurs vers les pays du BRICS sur la période 1996-2012. L'estimation d'un modèle à effets aléatoires confirme l'*avantage comparatif* lié au développement financier pour les secteurs qui dépendent de la finance externe et / ou ceux qui présentent peu d'actifs tangibles. Cet avantage comparatif semble par contre avoir été réduit pendant la crise. Ce résultat confirme que la crise a un effet sur le commerce via le canal financier, connu sous le nom *Trade Finance*. Malgré le rôle présumé du niveau de développement financier dans la réduction des coûts de transaction et d'information, le manque de liquidité au niveau mondial a causé une baisse des exportations surtout dans les secteurs qui ont des besoins importants de financements bancaires. Ces résultats sont robustes aux ajouts de variables de contrôle, notamment pour la qualité des institutions.

D'autres analyses montrent que l'effet de la crise sur l'importance du développement financier dans l'explication des performances d'exportation dans les secteurs dépendants de la finance externe, a été plus marqué dans les pays avec des cadres institutionnels moins développés et dans les pays développés. Afin de vérifier la particularité des effets de la crise de 2008, nous avons testé le même modèle en considérant tous les épisodes de crises financières, bancaires ou de change dans les pays exportateurs. Les résultats montrent que l'impact de ces épisodes sur l'avantage comparatif lié au développement financier est comparable à celui de la récente crise de 2008. Ce résultat remet en question les causes de la baisse sans précédent des flux de commerce international, suite à la récente crise de 2008. Enfin, du point de vue des pays BRICS, ces résultats montrent que les importations des BRICS ont été négativement affectées par la crise à cause des problèmes de financement au niveau des pays exportateurs. La transmission de la crise vers ces pays via le canal du commerce semble donc confirmée.

**JEL Classification:** F12, F14, F42, F59, G01, G20

**Keywords:** Financial Development, Financial Crisis of 2008, Exports, Sector-level, External Finance Dependence, BRICS

### 3.1 Introduction

The recent financial crisis of 2008 has resulted in an unprecedented slowdown in the international economic activity. Despite the financial origin of the crisis, the drop of international trade flows was sharp. According to the WTO, world trade flows decreased by approximately 30%, between September 2008 and the first quarter of 2009. Precisely, the decline in exports and imports was larger in comparison to the world GDP loss over the same period. While the literature agrees about the negative effect of the crisis on trade flows, two opposite views about the transmission channel have emerged. The first view considers that the demand-side shocks caused by the crisis are behind the drop of international trade flows. The financial crisis has resulted in a slowdown of the economic activity of advanced economies -starting with the United States (US hereafter)- which has caused a drop in the world demand of commodities. The fall of international trade flows has been even sharper due to the expansion of Global Value Chains (henceforth GVC). The second view stresses rather the role of supply-side shocks, namely the credit tightening. The idea is that the credit crunch that followed the bankruptcy of Lehman Brothers in fall 2008, has led to a credit scarcity in the international financial market. Consequently, this has negatively affected the trade finance and restrained producers' export capacities. In line with this debate, the present paper seeks evidence about the importance of trade finance channel in explaining the decrease of international trade flows during the crisis.

During the last two decades, the BRICS countries (Brazil, Russian Federation, India, China and South Africa) have been achieving remarkable progresses in terms of both growth and trade openness. These countries have acquired central roles in the international scene due to the global production fragmentation. This has led to a *reorientation* of exports towards BRICS countries in the last decade. In this regard, Clemens et al (2011) argue that the manufacturing exports of Germany are being reoriented to emerging countries, although the European Union remains the dominant importer. Due to the increasing role of BRICS countries in GVC, this shift is particularly noticed in exports in industries with high R&D intensity. The development of National Innovation Systems (NIS)<sup>1</sup> in BRICS countries has permitted to attract FDI in R&D (Baskaran and Muchie, 2008). On this subject, the share of R&D intensive goods in Chinese imports has increased by 12% over the last decade. These different facts attest of the changes that are being processed in the content of emerging countries' imports. These recent developments make it interesting to study the exports to BRICS countries in manufacturing industries, with different levels of R&D intensity.

Although BRICS countries -among other emerging economies- have been assumed to decouple from developed economies' growth (Asmundson et al, 2010), the statistics show that

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<sup>1</sup>NIS are tools to enhance industrial and economic competitiveness in domestic countries. They include the development of incentives to permit the evolution of the link between institutions, innovation and technology, and the definition of a conceptual framework that governs the interaction between the nation's political and economic change (Baskaran and Muchie, 2008).

these countries have witnessed a drop in output, similar to that of advanced economies during the crisis (Llaudes et al, 2010). In this regard, the negative effects on trade of BRICS would be even more stressed when taking into account the generalized lack of confidence in the aftermath of crisis. In fact, BRICS countries have undertaken a financial liberalization process starting from the 1990s which has led to important capital flows into these economies. The dynamics of these inflows have been unstable over the period 2000-2010, and this instability has been stressed during the financial crisis (Munhoz et al, 2011). Because of the fragility of their financial fundamentals, BRICS economies suffer from lack of credibility (Knoop, 2013, p.161) which has led banks and investors in advanced economies to reduce their exposure to emerging economies. These facts, coupled with the capital controls implemented by BRICS after the crisis, translate into problems in credit availability in these economies. Following the literature on the link between finance and trade, this financial vulnerability would affect the availability of *Trade Finance* in BRICS countries, and their international trade performances (both exports and imports).

Despite these facts, the BRICS continue to contribute to the global economic growth, even after the crisis (Groot et al, 2011). These countries also continue to attract exports. In a report of 2011, Andrew Goodwin, a senior economic advisor to the Ernst & Young Item Club, believes that a reorientation of the United Kingdom's exports towards emerging countries would enhance the country's economic growth. Similarly, the Irish government announced in 2011 the implementation of a number of (tax) incentives aiming at boosting exports to BRICS countries. For all these reasons, it is interesting to study exports to BRICS countries and their determinants. Motivated by the effects of the recent financial crisis, the focus in the present study is on financial determinants.

The analysis of the link finance-trade has experienced a renewed interest, due to the crisis of 2008. The literature has particularly confirmed the role of the quality of financial systems in international trade performances. From a theoretical perspective, Manova (2013) argues, through a micro-level based framework, that financial development positively affects the export performances due to extensive and intensive margins of countries' exports. Berthou (2010) finds however that the positive effect of financial development on trade channels *mainly* through the intensive margin of trade. The importance of financial development in explaining trade has been also confirmed empirically at firm-level (Muûls, 2008; Berman and Héricourt, 2010) and at aggregate-level (Hur et al, 2006; Manova, 2013). As for the relation between financial development and the economic growth, the link between finance and trade can be subject to a reverse causality problem. To deal with this issue, the literature exploits the innovation of Rajan and Zingales (1998, RZ hereafter). RZ propose sector-level indexes of dependence on external finance, which capture the heterogeneity between sectors in terms of *inherent* needs of funds provided by the financial sector, i.e. those tributary to the technological characteristics. Based on this innovation, Manova (2013) argues that well-developed financial markets provide a *comparative advantage* in terms of trade performances, partic-



ularly in industries that exhibit higher needs of external finance. The quality of financial systems and the reinforcement of contractibility ensure a better access to finance, which benefits more for sectors that are by their nature, more reliant on outside capital. In crisis times however, the quality of financial institutions can affect the access to finance in two different ways. First, the financial development is supposed to reduce the risks related to financial transactions and ensure a better financial intermediation. Considering this, one could suggest that the importance of the quality of financial systems would be stressed in crisis times, which will reinforce the comparative advantage in financially vulnerable<sup>2</sup> industries. However, the literature on banking and financial crises proposes that the domestic credit is among aggregates that predict the best financial crises ( Kaminsky and Reinhart, 1999; Demirguc-Kunt and Detragiache, 2000). In line with this view, Rajan (2005) suggests that the multiplication of financial intermediaries can accentuate the fluctuations and then expose the economy to higher risks. Considering these different risks, the comparative advantage related to financial development would be decreased in sectors with high reliance on external funds during the crisis. This present paper contributes to this debate by exploring the effect of the financial crisis of 2008 on the comparative advantage of financial development with regards to export performances.

The literature on the impact of banking and financial crises on trade patterns has also been enriched since the recent crisis of 2008. Kiendrebeogo (2013) confirms the negative effects of banking crises on bilateral trade and suggests that the supply-side shocks generated by these crises outstrip the demand-side effects. In this regard, a number of recent works have supported the importance of trade finance in explaining trade flows. Korinek et al (2010) and Chor and Manova (2012) suggest that the increase in the cost of trade finance during the recent crisis was behind the sharp drop of international trade flows. The literature fails however to examine the role of financial development in stressing the trade finance transmission mechanism of the crisis. Hence, the primary goal of this paper is to fulfill this gap by analyzing the effect of financial development on trade flows during the crisis of 2008.

Overall, the contribution of this paper is threefold. First, this study provides further evidence on the *comparative advantage* of financial development in sectors with high needs of outside capital, with regards to the intensive margin of trade. Particularly, this paper tests the role of the quality of financial systems in the transmission of the crisis to trade. To my knowledge, there are only few empirical works that assess the role of financial development in the trade finance channel of the crisis. Only the cost of trade finance has been analyzed (for instance, Chor and Manova (2012)). Second, this paper tests whether the effects of the recent global crisis are different from those of past banking and financial crises. To do so, I exploit information from a newly updated database on banking crises occurred in 1970-2010, generated by Laeven and Valencia (2012). The last contribution of this paper is related to the focus on the specific trade relations with BRICS countries. This paper tests whether

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<sup>2</sup>Financially vulnerable industries are considered to be those which highly depend on external finance.

the effects of *supply-side* shocks in exporting countries are behind the drop in the imports of BRICS countries during the crisis. The comparison of the results of this paper with the literature's predictions will permit to see if there is a particular effect of exporting countries' constraints on their trade with BRICS. As said earlier, exports to BRICS are being more intensive in terms of R&D. The R&D intensity is seen as a predictor of higher external finance dependence (Manova, 2008; Kroszner et al, 2007). Given that, the results of this present study would permit to predict the evolution of the level of vulnerability of BRICS' imports to the financial conditions in their partner countries, in the future.

Specifically, I examine the effects of financial development in a large sample of exporting countries on the evolution of yearly exports to BRICS countries, before and after the crisis, namely over 1996-2012. I also closely follow Manova (2013) and consider the differential impact of financial development on trade in financially vulnerable sectors, i.e. those which exhibit high dependence and external finance and/or with few tangible assets. To this end, I consider sector-level UN COMTRADE data<sup>3</sup> on trade flows to the BRICS. As measures of dependence on external finance, I consider RZ indexes computed over the 1980s and their updates provided by Kroszner et al (2007). I also use measures of asset tangibility initially proposed by Braun (2003) and similarly updated by Kroszner et al (2007) to cover the 1990s.

Three main findings are suggested by the present empirical paper. First, the study confirms the *comparative advantage* related to the quality of financial institutions, in financially vulnerable sectors. Second, it seems that the financial development has played a role in the transmission of the financial crisis to trade flows. In fact, the results show that the positive effect of financial development on exports of sectors that highly depend on external finance has been reduced during the crisis. The quality of financial institutions may not have been sufficient to prevent domestic markets from being affected by the global credit tightening. These findings are robust to the inclusion of control variables and additional fixed effects. I also explore the institutional and economic heterogeneity across exporting countries and across BRICS countries. The effects of the crisis of 2008 on the comparative advantage related to financial development are higher in developed economies as well as in countries with low institutional quality. Finally, this study shows that the effects of the recent financial crisis, on the role of financial development in explaining trade, are *comparable* to those effects of past banking and financial crises.

The remainder of this paper is organized as follows. In Section 2, I review the related literature on the impact of financial development, financial crises and financing constraints on international trade performances. Section 3 describes the recent financial crisis context focusing on trade and credit collapses. A particular attention goes to emerging economies, notably BRICS countries. Data used in this empirical analysis are described and detailed in Section 4. Section 5 examines the role of financial development in explaining trade flows to BRICS, across countries and sectors. In this section, I present the empirical strategy, core

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<sup>3</sup>Precisely, from World Bank International Trade Solutions (WITS). See details in Data section.

results as well as robustness checks. The following section explores exporting country heterogeneity, notably in terms of institutional frameworks and economic development. Section 7 goes beyond the recent financial crisis and studies the effects of past banking and financial crises on international trade flows. The last section concludes.

### 3.2 A brief outline of the Recent crisis

One crucial goal of this paper is to analyze the evolution of trade flows during the recent crisis of 2008. Although the crisis originated in advanced countries, the effects of the crisis have been global. Figure 3.1 presents the main trends of aggregate world trade during the crisis period. World exports contracted by approximately 38% between September 2008 and February 2009, while imports fell by 34%. The statistics highlight the financial crisis effects on both demand- and supply- sides of trade. Figure 3.2 shows that the contraction of trade in Fuels and mining products (of 35%) has been larger than that of agricultural (12%) and manufacturing sectors (20%), in the period 2008-2009. This can be also explained by the drop in commodities prices due to the global recession. While the evolution of OECD countries trade seems to be similar to world trade, Figure 3.1 shows slight differences for BRICS countries' international trade flows. The drop in BRICS exports has been of 50% between September 2008 and February 2009 and their imports decreased by 47%. Contrary to common expectations, these figures suggest that emerging countries as represented here by BRICS group, failed to decouple from advanced economies during the crisis.

In terms of volumes however, the drop of BRICS trade was similar to the decline of advanced economies' exports (of 22% between April 2008 and January 2009). Focusing on trade in goods, exports of Brazil and China have dropped by 52% in the last trimester of 2008. Concerning the imports, the drop of Brazilian flows was of 54%, slightly higher than Chinese imports (43%) (WTO, 2015). These figures show that BRICS countries were not as resilient to the global crisis, although they showed signs of recovery, soon after the crisis.

As said earlier, the transmission of the crisis to emerging countries, and more precisely to BRICS, has been through trade, finance and confidence channels (The BRICS Report, 2012). The effects of the trade channel of the crisis are intensified for BRICS countries due to their growing place in the global production system (Didier et al, 2011).

With regards to the financial channel of the crisis, the credit tightening that characterized the worldwide financial market has caused difficulties in financing international trade activities, which resulted in problems in the supply of goods. Despite the gap between advanced and emerging economies in terms of financial and institutional development, advanced economies were the first to be hit by the shrink in credit. This leads to question the role of financial development in preventing crises' formation. In order to assess the effects of the drop in trade finance, Chauffour and Malouche (2011) conduct a survey on a number of exporters and importers in developing and low-income countries. The results show that small

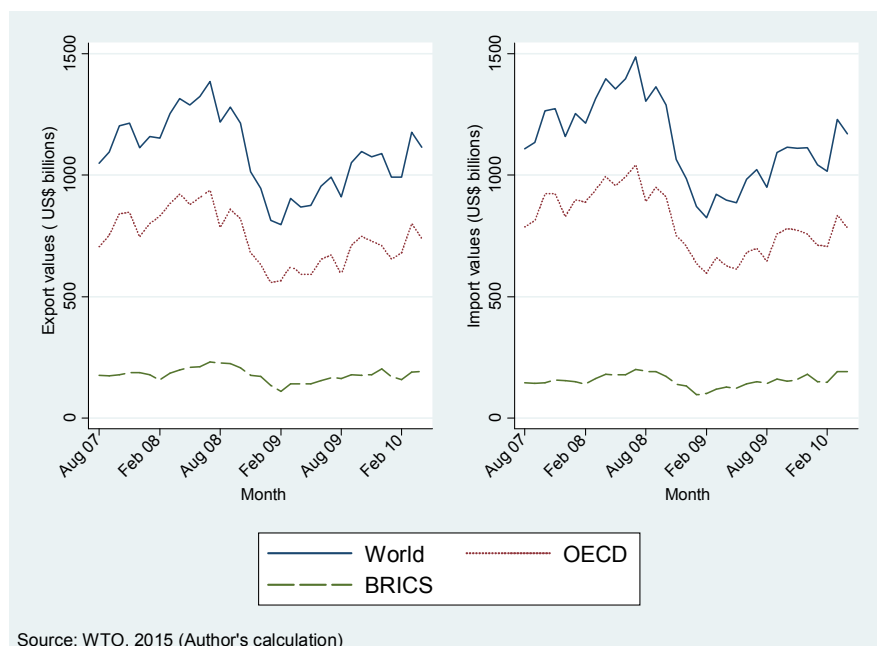


Figure 3.1: Evolution of Trade during the Crisis

and medium firms were the most affected by the drop in trade finance. This is mainly due to the increasing requirements of guarantees by banks during the crisis. The results also show that the lack of financing impedes more international trade activities in developing countries, compared with low-income countries.

The estimates show that the drop in trade finance ranges from 25 to 500 billion US dollars (Chor and Manova, 2012). As for advanced economies, after the collapse of Lehman brothers, the cost of borrowing in emerging markets has increased. For instance, a survey conducted by IMF-BAFT (Bankers' Association of Finance and Trade) in 2009, on 44 banks from 23 developed and emerging countries, has shown that trade finance decreased in the fourth quarter of 2008. The survey also shows that the cost of different instruments of trade finance, including export credit insurance and documentary credits, has dramatically increased during this period.

Regarding this financial channel of the crisis, the effects are even more important for countries with less-developed financial systems (Liston and McNeil, 2010). In fact, due to the generalized lack of confidence, banks and investors in advanced economies decided to reduce their exposure to developing and emerging economies, which has tightened the external financing conditions in those countries (Global Monitoring Report, 2009). In this regard, Korinek et al (2010) show that the fall in trade finance to non-OECD economies (of 14%) has been sharper than that to OECD countries.

Finally, while most of the researchers support the importance of trade finance in explaining the drop of international trade flows during the recent crisis (Chauffour and Farole, 2009; Chor

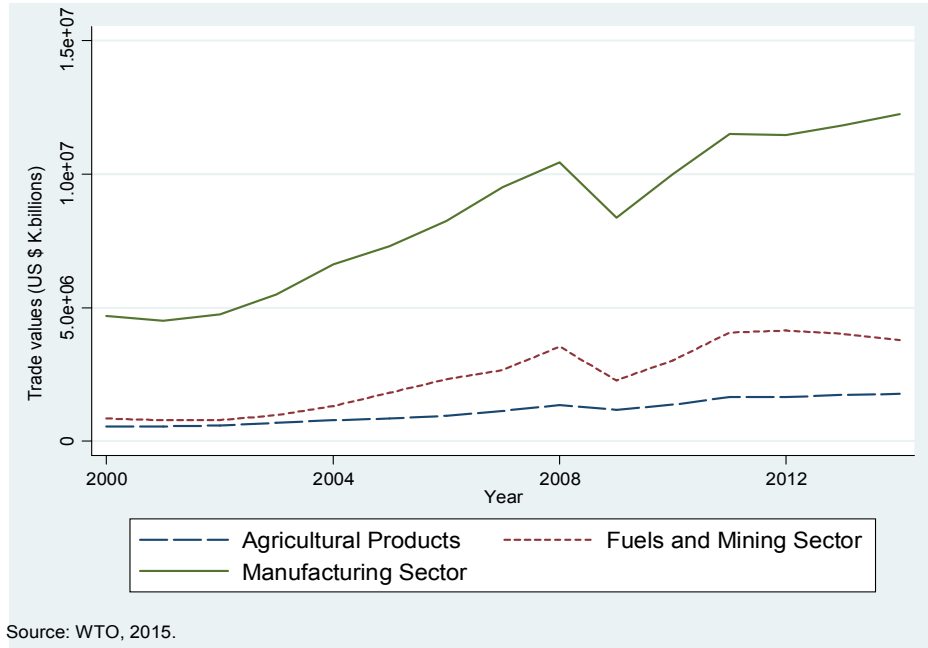


Figure 3.2: Evolution of World Trade by sector

and Manova, 2012), other studies put this idea into perspective. For instance, Asmundson et al (2010) argue that the drop in trade finance has been smaller than the drop of trade in goods. According to the World Bank, trade finance is estimated to explain 10-15% of the drop in international trade (Auboin, 2009). Considering these different views, the link between the "financial" and "trade" components of the recent crisis remains a source of debate.

### 3.3 Literature Review

This paper adds to the established literature on the role of financial frictions in predicting international trade patterns. First, the role of financial development in explaining international trade flows has been theoretically and empirically analyzed. Inspired by the literature linking finance to growth, a number of theoretical papers have proposed that financial development becomes a source of *comparative advantage* in the presence of credit constraints. Building on the pioneering empirical work of RZ, Beck (2002) and Becker and Greenberg (2007) succeed to verify that developed financial systems positively affect the performances of sectors that rely more on external finance. This contribution is in line with the theoretical assumptions introduced by the Heckscher-Ohlin-Samuelson (HOS)'s international trade model, where countries' factor endowments and sectors' levels of capital intensity determine international trade patterns. Sectors differ by their *technological differences* which affect their dependence on external finance and they are then more likely to export in countries with better capital

endowments. Focusing on the impact of financial conditions on export performances, Manova (2008, 2013) provides further evidence through a heterogeneous-firms framework *à la Melitz* (2003), in which financial frictions are introduced<sup>4</sup>. The author considers that firms operating in sectors that highly depend on external capital, tend to export more when the financial market in the domestic country is well-developed. Evidence on the importance of financial development, in explaining trade flows, has also been proved empirically. Svaleryd and Vlachos (2005) analyze the effects of financial conditions on the industrial specialization for OECD countries. They show that countries with well-functioning financial systems are more likely to specialize in sectors with higher needs of external capital. Hur et al (2006) investigate the impact of a country's level of financial development and a firm's asset structure on the trade flows of different industries. Using data on 42 countries and 27 industries, the researchers find that economies with well-developed financial systems present higher export shares and trade balances in industries with higher dependence on external finance. More recently, Manova (2013) studies bilateral exports for 107 countries and 27 sectors over the period 1985-1995. The results show that financially developed economies are more export performant in financially vulnerable sectors, because they are able to enter more markets (*extensive margin of trade*) and export more products to each destination (*intensive margin*). Similar results are proposed by Becker et al (2013). The authors provide evidence that financial development enhances exports of industries with high fixed costs<sup>5</sup>. Other empirical studies have exploited *firm-level* data to provide further evidence on the role of financial development and sector dependence on external finance in trade. Using data on Belgian manufacturing firms, Mûuls (2012) shows that firms are more likely to be export performant in sectors with low credit constraints. Similarly, Bellone et al (2010) show, using data on French firms for the period 1993-2005, that credit constrained firms are less likely to enter the export market and that the dependence on external funds does matter for the export status of the firm. Manova et al (2011) focus on export performances of Chinese firms and provide additional evidence on the link between credit constraints and exporting behavior<sup>6</sup>. This chapter adds to this literature by focusing at the aggregate-level and exploring the effects of financial crises on the link between financial development and exports.

Finally, note that in general financial development is measured by country-level variables notably the private credit to GDP, accounting or creditor rights protection standards. These different measures make financial development linked to the strength of the institutional framework of the country. This idea has been considered in the theoretical contribution of Ju and Wei (2011) who develop a general equilibrium model in which the role of finance as a source of *comparative advantage* in trade depends on the quality of institutions of the country. Therefore, it is interesting to disentangle the *exogenous* financial component from

<sup>4</sup>Matsuyama (2005) and Chaney (2008) provide further theoretical contributions to the literature on the patterns of international trade in the presence of financial frictions.

<sup>5</sup>See Beck (2002, 2003) for further empirical evidence on the role of financial development in explaining international trade patterns.

<sup>6</sup>See Berman and Héricourt (2010), Minetti and Zhu (2011) for further firm-level empirical evidence.

the institutional component when looking at the level of a country's financial development effects. This question is addressed in the robustness checks' section of this paper.

Another strand of the literature highlights the impact of financial crises on trade flows. This issue has achieved renewed relevance due to the "Great Trade Collapse of 2008" (Baldwin, 2009). Researchers confirm the negative effect of financial crises on the international trade flows. However, they oppose two different views when analyzing the mechanism through which a financial crisis is transmitted to trade flows. The first view is that the transmission mechanism of the crisis to the real sphere is mainly caused by a shock at the demand-side. Ma and Cheng (2005) analyze the bilateral trade for 50 countries over the 1990s and find that banking crises are associated with a decline in imports and that the effect on exports is positive. Similar results are found by Abiad et al (2014) who exploit an augmented gravity model and approximately 180 episodes of banking crises over the period 1970-2009. The authors point the fact that financial crises are associated with strong losses in imports of the crisis country and that the effects on exports do not persist. The argument behind this view is that financial crises result in a recession in the crisis-hit countries which negatively affect their economic activity and then cause a drop in their domestic demand<sup>7</sup>. The other view considers the importance of the supply-side channel of the crisis transmission. Here, the idea is that the financial crisis causes a tightening in the supply of credit which adversely affects the activities of the crisis-hit economy, especially foreign-oriented ones (Love et al, 2007). Focusing on this *trade finance* channel, Ahn (2011) develops a model that suggests a larger negative effect of foreign lending supply shocks on trade, compared to the effects on the domestic activity. These results are also supported by Ronci's (2004) findings which indicate that trade finance explains trade flows in the short-run, especially in periods of financial turmoil. Kiendrebeogo (2013) exploits a database on banking crises over the period 1988-2010 and shows, through the study of bilateral exports of a sample of developed and developing countries, that crisis-hit countries experience drops in bilateral exports. The author also finds that supply-side shocks seem to be more important than demand-side shocks especially when focusing on developing countries. Other results show that banking crises' effects are higher for industries that highly depend on external finance. Focusing on the recent crisis of 2008, Paravisini et al (2012) show, using customs and firm-level bank data from Peru, that credit shocks affect the intensive margin of trade rather than the extensive margin of trade. The researchers find however that the determinants of the Peruvian exports are mainly related to non-credit factors, notably the drop in the international demand.

Other studies have also considered the higher sensitivity to financial crises in sectors with high external financial needs as proposed by RZ. Using firm-level data for France over the period 2000-2009, Bricongne et al (2010) find that firms operating in sectors with high dependence on external finance have witnessed a larger drop in their exports after the recent financial crisis. Berman et al (2012) find similar results with French exporter data for 1995-

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<sup>7</sup>See, for instance, Eaton et al (2011) and Johnson and Yi (2011) for further evidence about the demand-side channel of the crisis transmission.

2005. The authors use time-to-ship as proxy for financial constraints. Their findings show that exporters reduce their exports to destinations affected by financial crisis, and particularly those with longer time-to-ship. In the same line, Iacovone and Zavacka (2009) use data on a set of developed and emerging countries covering 23 banking crises over 1980-2006 and find that banking crises have an adverse effect on the annual export growth rates. This effect is found to be magnified in sectors with high reliance on external funding and/or those with few tangible assets. Chor and Manova (2012) focus on the recent crisis of 2008 and test whether the negative effect of financial frictions on sector exports has been amplified during the crisis. Considering monthly data on US sector imports in 2006-2009, their results show that countries with higher interbank rates export less to the US during the crisis, and that this effect is especially pronounced in financially vulnerable sectors. Claessens et al (2014a) also contribute to the literature on the supply-side transmission channel of the recent crisis. The researchers test the role of financial development in facilitating trade particularly in sectors with high levels of financial vulnerability. They also stress the positive effect of the presence of foreign banks on bilateral exports in crisis time. Their findings show that bilateral exports are higher in financially vulnerable sectors in presence of foreign banks (*finance channel*) and that this effect is stronger when foreign banks from the importing country are present in the provenance country (*informational channel*). This present chapter contributes to this strand of literature by analyzing the effects of the recent global financial crisis, particularly the *financial* transmission channel.

A third body of literature links the literature on financial development to that on financial crises and looks at the extent to which the level of financial development can provide a source of *comparative advantage* in economic performances in crisis times. In fact, the financial crisis of 2008 has led economists to rethink the benefits of financial deepening since the crisis has originated in developed countries where financial markets are well-functioning. For instance, Rajan (2005) argues that the financial development can be dangerous with regards to the economic stability. This suggests the existence of a threshold above which the financial development becomes harmful. Consistent with this idea, Rioja and Valev (2004) suggest a non-monotone relationship between financial and economic development. Rousseau and Wachtel (2011) present a different point of view and argue that there is a "vanishing effect" of financial development. The authors find that financial deepening has no statistically significant effect on economic growth. They also argue that banking crises are the "culprits" of financial development (Arcand et al, 2012). A third point of view is presented by Liston and McNeil (2010). The authors confirm the importance of trade finance in explaining trade volumes and note that the link between these two variables is stressed in countries with high levels of financial development. In this regard, the present work contributes to the literature on trade by evaluating the role of financial development in crisis times.

Finally, a new body of literature is interested in the sensitivity of less developed countries to financial crises. Using data on Sub-Saharan Africa, Berman and Martin (2012) analyze



the effect of past banking crises (1976–2002) on African exporters. They show that African countries are vulnerable to banking crises in their partner countries and that the transmission of the crises is mainly driven by the trade finance channel. Moreover, the recent literature on the effects of financial crisis presents a debate on the level of resilience of emerging economies to the recent crisis of 2008. While emerging economies were expected to decouple from advanced economies, the post-crisis studies seem to confirm that emerging economies were also hit by the global crisis of 2008 as much as advanced economies. Didier et al (2011) support this idea through a comparison between post-crisis GDP growth and pre-crisis growth rates. This paper adds to these few works on this issue by analyzing exporting countries' financial conditions on BRICS imports during the crisis of 2008.

### 3.4 Data

The primary goal of this paper is to provide evidence on how source-countries differences, in terms of development of their financial sectors, affect their trade performances with BRICS countries. I also consider the sector heterogeneity in terms of financial needs, as defined by RZ. A particular attention goes to the evolution of trade during periods of crisis, especially the recent financial crisis of 2008. To this end, I need to combine data on bilateral sector imports of BRICS countries with data on manufacturing industries and source-countries characteristics.

Data on bilateral trade flows come from the UN COMTRADE database<sup>8</sup> and cover the period 1996–2012. While I limit importing countries to BRICS countries, I consider a sample of 156 developed and developing exporting economies including Brazil, Russian Federation, China, India and South Africa. Trade flows are mainly disaggregated at the 3-digit ISIC industry level (Revision 2)<sup>9</sup>, which leads to a sample of 36 manufacturing sectors. As shown in Figure 3.2, international trade flows in *manufacturing* sectors contracted by 20% during the recent crisis. The use of bilateral sector exports to BRICS will then permit to explore the heterogeneity in the effect of crisis across countries and sectors. Appendix 3.1 reports, for each source-country, the total value of BRICS imports as well as the number of exporting industries to BRICS in 2006. Unsurprisingly, the United States is the biggest exporter to BRICS countries. Among BRICS countries, China is the largest exporter of manufacturing products. As familiar with international trade flows, the number of trading partners greatly differs in time and across sectors. UN COMTRADE database only provides data on positive trade flows. Considering all sectors and partner countries, missing trade flows account for around 50% of the total sample. While common perceptions consider missing flows as zero trade flows, the examination of mirror data from exporting firms show that missing flows do not necessarily represent zero observations<sup>10</sup>. Therefore, I only consider positive values of

<sup>8</sup>The access to the UN COMTRADE database is through the World International Trade Solution of the World Bank.

<sup>9</sup>ISIC stands for International Standard Industrial Classification. For concordance purpose with other variables in this paper, trade data are obtained using the second revision of the ISIC.

<sup>10</sup>For example, there are some countries that register zero trade flows if the flow is below a minimum level

trade flows. Based on the fact that the literature particularly stresses the effects of financial development on the *intensive* margin of trade (Berthou, 2010), I consider that the use of positive values will not bias the estimates<sup>11</sup>. Once missing values are taken out, the full sample contains 234487 observations covering sector-level imports of BRICS countries from 156 countries over 1996-2012. In order to take the skewed distribution of imports into account, my dependent variable is the log of imports of country  $j$  from the source-country  $i$  in 3- (or 4-) digit ISIC sector  $s$  and in year  $t$ .

My empirical strategy also exploits sector differences in terms of their financial vulnerability, i.e. their constraints' levels when access to outside capital. The pioneering work of RZ has presented an index that reflects the sector-level reliance on external finance. Here, external finance includes all the financing flows that are not generated by the internal cash-flow of the firms. While RZ sectoral indicators are calculated using data on U.S. manufacturing sectors over the 1980s, the literature has considered them as measures of external finance dependence for industries in other countries, over different periods of time. Since the U.S. are considered to have the *least distorted* financial market<sup>12</sup>, RZ indicators are assumed to reflect as *precisely as possible* intersectoral technological differences, i.e. the *exogenous* needs of external finance. In order to capture the financial needs of exporting sectors, I then follow the literature and use the RZ index of external finance dependence. This variable ( $ExtFin80_s$ ) is measured as the fraction of the total capital expenditures that are not financed by internal cash flows from operations. As said earlier, this measure is calculated for U.S. sectors over the 1980s. To check the pertinence of these indicators when describing financial needs in the late 1990s and the last decade, I also use the updated version of these indicators ( $ExtFin90_s$ ) proposed by Kroszner et al (2007). The authors compute RZ indexes using data on U.S. manufacturing sectors over the 1990s<sup>13</sup>. I also use the level of asset tangibility, presented by Braun (2003), as an additional measure of sector financial vulnerability. Actually, sectors differ in terms of their firms' endowments of tangible assets. Sectors with more tangible assets are supposed to be less credit constrained since they can offer their tangible assets as collaterals to the financial system. This measure is then considered to be inversely related to the sector financial vulnerability. The level of asset tangibility ( $Tang_s$ ) is represented by the fraction of plant, property and equipment in the total assets. All these proxies of financial vulnerability are detailed in Appendix 3.2. Moving to the level of financial development in exporting countries, I follow the literature and consider the credit to the private sector over GDP. Data on this variable are obtained from the database of World Development Indicators of the World Bank.

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of bilateral trade (Kiendrebeogo, 2013).

<sup>11</sup>While there exist a number of international trade databases, UN COMTRADE database presents a particular advantage, since it provides sector-level trade using the ISIC rev.2. This is of a particular relevance for this study since the indexes of sector level financial vulnerability are computed using ISIC rev.2 industry classification. This prevents us from losing information on sectors (as it can be the case when using correspondence tables).

<sup>12</sup>which ensures an optimal allocation of capital.

<sup>13</sup>See Chapter 1 for further details about the pertinence of RZ original indicators in assessing sector financial needs in other countries and in other periods of time.

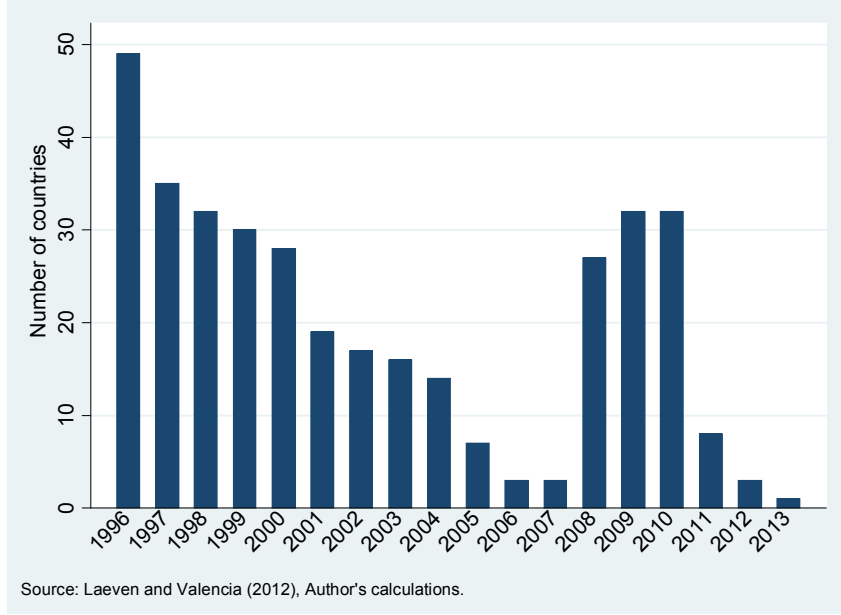


Figure 3.3: Number of Countries Experiencing a Banking or Financial Crisis ( $t - t+2$ )

In order to check the robustness of the main results, I introduce a number of *control* variables to capture country differences. As familiar in gravity models in international trade, these variables include the exporting country's size measure ( $GDP_{i,t}$ ) and income measure GDP per capita ( $GDPcap_{i,t}$ ). Data on these variables are obtained from the database of World Development Indicators of the World Bank. As proposed in the literature, the quality of institutions is considered as a determinant of bilateral trade. Hence, a number of variables describing the level of institutional development in exporting countries are included. These variables include the quality of legal frameworks ( $Legal_{i,t}$ ), credit information ( $Info_{i,t}$ ) and investor protection ( $Investor_{i,t}$ ). I also explore the heterogeneity between exporting countries in terms of economic development ( $Dev_i$ ). The economic development classification is obtained from the World Bank website. 47% of the observations are sector-exports of Developed countries. Definitions and sources of all variables are detailed in Appendix 3.3.

Finally, I also explore the effects of past banking crises in exporting countries on international trade performances. Data on financial crises come from a newly updated banking crises' database of Laeven and Valencia (2012). The database covers data on all systemic banking crises, currency crises as well as sovereign debt crises in the period 1970-2011. Figure 3.3 considers all types of crises and shows that financial crises have been spread worldwide, even before the recent crisis of 2008. A large number of countries have been hit by banking crises, especially in 1996 and during the recent global crisis of 2008-2009. Note that, following Kiendrebeogo (2013), I consider a country to be hit by a crisis at the starting date of a given crisis and two years after.

Summary statistics of all variables used in this paper are presented in Appendix Table

3.4.1. The sample covers 775 exporting-importing ( $ij$ ) country pairs, considering 155 exporting countries and five importing BRICS countries. Among the 36 manufacturing sectors considered in this study, Machinery's sector (ISIC 311) is the most represented (Appendix Table 3.4.2). Considering that the recent global crisis covers the period 2008-2009, one can notice that only 13% of the observations correspond to the recent crisis period. Finally, correlations between the main variables are presented in Appendix Table A.3.4.3. Consistent with literature predictions, the level of financial development in exporting countries is positively related to their exports to BRICS. Similarly, the income level and the size of the economies are positively related to international trade flows. Regarding the importance of the quality of the institutional framework, the correlation coefficients are in favor of a positive relation between the quality of institutions in exporting countries and their export flows to their partner countries. However, the correlations do not provide strong evidence about the negative impact of the recent crisis of 2008 as well as the past financial crises in exporting countries on international trade flows. The link between financial development, financial crises and international trade flows will be formally explored in the following sections.

### 3.5 Effects of financial constraints across countries and sectors: Zoom on the recent global crisis

In this section, I analyze the effects of financial development in exporting countries on international trade flows to BRICS with a focus on the recent global crisis effects. The aim is to assess the role of the *financial channel* in the collapse of world trade in 2008. I pay particular attention to the heterogeneity between manufacturing sectors in terms of external finance dependence. I first test how financially developed economies export more to BRICS countries, in sectors that highly depend on external financing and show that the importance of financial conditions in explaining trade flows has been affected during the crisis of 2008. I then implement a number of checks in order to isolate the effects of financial constraints at sector- and country- levels from other factors that may impact export flows.

#### 3.5.1 Empirical Specification

The main empirical specification of this study closely follows Manova (2013) who tests the effect of financial development on bilateral trade using a traditional gravity model, and exploiting the sector-level heterogeneity in terms of financial constraints. Here, I consider industry-level exports to the BRICS countries. The aim is therefore to verify the findings of Manova (2013) when only considering trade flows to BRICS. In order to assess the recent crisis effects, I also introduce the crisis variable as in Manova and Chor (2012). As detailed in data section, three proxies of sector-level financial vulnerability ( $FinVul_s$ ) will be considered : dependence on external finance in the 1980 ( $ExtFin80_s$ ), dependence on external finance in the 1990s ( $ExtFin90_s$ ) and the endowment of tangible assets ( $Tang_s$ ). Considering one measure at a

time, here  $ExtFin80_s$ , the baseline model is then specified as follows:

$$\begin{aligned} LnM_{i,j,s,t} = & \beta_1 FinDev_{i,t} + \beta_2 FinDev_{i,t} \times Extfin80_s + \\ & \beta_3 FinDev_{i,t} \times Extfin80_s \times Crisis_t + \rho_{j,t} \\ & + \varphi_s + \mu_t + \theta_{ij} + \varepsilon_{i,j,s,t} \end{aligned} \quad (3.1)$$

where  $LnM_{i,j,s,t}$  is the (log) value of imports of country  $j$  (Brazil, Russian Federation, India, China or South Africa) from the source-country  $i$  in industry  $s$  in year  $t$ <sup>14</sup>.  $FinDev_{i,t}$  stands for the level of financial development in the exporting country  $i$ <sup>15</sup>. I define a dummy variable  $Crisis_t$  that equals to 1 for the period 2008-2009 considered as the crisis period. The choice of this period is motivated by the fact that, although the first signs of the crisis appeared since the end of 2007, the real effects, notably on international trade, were not visible before 2008. Furthermore, ending the crisis period at 2009 is motivated by the signs of recovery starting from 2010, especially for emerging countries. While using monthly data (Chor and Manova, 2012) would precisely capture the crisis scope, yearly data allow me to have a general picture about the evolution of international trade flows during the crisis.

I also incorporate a set of fixed effects in order to control for the potential endogeneity problem.  $\rho_{j,t}$  controls for all importer country time-variant characteristics that affect their import demands<sup>16</sup>. These characteristics include the level of financial, institutional and economic development. This fixed effect also controls for the drop in the production and for the drop in trade finance caused by the crisis.  $\varphi_s$  captures the characteristics of the sector  $s$  that do not vary in time. This fixed effect includes information on financial needs which are inherent to the activity of the sector, as well as the factor intensity.  $\theta_{ij}$  refers to country-pair fixed effects. As in traditional trade models, this term would include information on distance, contiguity, common language, etc. I further add year fixed effects  $\mu_t$  to control for the fluctuations in the import demand of BRICS countries and/ or the supply of exporting countries. At this level, it is worthy to mention that with the extensive set of fixed effects included, concerns about omitted variables are significantly lessened (Claessens et al, 2014a). Finally, regressions are estimated using random-effects model by considering importer-exporter-sector groups  $ijs$  as the individual, in addition to the time dimension  $t$ . I do not consider  $ijs$ -level fixed effects. I rather consider the set of fixed effects detailed in Eq. (3.1). In fact, in presence of four-dimensional panel data, the estimation of a fixed-effect model would consider a  $ijs$ -level fixed effect. This fixed effect would control for a large part of international trade flows determinants which leads to a drop in the explicative power of the independent variables in the model<sup>17</sup>. Finally, I allow for correlated idiosyncratic shocks at the importer-exporter

<sup>14</sup> Also denoting exports of country  $i$  to one of the BRICS countries  $j$ .

<sup>15</sup> Financial development is measured in percentages. I therefore use it without logs since the coefficient can be directly interpreted as an elasticity.

<sup>16</sup> Recall that the model considers five importers: Brazil, Russian Federation, India, China and South Africa.

<sup>17</sup> The estimation of a fixed-effect model by considering  $ijs$ -level fixed effects has led to non-significant

level. Standard errors are thus clustered at the country-pair level  $ij$ .

Since the literature argues that financial development positively affects exports, I then expect  $\beta_1$  to be positive. The variables of interest in the specification described above are the double and triple interaction terms. The coefficient on  $FinDev_{i,t} \times Extfin80_s$  captures the effect of the variations in the level of financial development over time on the sectoral composition of country  $i$ 's exports<sup>18</sup>. Based on the theoretical predictions of Manova (2013), I expect  $\beta_2$  to be positive, i.e. countries with well-developed financial systems will export relatively more to BRICS countries in industries with high dependence on external funds. Note that this coefficient is expected to be also positive when using  $Extfin90_s$  and negative when using  $Tang_s$ . The idea is that the importance of the financial system quality is reduced for sectors that can easily offer hard assets as collaterals to the financial system. The triple interaction term  $FinDev_{i,t} \times Extfin80_s \times Crisis_t$  tests whether the role of financial development in boosting exports in financially vulnerable sectors has been altered during the crisis of 2008. In other words,  $\beta_3$  estimates whether the development of financial systems in countries exporting to BRICS, has permitted a better supply of credit during the crisis. As indicated earlier, the financial development is supposed to relax financial constraints especially for sectors with higher needs of external funding. The sign of  $\beta_3$  brings additional information about the trade finance channel of the crisis. Two possible anticipations can be made. On the one hand, the financial development of a country allows to reduce the informational problems and to prevent the risky fluctuations in the cost of capital. This is supposed to positively affect the *availability* of trade finance. Considering that, the importance of the level of financial development in relaxing sectors' credit constraints will be thus intensified during the crisis. This expectation is reinforced by the findings of Chor and Manova (2012). The authors show that higher inter-bank rates (indicating trade finance *scarcity*) negatively affect trade of financially vulnerable sectors, and that this effect has been intensified during the crisis of 2008. Therefore,  $\beta_3$  is expected to be positive when using external finance dependence proxies of sector financial vulnerability and negative when using  $Tang_s$ . On the other hand, a better quality of financial systems can be associated with a relatively high exposure to the fluctuations in the global financial markets. Arcand et al (2012) argue that well-developed financial markets tend to attract investors and can result in "too much" finance. The authors suggest that there could be a threshold above which financial development effects turn negative. Precisely, they find that finance starts to negatively affect the output growth when credit to the private sector reaches 100% of GDP. This "vanishing" positive effect of financial depth on growth is also confirmed by Rousseau and Watchel (2011). Kaminsky and Reinhart (1999) go beyond and show that the depth of financial systems can be a good predictor of banking and currency crises. Their results are emphasized by Rajan (2005) and Gennaioli et al (2010).

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coefficients which could be explained by the fact that these fixed effects controls a very large part of international trade flows.

<sup>18</sup>Since the level of external finance dependence is subsumed by the sector fixed effect, the interpretation of the interaction term only relies on the level of financial development.

Following this point of view, one may expect that the *comparative advantage*, provided by financial development in exporting countries to sectors with high needs in terms of external finance could be lowered during the crisis.  $\beta_3$  will then be negative when using *Extfin80<sub>s</sub>*. Overall, this coefficient will permit to test for the robustness of Manova's (2013) predictions with regards to the recent crisis context.

### 3.5.2 Main Results

The regression results of Eq. (3.1) are presented in Table 3.1. As expected, financially developed countries export more to BRICS countries, in sectors with higher requirements in terms of outside capital ( $\beta_2 > 0$ , columns 1 and 4). Therefore, the predictions of Manova (2013) are confirmed when considering exports to BRICS countries. Due to their increasing role in GVC, BRICS countries' manufacturing trade is being more intensive in capital and in R&D. R&D-intensive sectors are generally considered to be more dependent on external finance. Since the financial development is found to enhance exports in these financially vulnerable sectors, one could suggest that the development of financial systems in exporting countries will be of a higher importance for BRICS countries.

The comparative advantage related to the quality of financial systems is however *reduced* during the crisis of 2008 ( $\beta_3 < 0$ , columns 2 and 5). Financially vulnerable sectors seem to have less benefited from the financial development in exporting countries, during the crisis. The negative and significant sign of  $\beta_3$  is therefore in favor of a "vanishing" effect of financial development during the recent global crisis. The results suggest that, during the crisis, financially developed countries have reduced their exports to BRICS in sectors that highly depend on external finance. The drop of BRICS' imports during the crisis could be then partly explained by the *financial* transmission channel of the crisis.

Given these findings, some doubts about the importance of financial development in boosting trade can be raised. In fact, this finding is in line with the "vanishing effect" of financial development claimed by Rousseau and Watchel (2011) and Arcand et al (2012). These authors argue that there is a threshold above which financial development effects on real economy turn negative. Rather, this present study suggests that the positive effect of financial development on trade is reduced, due to the recent crisis effects. This result can be supported by a number of explanations. First, as stated in the literature, the high quality of financial system is associated with a higher exposure to the international financial system activity. The fact that the crisis has emerged in the U.S. -assumed to have the most developed financial sector- attests of the risks related to financial development. Second, considering the growing interconnection of financial markets all over the world, a financial crisis could be transmitted to well-developed financial systems, which will negatively affect financing conditions in the domestic markets. Recall that the contagion effect in the European financial market has been noticed, soon after the collapse of Lehman Brothers. In contrast, Carrasco and Williams (2012) argue that for Brazil, for example, the trade flows have not been strongly affected during the crisis due

to the relatively low exposure of Brazil to the U.S. financial market. The interconnection between financial markets has been particularly embodied, during the two last decades, by the presence of foreign banks in domestic markets. While the presence of foreign banks is supposed to increase the quality of financial intermediation (Claessens, 2006), a number of studies suggest that foreign banks can be destabilizing in the domestic market. For instance, Ongena et al (2013) argue that banks with foreign-owned participation have more contracted their lending during the recent financial crisis, resulting in credit scarcity in domestic markets. Given these ideas, financially developed countries could have seen their positive effects on exports in financially vulnerable sectors reduced because of the link between financial development and the sensitivity to the international context. A third possible explanation is related to the worldwide increase in the cost of capital during the crisis (Chor and Manova, 2012). Even with developed financial systems, the credit tightening has negatively affected the liquidity supply in domestic markets which have led to problems of financing, especially for sectors that are *by nature* intensive in external finance. In the light of these different explanations, the quality of financial institutions does not seem to prevent the trade finance transmission mechanism of the crisis. These results complement those of Liston and McNeil (2010). The authors suggest that trade finance is an important determinant of trade especially for countries with higher levels of financial development. Given the comparative advantage of financial development in financially vulnerable sectors, trade finance would be an important determinant of trade especially in sectors with higher needs of external capital. The results of this present study suggest that in times of crisis, the drop of trade finance will adversely hit these sectors, especially in countries with well-developed financial systems. Overall, the results of this analysis, coupled with those of Chor and Manova (2012), show that financial development fails in reducing the cost of external finance during the crisis. This has negatively affected exports especially in external finance dependent sectors. Lastly, before moving to the presentation of additional results, it is noteworthy to mention that the coefficients  $\beta_2$  and  $\beta_3$  present the same sign and significance level when using  $Extfin80_s$  or  $Extfin90_s$  as measures for sector external finance dependence. This finding supports the assumption of RZ regarding the existence of a *technological component* that distinguishes between sectors and that is stable over time.



Table 3.1: Effects of Financial Development across Countries and Sectors during the Crisis 2008-2009

Robust Standard Errors in parentheses. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively. Standard Errors are clustered at the country-pair level. The dependent variable is the log value of yearly exports to one of the BRICS countries (Brazil, Russian Federation, India, China or South Africa) in 3- or 4-digit ISIC manufacturing sectors (Revision 2). All specifications include Sector, Year, Importer-Year and Country pair fixed effects. The financial vulnerability is measured by ExtFin80 in columns 1-3, ExtFin90 in columns 4-6 and Tang in columns 7-9. Country size and income controls are included in the last column for each measure. The crisis dummy equals 1 for 2008 and 2009.

Dep. Var: LnM <sub>i,j,s,t</sub>	ExtFin80			ExtFin90			Tang		
	1	2	3	4	5	6	7	8	9
FinDev <sub>i,t</sub>	-0.00529*** (0.00097)	-0.00529*** (0.00098)	-0.00562*** (0.00099)	0.00012 (0.00089)	0.00012 (0.00089)	-0.00024 (0.00091)	0.00386*** (0.00129)	0.00384*** (0.00129)	0.00338*** (0.00132)
FinDev <sub>i,t</sub> × FinVul <sub>s</sub>	0.01538*** (0.00100)	0.01558*** (0.00101)	0.01548*** (0.00101)	0.00746*** (0.00056)	0.00762*** (0.00056)	0.00760*** (0.00056)	-0.01200*** (0.00335)	-0.01251*** (0.00340)	-0.01213*** (0.00342)
FinDev <sub>i,t</sub> × FinVul <sub>s</sub> × Crisis <sub>t</sub>		-0.00113*** (0.00032)	-0.00114*** (0.00032)		-0.00090*** (0.00025)	-0.00090*** (0.00025)		0.00288*** (0.00099)	0.00284*** (0.00102)
Constant	14.33272*** (0.15146)	14.32939*** (0.15159)	23.09804*** (7.29210)	14.20737*** (0.15073)	14.20773*** (0.15073)	22.62138*** (7.29060)	14.18548*** (0.15214)	14.19491*** (0.15237)	22.22575*** (7.30175)
Observations	220,435	220,435	218,827	220,435	220,435	218,827	220,435	220,435	218,827
R-squared	0.23935	0.23938	0.24153	0.23313	0.23315	0.23540	0.22916	0.22920	0.23140
Number of <i>ij</i> pairs	750	750	745	750	750	745	750	750	745
Sector and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size and income controls in <i>i</i>	No	No	Yes	No	No	Yes	No	No	Yes

I then move to the interpretation of the results, considering the level of asset tangibility  $Tang_s$ , inversely related to the sector-level financial vulnerability. Sectors with more tangible assets are supposed to be less credit constrained. Indeed, in these sectors, firms can offer their assets as collaterals to secure a loan. These sectors are then less sensitive to the *credit relaxation* provided in countries with developed financial systems. This prediction is confirmed when considering exports to BRICS countries ( $\beta_2 < 0$ , column 7). Countries with high levels of financial development export relatively less in sectors with many tangible assets.

I also expect the sign of the coefficient  $\beta_3$  to be the opposite of what is found for measures of external finance dependence. This prediction is also confirmed.  $\beta_3$  turns positive which suggests that the financial development acquires a relatively *greater* importance in explaining exports of sectors with tangible assets, in crisis times. The quality of financial systems in domestic markets matters more for sectors with high endowments of tangible assets during the crisis of 2008, compared to "tranquil" times. This can be explained as follows. The financial crisis of 2008 has resulted in a problem at the supply-side of credit. While sectors with many tangible assets have greater access to credit in tranquil times, they are likely to have encountered financing problems during the crisis due to the international liquidity shortage. In this context, the role of financial development, in reducing informational costs and insuring a certain level of confidence between lenders and borrowers, can be highlighted. In financially developed countries, getting precise information would help bankers to better allocate capital by targeting less risky firms. In this regard, firms operating in sectors with high levels of asset tangibility can be considered as privileged by the banking system, since they can easily present tangible assets as a guarantee. Firms operating in these sectors would therefore have fewer problems to access credit during the crisis, which would allow them to have higher export performances. The financial development could then be seen as a sort of comparative advantage for sectors with many tangible assets, *during the crisis*. This idea can be supported by the generalized lack of confidence in the aftermath of the crisis. A final comment goes to the coefficients  $\beta_1$ . Considering the literature on financial development, this coefficient is expected to be positive. Here, the results present mitigated effects of financial development on trade. As in Claessens et al (2014a), this result can be due to the high variance in terms of financial development between exporting countries in my sample.

Bottom line, the main findings of this study propose that the response of trade with BRICS varies across exporting countries and across industries. Financially developed countries perform better in terms of exports in financially vulnerable sectors. It seems however that the financial crisis has led to a drop in the importance of financial development in explaining trade. Even for exporting countries with well-developed financial sectors, exports to BRICS have been negatively affected by the crisis. While the demand-side of the crisis shock is not properly studied in this empirical analysis, the results confirm the importance of supply-side shocks in explaining the drop of BRICS imports. These negative effects can be even more important for BRICS countries, due to their growing role in the global manufacturing system.

### 3.5.3 Sensitivity analysis

In this subsection, I carry out a number of robustness checks in order to verify that the effects presented in Table 3.1 are not driven by other omitted factors, although the inclusion of an extensive set of fixed effects in Eq. (3.1) allays concerns about this potential problem. I first control for a number of variables that may be correlated with the level of financial development in exporting countries. I then include additional fixed effects in order to capture the importing countries' characteristics. I also test for the crisis time span pertinence by considering 2007 as a crisis year. Next, I explore sector-level heterogeneity in terms of dependence on external finance to see if the sensitivity of trade with BRICS does change depending on the level of reliance on external finance. Finally, I check if the results are sensitive to the importing country heterogeneity.

#### Income, size and institutional environment effects

In this paragraph, I test the sensitivity of the main results to the inclusion of a number of additional control variables in Eq. (3.1). I first allow for the possibility that the level of financial development captures the exporting country size or its overall economic development. To do so, I include exporting country's GDP ( $GDP_{i,t}$ ) and GDP per capita ( $GDPcap_{i,t}$ ). Even with these controls, the baseline findings, on the *comparative advantage* related to the level of financial development in exporting countries, continue to hold. The crisis effects on the importance of financial development in explaining the trade with BRICS countries remain also unchanged.

Considering the literature on the importance of the quality of institutions in explaining international trade flows (Carrère, 2006; Lavallée, 2006), I next include different measures of the quality of institutions as control variables. In fact, it has been established that there is an interplay between financial development and the quality of legal and institutional frameworks (Arestis and Demetriades, 1996). Particularly, La Porta et al (1997) demonstrate that the quality of legal environment and contract enforcement greatly influence the size and the well-functioning of financial markets. In other words, the availability of external capital is in a way determined by the legal rules (Law and Azman-Saini, 2008)<sup>19</sup>. Therefore, the introduction of measures that describe the quality of institutions in exporting countries to BRICS, in Eq. (3.1) will permit to test whether the effects of financial development would pick up the effect of institutions on trade flows. Three proxies for the quality of institutions ( $InstQual_{i,t}$ ) are considered: the legal framework strength (*Legal*), the creditor information quality (*Info*) as well as the level of investor protection (*Investor*). The estimation results are summarized in Appendix Table A.3.5.1. The main results hold. The comparative advantage of financial development in sectors that depend more on external finance, with regards to their exports

<sup>19</sup>Law and Azman-Saini (2008) provide a detailed review of literature on the link between financial development and institutions.

to BRICS, persists. This effect is reduced during the crisis. The coefficients related to the institutional quality's measure are found to be positive and significant which confirms the importance of the regulatory framework's quality as a determinant of international trade flows. When introducing institutional controls,  $\beta_1$  in Eq. (3.1) turns positive in most of the regressions. This confirms that the *financial* component of financial development positively affects trade flows to BRICS, as the literature predicts.

### Further checks

I then conduct a number of additional tests in order to check the robustness of the main results. While the aim of this paper is to explain trade with BRICS countries, the accent is particularly made on the export side of the international trade flows. In fact, in Eq. (3.1), I explain exports to BRICS with a number of variables related to the exporting countries  $i$ . In order to further control the importer side, I introduce an importer-sector fixed effect  $\lambda_{j,s}$  that captures the importance of particular sectors in importing countries depending on the factor endowments of the country and the factor intensity of the manufacturing sectors. This fixed effect may then control for the role of every country from BRICS in the GVC (depending on their comparative advantages). The estimation results are displayed in Appendix Table A.3.5.2 and confirm the robustness of core results. The findings are also robust to the changes of the crisis period. In fact, similar results are found when I allow the crisis effects to span from 2007 to 2009 (See Appendix Table A.3.5.3).

Finally, in order to check the linearity of the reduced effect of financial development on exports to BRICS during the crisis, I test Eq. (3.1) over different groups of sectors depending on their level of dependence on external finance. Two classifications are considered. The first distinguishes between sectors with Low, Medium and High dependence on external finance (See details in Appendix Table 3.5.4). The second considers two groups: Low dependence for sectors with levels of external finance dependence (based on the measure  $Extfin90_s$ ) below the median value, and High dependence for the remaining sectors. The results in Appendix Table A.3.5.4 show that the *reduced* role of financial development in boosting exports to BRICS in financially vulnerable sectors, during the crisis, persists across different groups of sectors. Crisis effects seem to be *sharper* for sectors with low levels of dependence on external finance. This result is not in line with the common expectations of a higher negative effect of the crisis on sectors that rely more on funds provided by the financial sector. These sectors are supposed to be more sensitive to credit availability and then more sensitive to the credit shortage caused by the crisis. These results are however in line with the findings of Berthou (2010). In fact, contrary to traditional perceptions, the author finds that when the exporting economies exhibit poor financial institutions, the financial development benefits more for exports in sectors with low dependence on external finance.

**Do differences between BRICS countries matter?**

This paragraph provides additional robustness checks by verifying that the effects of financial conditions in exporting countries on exports during the crisis do not depend on the characteristics of the *importing* country. In fact, although Brazil, Russian Federation, India, China and South Africa form one group BRICS, an heterogeneity exists between these countries in terms of factor endowments, development policies as well as the role in GVC (Groot et al, 2011). China appears as the leader of the group in terms of participation in the global manufacturing system, followed by India (Sturgeon et al, 2013). Brazil, Russian Federation and South Africa are however likely to witness a de-industrialization (Naudé et al, 2013). This would affect BRICS countries' sector composition of trade.

Focusing on the differences between Brazil and China, some remarks can be made. Brazil seems to specialize in primary goods, whereas for China, the share of trade in sectors with R&D intensity is increasing over years. These differences naturally affect the *technological component* of their trade flows. While the focus in this paper is on the sector composition of exports to BRICS countries, these differences would magnify/reduce the vulnerability of different BRICS countries' trade to the financial conditions in their partner countries. With regards to the financial aspect, while China presents a better overall financial health (cf. financial development indicators, Chapter 1), Brazil seems to be more financially integrated with the world economy<sup>20</sup> (Banerjee and Vashisht, 2010). This financial heterogeneity could have driven differences in terms of response of *both* economies to the changing in the financial conditions in their partner countries, during the recent crisis.

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<sup>20</sup>In 2007 for example, Brazil presents the highest level of total portfolio transaction as a percentage of GDP across BRICS countries (33%).

In order to verify the stability of the effects financial development and the crisis effects on sector exports, I estimate the following Eq. (3.2), considering the exports to one country at a time (Brazil / China), as follows:

$$\begin{aligned} LnM_{i,s,t} = & \beta_1 FinDev_{i,t} + \beta_2 FinDev_{i,t} \times Extfin80_s + \\ & \beta_3 FinDev_{i,t} \times Extfin80_s \times Crisis_t + \\ & + \varphi_s + \mu_t + \theta_i + \varepsilon_{i,s,t} \end{aligned} \quad (3.2)$$

where  $LnM_{i,s,t}$  represents the (log) value of imports (of Brazil, and China respectively) from the source-country  $i$  in industry  $s$  in year  $t$ .  $\theta_i$  is an exporter fixed-effect. The estimation results for Brazil and China are respectively displayed in Table 3.2 and Table 3.3<sup>21</sup>. The results show that the effects of financial development are maintained when considering exports to Brazil and China individually.  $\beta_2$  has the expected and significant signs for both samples. Financially developed countries export more to Brazil (and China, respectively) in sectors with high external finance needs. The coefficients  $\beta_3$  have globally the expected signs although they are in some cases not statistically significant. This can be due to the few number of observations where the crisis dummy equals to 1 in both sub-samples. Overall, financially developed countries export relatively *more* in sectors with high dependence on external finance. The *comparative advantage* related to financial development is however reduced during the crisis. These results confirm the fact the credit scarcity in exporting countries, during the crisis, has had similar effects on their trade relations with Brazil and China.

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<sup>21</sup>Similar results are found for India, Russian Federation and South Africa (Available under request).

Table 3.2: Impact of Financial Development on Exports to Brazil during the Crisis

Robust Standard Errors in parentheses. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively. Standard Errors are clustered at the exporter level. The dependent variable is the (log) value of sector-level exports to Brazil. All specifications include Sector, Year and Exporter fixed effects.

Dep. Var: $\text{Ln}M_{i,s,t}$	BRAZIL								
	1	2	3	4	5	6	7	8	9
FinDev <sub><i>i,t</i></sub>	-0.00796*** (0.00191)	-0.00795*** (0.00192)	-0.00782*** (0.00207)	-0.00119 (0.00160)	-0.00119 (0.00160)	-0.00112 (0.00177)	0.00756** (0.00335)	0.00755** (0.00335)	0.00755** (0.00345)
FinDev <sub><i>i,t</i></sub> xFinVul <sub><i>s</i></sub>	0.01874*** (0.00277)	0.01911*** (0.00280)	0.01888*** (0.00281)	0.00902*** (0.00146)	0.00909*** (0.00148)	0.00904*** (0.00148)	-0.02812*** (0.01001)	-0.02838*** (0.01022)	-0.02838*** (0.01027)
FinDev <sub><i>i,t</i></sub> xFinVul <sub><i>s</i></sub> xCrisis <sub><i>t</i></sub>		-0.00226*** (0.00075)	-0.00196** (0.00075)		-0.00042 (0.00050)	-0.00039 (0.00049)	0.00144 (0.00233)	0.00144 (0.00233)	0.00252 (0.00240)
Constant	14.40802*** (0.31452)	14.40039*** (0.31476)	3.31431 (26.44514)	14.21122*** (0.30652)	14.21136*** (0.30653)	2.30811 (26.56961)	14.23622*** (0.31710)	14.24164*** (0.31942)	2.50553 (26.64788)
Observations	37,181	37,181	36,959	37,181	37,181	36,959	37,181	37,181	36,959
R-squared	0.27901	0.27912	0.28219	0.26994	0.26995	0.27329	0.26678	0.26679	0.27016
Number of exporters <i>i</i>	150	150	149	150	150	149	150	150	149
Sector and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size and income controls in <i>i</i>	No	No	Yes	No	No	Yes	No	No	Yes

Table 3.3: Impact of Financial Development on Exports to China during the Crisis

Robust Standard Errors in parentheses. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively. Standard Errors are clustered at the exporter level. The dependent variable is the (log) value of sector-level exports to China. All specifications include Sector, Year and Exporter fixed effects.

Dep. Var: $\ln M_{i,s,t}$	CHINA								
	ExtFin80	2	3	4	5	6	Tang	7	8
FinDev <sub><i>i,t</i></sub>	-0.00401* (0.00210)	-0.00400* (0.00210)	-0.00505** (0.00212)	0.00280 (0.00194)	0.00281 (0.00194)	0.00175 (0.00198)	0.00810*** (0.00293)	0.00810*** (0.00293)	0.00694** (0.00301)
FinDev <sub><i>i,t</i></sub> xFinVul <sub><i>s</i></sub>	0.01964*** (0.00257)	0.01997*** (0.00258)	0.02003*** (0.00259)	0.00878*** (0.00136)	0.00902*** (0.00139)	0.00900*** (0.00139)	-0.01757** (0.00726)	-0.01773** (0.00739)	-0.01715** (0.00741)
FinDev <sub><i>i,t</i></sub> xFinVul <sub><i>s</i></sub> xCrisis <sub><i>t</i></sub>		-0.00188** (0.00075)	-0.00226*** (0.00075)		-0.00136* (0.00072)	-0.00138* (0.00072)	0.00083 (0.00187)	0.00083 (0.00187)	-0.00054 (0.00178)
Constant	13.84304*** (0.30746)	13.83698*** (0.30774)	49.13134*** (15.07493)	13.68306*** (0.30486)	13.68304*** (0.30485)	49.01882*** (15.14723)	13.67026*** (0.30629)	13.67308*** (0.30667)	49.13237*** (15.10500)
Observations	45,302	45,302	44,856	45,302	45,302	44,856	45,302	45,302	44,856
R-squared	0.31672	0.31678	0.32082	0.30814	0.30819	0.31217	0.30481	0.30481	0.30875
Number of exporters <i>i</i>	150	150	149	150	150	149	150	150	149
Sector and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size and income controls in <i>i</i>	No	No	Yes	No	No	Yes	No	No	Yes



### 3.6 Exploring exporting country heterogeneity

In this section, I investigate the role of *exporting country differences* in explaining trade with BRICS countries, during the global crisis of 2008. The role of the level of financial development, in reducing the cost of capital in industries with higher needs of external capital and enhancing their exports, may depend on the characteristics of the exporting countries. I first consider the heterogeneity in terms of institutional quality and then, I consider the heterogeneity in terms of overall economic development.

#### 3.6.1 Institutional differences

I begin by considering exporting countries heterogeneity in terms of institutional quality. As said before, there is an interplay between the level of financial development and the overall quality of institutions in exporting countries. The effects of the financial development on exports may depend on the overall level of institutional development. In fact, ensuring a better quality of financial intermediation relies on the institutional background notably in terms of contract enforcement, as proposed by Manova (2013).

Considering one measure of quality of institutions ( $InstQual_{i,t}$ ) at a time, I divide the sample of exporting countries depending on the similarity of their institutional characteristics. Two groups of countries are then defined: countries with "Strong" institutions and countries with "Weak" institutions. Eq. (3.1) is then estimated on these sub-samples. The regression results are displayed in Table 3.4<sup>22</sup>. As predicted, the coefficients  $\beta_2$  are positive when using  $Extfin90_s$  and negative<sup>23</sup> when using  $Tang_s$ , which suggests that the comparative advantage of financial development in financially vulnerable sectors persists independent of the quality of institutions in exporting countries. This confirms the importance of financial development in boosting exports of financially vulnerable sectors.  $\beta_3$  coefficients related to the crisis effects are also significant and have in most of cases the expected sign. This attests of the *altered* effect of financial development on exports in financially vulnerable sectors during the crisis. The role of financial development in boosting exports of financially vulnerable sectors has been reduced during the crisis in countries with strong institutions and in those with poor institutions, as well. This result can be supported by the fact that the effects of the crisis were strong in advanced countries that are assumed to generally present high-quality institutional frameworks.

Looking at different classifications of institutions, one remark can be pointed out with regards to the crisis effects. The coefficients  $\beta_3$  are higher for the sub-sample of countries with relatively "Weak" institutional frameworks. This result suggests that in countries with "Weak" institutions, the importance of financial development as a *comparative advantage* for exports in sectors with high needs of external finance is *more affected* during the crisis, compared to countries with stronger institutions. The financial crisis seems then to stress

<sup>22</sup>Results based on creditor information quality proxy are displayed in Appendix 3.6.

<sup>23</sup>Similar results are found when using  $Extfin80_s$  (Available under request).

the negative effect of weak institutions on information and credit availability, which more adversely affects sectors with higher needs of external capital.

Table 3.4: Exporting Country Heterogeneity in terms of Institutional Quality

Robust Standard Errors in parentheses. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively. Standard Errors are clustered at the country-pair level. All specifications include Sector, Year, Importer-Year and Country pair fixed effects. The financial vulnerability is measured by ExtFin90 and Tang. Country size and income controls are included in all specifications. The crisis dummy equals 1 for 2008 and 2009. Three proxies of quality of institutions are considered: Legal rights, Credit Information and Investor protection indexes. Considering these proxies one by one, countries with "Strong" institutions are those for which the mean value of the proxy over the period is above the median value of the proxy in the sample. The remaining countries present "Weak" institutional quality. In this table, the results using Credit Information indexes are not presented. The results using Credit Information are presented in Appendix 3.6.

Institutional Quality	Legal Strong		Weak		Investor Strong		Weak	
	ExtFin90	Tang	ExtFin90	Tang	ExtFin90	Tang	ExtFin90	Tang
Dep. Var: LnM <sub>i,j,s,t</sub>	1	2	3	4	5	6	7	8
FinDev <sub>i,t</sub>	-0.0014 (0.0010)	-0.0031** (0.0014)	0.0039* (0.0021)	0.0125*** (0.0035)	-0.0032*** (0.0009)	-0.0001 (0.0014)	0.0070*** (0.0022)	0.0117*** (0.0030)
FinDev <sub>i,t</sub> xFinVul <sub>s</sub>	0.0068*** (0.0007)	0.0060* (0.0034)	0.0051*** (0.0017)	-0.0300*** (0.0096)	0.0077*** (0.0007)	-0.0099** (0.0040)	0.0071*** (0.0010)	-0.0173** (0.0068)
FinDev <sub>i,t</sub> xFinVul <sub>s</sub> xCrisis <sub>t</sub>	-0.0005* (0.0003)	0.0004 (0.0010)	-0.0020*** (0.0007)	0.0093*** (0.0026)	-0.0009*** (0.0003)	0.0003 (0.0011)	-0.0010** (0.0004)	0.0076*** (0.0019)
Constant	54.7260*** (9.5740)	54.3729*** (9.5914)	-3.7418 (8.7592)	-3.6809 (8.6527)	58.4853*** (7.6048)	58.1654*** (7.6198)	-6.1721 (8.9449)	-6.3149 (8.8698)
Observations	119,958	119,958	77,113	77,113	127,901	127,901	88,518	88,518
R-squared	0.2887	0.2836	0.1901	0.1911	0.2629	0.2576	0.2106	0.2092
Number of <i>ij</i> pairs	353	353	328	328	382	382	358	358
Sector and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size and income controls in <i>i</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

### 3.6.2 Overall economic development

In this paragraph, I am interested in analyzing the differential effects of financial conditions on export flows to BRICS countries while considering exporting country heterogeneity in terms of *economic development*. I explore the role of country differences by splitting the exporting economies into two groups: "Developed" countries and "Developing and Emerging" countries. The results are presented in Table 3.5. The idea that financial development promotes exports to BRICS especially in sectors with high external finance dependence is confirmed (coefficients  $\beta_2$  have the expected signs). The main results are thus robust to the particularities of the exporting country sample. The quality of financial development permits higher export performances especially in financially vulnerable sectors, independent of the level of economic development in the exporting country. Moving to the financial crisis effects ( $\beta_3$ ), the results show that the crisis has *reduced* the positive effect of financial development on exports in financially vulnerable sectors, *more* in "Developed" countries compared with "Developing and Emerging" countries. This result is in line with the fact that advanced countries have been more adversely hit by the crisis. This result can also be supported by the possible *non-linear* effect of financial development on real outcomes (Arcand et al, 2012). Developing and emerging countries have frequently less-developed financial systems. In tranquil times, an increased access to financial resources will permit to relax the financial constraints of financially vulnerable sectors ( $\beta_2 > 0$ ). In crisis times, the relatively lower level of financial development in these countries could have translated into a weak exposure to the international financial market fluctuations which has (relatively) protected them from the crisis negative effects ( $\beta_3$  non-significant). On the opposite, developed economies exhibit in general higher levels of financial development which makes them *more* exposed to the international financial market (Kaminsky and Reinhart (1999)). In financial crisis time, these countries are therefore more exposed to the negative effects of the crisis on credit availability which hurts financially vulnerable sectors. These results somehow contradict those of Kiendrebeogo (2013) who suggests that exports in financially vulnerable sectors are more adversely hit by financial crises in developing countries compared to advanced economies.

To conclude, while the financial development tends to procure an export advantage in financially vulnerable sectors, its importance is reduced in crisis times, especially in developed countries.

Table 3.5: Exporting Country Heterogeneity in terms of Economic Development

Robust Standard Errors in parentheses. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively. Standard Errors are clustered at the country-pair level. All specifications include Sector, Year, Importer-Year and Country pair fixed effects. Based on the World Bank classification, two groups of countries are distinguished: Developed countries and Emerging countries. The main specification is then estimated on these two sub-samples.

Dep. Var: $\text{LnM}_{i,j,s,t}$ Eco. Dev. Level	ExtFin80		ExtFin90		Tang	
	Developed 1	Dev. and Emerg. 2	Developed 3	Dev. and Emerg. 4	Developed 5	Dev. and Emerg. 6
FinDev $_{i,t}$	-0.00576*** (0.00091)	-0.00843** (0.00345)	-0.00173** (0.00082)	-0.00449 (0.00326)	0.00618*** (0.00167)	0.00058 (0.00422)
FinDev $_{i,t}$ xFinVul $_s$	0.01168*** (0.00132)	0.01139*** (0.00207)	0.00593*** (0.00074)	0.00257*** (0.00095)	-0.02588*** (0.00478)	-0.01737* (0.00973)
FinDev $_{i,t}$ xFinVul $_s$ xCrisis $_t$	-0.00193*** (0.00031)	0.00086 (0.00080)	-0.00064** (0.00026)	-0.00122 (0.00074)	0.00022 (0.00113)	0.00824*** (0.00244)
Constant	19.07669** (7.89349)	67.67861*** (10.63375)	18.32802** (7.93558)	67.75718*** (10.62276)	18.24956** (7.95319)	67.40122*** (10.58222)
Observations	104,135	114,692	104,135	114,692	104,135	114,692
R-squared	0.36559	0.19764	0.36190	0.19542	0.36213	0.19582
Number of $ij$ pairs	249	496	249	496	249	496
Sector and Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Size and income controls in $i$	Yes	Yes	Yes	Yes	Yes	Yes

### 3.7 Financial crises and Bilateral trade with BRICS

The financial crisis of 2008 has raised the issue of the impact of financial and banking crises on trade. In this section, I further control financial conditions in exporting countries by introducing information on past banking and financial crises. Banking and financial crises are not new phenomena. While the recent crisis is revealed as global, a number of countries have been individually hit by a financial or a banking crisis, over the period of study 1996-2012. Data on these crises are provided by Laeven and Valencia's (2012) database on banking crises starting from 1970.

In this section, I first introduce information on crises in exporting countries as variables of control to Eq. (3.1). As a robustness check, I then distinguish between two types of crises: Systemic Banking Crises (SBC) and Currency Crises (CC). Finally, I verify if the effects of crises in exporting countries on the *comparative advantage* related to financial development are different from those of the financial crisis of 2008. This will permit to verify if the effects of the recent financial crisis could be generalized to local financial crises.

#### 3.7.1 Controlling for crises in Exporting countries

I first control for banking and financial crises in exporting countries and estimate Eq. (3.3), by considering one measure of external finance dependence at a time (here  $Extfin80_s$ ), as follows:

$$\begin{aligned} LnM_{i,j,s,t} = & \beta_1 FinDev_{i,t} + \beta_2 FinDev_{i,t} \times Extfin80_s + \\ & \beta_3 FinDev_{i,t} \times Extfin80_s \times Crisis_t + \beta_4 Crisis_{i,t} \\ & + \beta_5 Crisis_{i,j,t} + \rho_{j,t} + \varphi_s + \mu_t + \theta_{ij} + \varepsilon_{i,j,s,t} \end{aligned} \quad (3.3)$$

Where  $FinDev_{i,t} \times Extfin80_s \times Crisis_t$  informs about the effects of the recent financial crisis on the *comparative advantage* of the financial development in exporting countries on exports of financially vulnerable sectors.  $Crisis_{i,t}$  is a binary variable that controls for all financial crises that could have hit the exporting country  $i$  in the period of study 1996-2012. This variable takes the value of 1 at the starting date of the financial crisis in the hit-exporting country  $i$  and two years after. Here, the variable  $Crisis_{i,t}$  include all types of crises proposed in Laeven and Valencia's (2012) database: Systemic Banking Crises (SBC), Currency Crises (CC) and Sovereign Debt Crises (SDC).  $Crisis_{i,j,t}$  is an interaction term between the crisis in the *exporting* countries  $i$  ( $Crisis_{i,t}$ ) and in the importing countries  $j$ <sup>24</sup>. This variable captures the effect of simultaneous crises in importing and exporting countries. Considering the literature's findings regarding the effects of crises on trade, the coefficients on both variables  $Crisis_{i,t}$  and  $Crisis_{i,j,t}$  are expected to be negative. The results are presented in Table 3.6.

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<sup>24</sup>Note that the effects of  $Crisis_{j,t}$  (in the importing countries) are subsumed in the fixed effect  $\rho_{j,t}$ .

To begin with, the coefficients  $\beta_2$  and  $\beta_3$  have the expected signs and are statistically significant. The results confirm the importance of financial development in exporting countries as a source of comparative advantage with regards to exports to BRICS in sectors with high external finance dependence. They also stress the negative effects of the recent financial crisis on the role of financial development in boosting trade. Moving to  $Crisis_{i,t}$ , the coefficient is negative and significant which attests of the negative effect of banking crises on trade with BRICS countries, as predicted by the literature. Finally, the coefficient on the interaction term  $Crisis_{i,j,t}$  has the expected sign albeit it is not statistically significant. This suggests that simultaneous crises in exporting and importing countries would negatively affect the bilateral trade. Note that the non-significance of  $\beta_5$  can be due to the extensive set of fixed effects in Eq. (3.3).

As a robustness check, I distinguish between systemic banking crises (SBC) and currency crises (CC), and estimate Eq. (3.3) by considering one type of financial crises at a time. Appendix 3.7 shows that the results are robust to the different controls of financial crises in exporting countries.

Table 3.6: Effects of Financial Development when controlling for Banking and Financial Crises in Exporting Countries  
*Robust Standard Errors in parentheses. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively. Standard Errors are clustered at the country-pair level. The dependent variable is the log value of yearly sector-exports to one of the BRICS countries (Brazil, Russian Federation, India, China or South Africa). Controls for banking and financial crises in exporting countries, and for simultaneous crises in exporting and importing countries are included. All specifications include Sector, Year and country-pair fixed effects.*

Dep. Var: $\text{LnM}_{i,j,s,t}$	ExtFin80			ExtFin90			Tang		
	1	2		3	4		5	6	
$\text{FinDev}_{i,t}$	-0.00548*** (0.00106)	-0.00548*** (0.00106)		-0.00049 (0.00096)	-0.00048 (0.00096)		0.00161 (0.00138)	0.00161 (0.00137)	
$\text{FinDev}_{i,t} \times \text{FinVul}_s$	0.01444*** (0.00105)	0.01444*** (0.00105)		0.00706*** (0.00060)	0.00706*** (0.00060)		-0.00724** (0.00366)	-0.00724** (0.00366)	
$\text{FinDev}_{i,t} \times \text{FinVul}_s \times \text{Crisis}_t$	-0.00051 (0.00034)	-0.00051 (0.00034)		-0.00075*** (0.00025)	-0.00075*** (0.00025)		0.00449*** (0.00108)	0.00448*** (0.00108)	
$\text{Crisis}_{i,t}$	-0.14070*** (0.03617)	-0.13173*** (0.04027)		-0.14582*** (0.03589)	-0.13688*** (0.04007)		-0.16676*** (0.03687)	-0.15832*** (0.04081)	
$\text{Crisis}_{i,j,t}$		-0.04203 (0.08315)			-0.04198 (0.08323)		-0.03935 (0.08263)	-0.03935 (0.08263)	
Constant	56.96555*** (6.75583)	56.94516*** (6.75134)		56.72022*** (6.76750)	56.69960*** (6.76294)		56.35922*** (6.76772)	56.34086*** (6.76346)	
Observations	186,159	186,159		186,159	186,159		186,159	186,159	
R-squared	0.26421	0.26422		0.25864	0.25864		0.25481	0.25481	
Number of $ij$ pairs	580	580		580	580		580	580	
Sector and Year FE	Yes	Yes		Yes	Yes		Yes	Yes	
Importer-Year FE	Yes	Yes		Yes	Yes		Yes	Yes	
Country pair FE	Yes	Yes		Yes	Yes		Yes	Yes	
Size and income controls in $i$	No	Yes		No	Yes		No	Yes	



### 3.7.2 Is the effect of the Recent crisis different from Past crisis episodes?

The recent financial crisis has resulted in a global collapse in finance and trade. Despite the multitude of financial crises in the past and the fact that economies are likely to be on their way to recovery, researchers are still focusing on the effects of this recent crisis. Economists often stress the *magnitude* of the effects of the recent financial crisis. Claessens et al (2014b) compare the recent financial crisis to anterior ones. The authors show that the recent crisis is similar to past crises with regards to the assets and credit booms that preceded the crisis. They stress however the fact that the recent crisis is different due to explosion of financial instruments and to the high level of integration of global financial markets, which has made its effects on the real economy sharper. Based on the multitude of factors behind financial crises and the types of financial crises (Claessens and Kose, 2013), I attempt to test whether the effects of this recent crisis can be generalized to other financial crises. In fact, it is unclear if the negative effects of this crisis of 2008 on the role of financial development in explaining trade hold when dealing with past local and less global crises. In order to test this idea, I consider different crisis episodes in exporting countries through the introduction of  $Crisis_{i,t}$  in Eq. (3.1), instead of  $Crisis_t$  which only captures the effects of the recent financial crisis. The equation to be estimated becomes:

$$\begin{aligned} LnM_{i,j,s,t} = & \beta_1 FinDev_{i,t} + \beta_2 FinDev_{i,t} \times Extfin80_s + \\ & \beta_3 FinDev_{i,t} \times Extfin80_s \times Crisis_{i,t} + \rho_{j,t} \\ & + \varphi_s + \mu_t + \theta_{ij} + \varepsilon_{i,j,s,t} \end{aligned} \quad (3.4)$$

The triple interaction term  $FinDev_{i,t} \times Extfin80_s \times Crisis_{i,t}$  will capture the *differential* effect of financial development in the exporting country on exports in financially vulnerable sectors when this exporting country faces a financial crisis<sup>25</sup>. If we consider that the effects of the recent crisis on the comparative advantage related to financial development *hold* when considering past crisis episodes in exporting countries, then, the coefficient  $\beta_3$  is expected to be negative when considering  $Extfin80_s$ , and positive when using  $Tang_s$ . The results displayed in Table 3.7 show that the impact of financial crises in exporting countries on the importance of financial development is comparable to the effects of the recent financial crisis. Financially developed economies tend to export more, to BRICS countries, in sectors with higher needs of external capital. The *comparative advantage* related to financial development is however reduced when the exporting country faces a financial crisis. These results suggest similar *negative* effects of past and recent financial crises on the role of financial development in ensuring credit availability, which adversely affects financially vulnerable sectors. The role of financial development on exports of sectors with high levels of asset tangibility is also found

<sup>25</sup>Recall that  $Crisis_{i,t}$  takes the value of 1 at the starting date of the crisis that hits the exporting country  $i$  and two years after.

to be reduced when the exporting countries are hit by financial crises. This result contradicts the main findings of this paper related to the effects of the recent crisis.

In sum, although the recent global crisis has been systemic and global, the results suggest a similar effect of the recent crisis on the link between financial development and trade, compared to past banking and financial crises. Financial crises negatively affect financially developed countries' performances in financially vulnerable sectors, even in a context of *less* financially integrated financial markets. This finding leads to a need of rethinking the specific reasons behind the sharp collapse of international trade flows that followed the recent crisis of 2008.

Table 3.7: Effects of Financial Development during Banking and Financial Past Crisis episodes in Exporting Countries

*Robust Standard Errors in parentheses. \*\*\*, \*\* and \* denote significance at 0.01, 0.05 and 0.1 levels, respectively. Standard Errors are clustered at the country pair level. The dependent variable is the log value of yearly sector-exports to one of the BRICS countries (Brazil, Russian Federation, India, China or South Africa). Here, I consider all banking and financial crisis episodes in exporting countries in the crisis dummy. All specifications include Sector, Year and country-pair fixed effects.*

Dep. Var: $\ln M_{i,j,s,t}$	ExtFin80			ExtFin90			Tang		
	1	2	3	4	5	6	7	8	9
FinDev <sub><i>i,t</i></sub>	-0.00529*** (0.00097)	-0.00400*** (0.00106)	-0.00569*** (0.00105)	0.00012 (0.00089)	0.00049 (0.00095)	-0.00120 (0.00095)	0.00386*** (0.00129)	0.00329** (0.00137)	0.00137 (0.00136)
FinDev <sub><i>i,t</i></sub> × FinVul <sub><i>s</i></sub>	0.01538*** (0.00100)	0.01540*** (0.00109)	0.01516*** (0.00109)	0.00746*** (0.00056)	0.00716*** (0.00060)	0.00711*** (0.00061)	-0.01200*** (0.00335)	-0.00560 (0.00358)	-0.00543 (0.00359)
FinDev <sub><i>i,t</i></sub> × FinVul <sub><i>s</i></sub> × Crisis <sub><i>i,t</i></sub>		-0.00345*** (0.00056)	-0.00308*** (0.00053)		-0.00073* (0.00039)	-0.00069* (0.00039)	-0.00458*** (0.00099)	-0.00381*** (0.00091)	
Constant	14.33272*** (0.15146)	14.26530*** (0.15228)	56.09226*** (6.74487)	14.20737*** (0.15073)	14.17601*** (0.14863)	55.20808*** (6.78037)	14.18548*** (0.15214)	14.07828*** (0.15171)	55.97467*** (6.74928)
Observations	220,435	187,564	186,159	220,435	187,564	186,159	220,435	187,564	186,159
R-squared	0.23935	0.25953	0.26431	0.23313	0.25344	0.25843	0.22916	0.24973	0.25466
Number of <i>ij</i> pairs	750	585	580	750	585	580	750	585	580
Sector and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size and income controls in <i>i</i>	No	No	Yes	No	No	Yes	No	No	Yes

### 3.8 Conclusion

The issue of the role of financial conditions in explaining international trade flows has been raised, soon after the trade collapse of 2008. The link between the level of financial development, trade finance and bilateral exports has been put under question.

It has been argued in the literature that financial development permits the reduction of the cost of capital and therefore provides a *comparative advantage* in sectors that exhibit higher levels of financial vulnerability, i.e. those with high dependence on external finance and / or those with few tangible assets (RZ; Manova, 2013). In addition, researchers agree about the negative effects of financial crises on cross-border activity. In the light of these two bodies of literature, this paper examines the role of financial development in explaining trade with BRICS, with a focus on the recent financial crisis effects. Particularly, the aim of this paper is to verify whether the quality of financial institutions in exporting countries has affected the *trade finance* channel of the crisis (supply-side). Focusing on exports to BRICS, this paper provides some explanations of the drop of BRICS trade flows (notably imports) among other emerging countries, during the crisis. In fact, these countries were supposed to decouple from advanced economies, but the facts show that they have been hit by the crisis in a similar way. The analysis of the effects of financial development on exports to BRICS in financially vulnerable sectors is even more interesting given the increasing role of BRICS countries in the GVC and the increase of their trade in R&D intensive sectors, which are by nature more financially vulnerable. This paper also seeks evidence about the *specific* impact of the recent crisis on the relation between financial development and trade, by comparing the effects of the *global* crisis of 2008 to those of past *local* banking and financial crises.

Using sector-level data on exports to BRICS over the period 1996-2012, I show through the estimation of a random-effects model<sup>26</sup> that financially developed countries export relatively more to BRICS in sectors that highly depend on external finance, as predicted by the literature. The comparative advantage of financial development seems however to be *reduced* during the recent crisis. This result remains robust to the inclusion of a number of control variables, notably those that describe the overall quality of institutions in domestic markets. The findings of this study provide evidence about the negative effect of financial crises on international trade flows. Two explanations may be behind the decreased importance of financial development during the crisis. The first is that the higher the quality of financial institutions is, the higher the exposure to international financial market will be (Rajan, 2005). The second is that the worldwide credit scarcity has been sharper enough to affect financially developed countries. This second explanation embodies the *trade finance* channel of the crisis. Well-developed financial systems, assumed to reduce informational and credit costs and prevent from the crisis effects of credit availability, are found to play a reduced role in relaxing financial constraints of financially constrained sectors, during the crisis. While this paper does not analyze demand-side effects of the crisis, supply-side shocks can be confirmed. Besides, the

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<sup>26</sup>in which I include an extensive set of fixed effects.

findings suggest that trade with BRICS has been affected by the financing problems in their partner countries, during the crisis. The results suggest that, due to global trade linkages, BRICS countries have been hit by the crisis (supply-side shock in their trade partners).

The paper also shows that the reduction in the comparative advantage of financial development persists across countries with different levels of institutions' quality, with higher effects in countries with weak institutions. The role of financial development in explaining exports in financially vulnerable sectors, is also found to be more reduced in developed countries, compared to developing and emerging countries, *ceteris paribus*. These findings contradict the traditional prediction that financial development affects more countries with low levels of development. Finally, I go beyond the effects of the recent crisis and consider different past episodes of banking and financial crises. The goal is to test whether the effects of the recent financial crisis on the financial conditions in exporting countries are different from those of past crises. The results show a similar response of trade flows to BRICS, to the effects of past banking and financial crises. Thus, the trade finance channel of the crisis does not seem to be specific to the recent financial crisis. This leads to rethink the causes behind the great collapse of trade in the aftermath of the crisis of 2008.

The findings of this paper propose broader contributions to the literature on the link between finance and trade. In fact, this chapter has confirmed the positive effect of financial development on trade. As predicted by Manova (2013), the quality of financial and banking institutions relaxes financial constraints for sectors with higher *inherent* needs of external finance. The financial crisis of 2008 has however put this positive link into perspective. Recall that this crisis has emerged in the US, assumed to be the most financially developed country. The high level of integration of global financial markets has led the crisis to be spread. Since the financial development is generally accompanied with a higher financial openness, the effects of the crisis may suggest that there is a *threshold* above which financial development becomes harmful (Rajan, 2005), notably for sectors with high reliance on funds provided by the financial sector. An additional policy implication of this paper is with regards to the specific effects of the recent financial crisis. The results of this paper are in favor of a similar effect of the recent crisis on *trade finance* channel, compared with past and *less* global crises. This *implicitly* sheds the light on the importance of the demand-side shocks caused by the recent crisis. Demand-side shocks would be even more important when studying the effects of the recent financial crisis, due to the increasing interdependence of local production systems. Once again, this question is of a high relevance for BRICS countries, given their increasing role in the GVC.

Finally, although this work provides evidence on the effects of the recent financial crisis, the use of monthly data on exports would be interesting in order to better capture the evolution of trade in the period of the crisis. While this paper focuses on the supply-side shocks, it will be also interesting to seek evidence about the demand-side shocks in BRICS countries in order to better explain the trade collapse. It will be also interesting to analyze the supply-

side shocks from the BRICS perspective. As a reaction to the crisis of 2008, these countries have implemented capital inflows controls, which can be a source of credit scarcity in these countries, capable of affecting their cross-border activities. It will be then constructive to test the effects of these policies on the availability of liquidity in domestic markets and on trade performances, as well.

### 3.9 Appendix

**3.1 Overview of Exporting of Exporting Countries' Trade Activity, 2006**

Exporter	Total Exports	Nr. Sectors	Exporter	Total Exports	Nr. Sectors
Afghanistan	1.92922	26	Denmark	3957.742	36
Albania	2.792815	27	Djibouti	1.583194	17
Algeria	657.7465	29	Ecuador	68.27844	34
Angola	5.550963	32	Egypt, Arab Rep.	920.226	36
Antigua and Barbuda	0.193241	19	El Salvador	36.66882	21
Argentina	11601.03	36	Equatorial Guinea	0.754477	17
Armenia	93.94884	30	Estonia	922.8115	35
Aruba	168.0569	10	Fiji	0.820451	16
Australia	12204.41	36	Finland	12215.18	36
Austria	6422.668	36	France	31224.22	36
Azerbaijan	157.5664	30	Gabon	22.48176	28
Bahrain	429.0387	35	Gambia, The	0.070698	17
Bangladesh	221.5528	33	Georgia	82.11575	29
Barbados	12.96156	16	Germany	95401.02	36
Belarus	202.4091	30	Ghana	42.26799	34
Belgium	13084.12	36	Greece	438.5845	36
Belize	4.057778	21	Guatemala	21.8378	26
Benin	16.5591	19	Guinea	179.5769	23
Bolivia	52.17464	28	Guyana	1.865908	9
Bosnia and Herzegovina	127.2369	27	Haiti	1.945873	15
Botswana	274.1353	16	Honduras	11.66365	27
Brazil	8139.362	36	Hungary	5012.963	35
Bulgaria	590.2768	35	Iceland	60.88636	30
Burkina Faso	1.764245	12	India	8758.644	36
Burundi	0.743872	8	Indonesia	13378.28	36
Cambodia	36.75318	30	Iran, Islamic Rep.	2163.11	36
Cameroon	12.2037	31	Iraq	200.0882	26
Canada	11397.43	36	Ireland	5014.201	36
Chad	0.338515	11	Israel	3843.453	36
Chile	5355.75	35	Italy	23615.67	36
China	55538.23	36	Jamaica	401.2526	28
Colombia	530.5674	33	Japan	178955	36
Congo, Dem. Rep.	56.31547	31	Jordan	141.3478	34
Costa Rica	3832.833	29	Kazakhstan	3379.076	35
Croatia	332.091	35	Kenya	59.19109	34
Cuba	604.2816	27	Korea, Dem. Rep.	1028.469	36
Cyprus	162.5518	34	Korea, Rep.	147278.3	36
Czech Republic	3861.255	36	Kuwait	1019.674	32
Côte d'Ivoire	58.21112	28	Latvia	451.4209	36

Exporter	Total Exports	Nr. Sectors	Exporter	Total Exports	Nr. Sectors
Lebanon	25.43685	31	Qatar	795.3264	35
Lesotho	2.581975	6	Romania	1246.848	36
Liberia	231.9713	24	Russia	7789.509	36
Libya	178.6868	23	Rwanda	1.425218	18
Lithuania	804.8474	36	Samoa	1.365218	13
Luxembourg	363.9624	32	Saudi Arabia	5320.614	35
Macao	240.222	32	Senegal	96.42284	32
Macedonia, FYR	58.60759	26	Sierra Leone	2.766318	31
Madagascar	7.909881	29	Singapore	35532.27	36
Malawi	19.93272	33	Slovak Republic	1872.148	34
Malaysia	44742.08	36	Slovenia	1129.998	35
Maldives	1.746721	27	Somalia	12.33588	21
Mali	2.865623	28	South Africa	4875.151	35
Malta	976.2227	31	Spain	8550.913	36
Mauritania	10.51667	13	Suriname	34.09399	15
Mauritius	51.96922	35	Sweden	12518.77	36
Mexico	6631.512	36	Switzerland	16373.07	36
Moldova	319.2395	29	Syrian Arab Republic	70.60804	34
Mongolia	76.72309	29	Tajikistan	26.54877	28
Morocco	1218.672	33	Tanzania	63.12338	35
Mozambique	34.81868	34	Thailand	27715.7	36
Myanmar	100.8796	30	Togo	2.010288	15
Namibia	248.2746	22	Tonga	0.062447	6
Nepal	319.4977	32	Trinidad and Tobago	112.9647	18
Netherlands	9947.411	36	Tunisia	195.6812	32
New Caledonia	222.5711	19	Turkey	4214.144	36
New Zealand	1542.306	34	Uganda	9.444915	32
Nicaragua	13.69145	24	Ukraine	10215.25	36
Niger	59.37268	25	United Arab Emirates	6269.731	36
Nigeria	221.6551	35	United Kingdom	23249.46	36
Oman	93.51281	34	United States	106777.6	36
Pakistan	2210.005	34	Uruguay	948.2742	35
Panama	466.1437	33	Uzbekistan	1244.825	36
Papua New Guinea	29.82883	16	Vanuatu	109.7193	11
Paraguay	382.5202	28	Venezuela	1664.823	35
Peru	1390.106	33	Vietnam	1139.154	34
Philippines	33363.86	36	Yemen	144.6897	27
Poland	4942.246	36	Zambia	418.733	34
Portugal	1072.933	36	Zimbabwe	481.4518	35



### 3.2 Meseasures of Financial Vulnerability

Industrial Sector	ISIC Rev 2	ExtFin80	ExtFin90	Tang
Food products	311	0.14	-0.15	0.37
Beverages	313	0.08	0.03	0.4
Tobacco	314	-0.45	-1.14	0.19
Textile	321	0.4	0.01	0.31
Apparel	322	0.03	-0.21	0.15
Leather	323	-0.14	-0.95	0.12
Footwear	324	-0.08	-0.74	0.13
Wood products	331	0.28	0.05	0.32
Furniture	332	0.24	-0.38	0.28
Paper and products	341	0.18	-0.35	0.42
Printing and publishing	342	0.2	-0.42	0.21
Other Chemicals- Including Drugs	352	0.22	-0.3	0.27
Petroleum refineries	353	0.04	-0.02	0.62
Petroleum and coal products	354	0.33	0.13	0.46
Rubber products	355	0.23	-0.02	0.36
Plastic products	356	1.14	-0.02	0.38
Pottery	361	-0.15	-0.41	0.28
Glass	362	0.53	0.03	0.42
Nonmetal products	369	0.06	-0.29	0.48
iron and Steel	371	0.09	0.05	0.44
NonFerrous metal	372	0.01	-0.12	0.32
Metal products	381	0.24	-0.25	0.28
Machinery	382	0.45	-0.04	0.22
Electric Machinery	383	0.77	0.24	0.21
Transportation equipment	384	0.31	-0.08	0.23
Professional goods	385	0.96	0.72	0.16
Other industries	390	0.47	0.28	0.18
Spinning	3211	-0.09	-0.05	0.38
Pulp and paper	3411	0.15	-0.07	0.6
Basic Exc Fertilizers	3511	0.25	-0.19	0.43
Synthetic resins	3513	0.16	0.03	0.4
Drugs	3522	1.49	2.43	0.16
Office and computing	3825	1.06	0.54	0.14
Radio	3832	1.04	0.7	0.14
Ship	3841	0.46	0.38	0.28
Motor vehicle	3843	0.39	0.06	0.28

### 3.3.3 Variable Definitions and Sources

This table presents the definitions and the sources of all variables used in this study.

Variable	Definition	Source
$\text{LnM}_{i,j,s,t}$	Log of the value of imports of Brazil, Russian Federation, India, China, or South Africa in USD at 3- (or 4-) digit ISIC level (Rev.2), at time $t$	UN COMTRADE
$\text{FinDev}_{i,t}$	Private credit by deposit money banks and other financial institutions as a percentage of GDP.	World Dev. Indicators, World Bank
$\text{ExtFin80}_s$	Share of capital expenditures not financed with cash flows from operations, calculated for US Compustat traded companies over the 1980s.	Rajan and Zingales (1998)
$\text{ExtFin90}_s$	An update of ExtFin80 using US data over the 1990s	Kroszner et al (2007)
$\text{Tang}_s$	Share of net property, plant and equipment in total book-value assets. Calculated for US-based companies using Compustat for the period 1980-1999.	Braun (2003)
$\text{LGDPcap}_{i,t}$	Log of the Gross domestic product per capita measured at constant 2005 USDs.	World Dev. Indicators, World Bank
$\text{GDP}_{i,t}$	Log of the Gross domestic product measured in USDs.	World Dev. Indicators, World Bank
$\text{Crisis}_{i,t}$	Dummy variable that takes the value of 1 when the exporting country experiences a financial crisis at time $t$ and two years after.	Laeven and Valencia (2012)
$\text{Legal}_{i,t}$	Strength of legal rights index (0=weak to 12=strong)	Doing Business, World Bank
$\text{Investor}_{i,t}$	Strength of investor protection index (0 to 10)	Doing Business, World Bank
$\text{Info}_{i,t}$	Depth of credit information index (0=low to 8=high)	Doing Business, World Bank

### 3.4 Descriptive Statistics

**Table A.3.4.1.** Summary of main variables

This table provides summary statistics of the variables.

Variable	Obs	Mean	Std. Dev.	Min	Max
$\text{LnM}_{i,j,s,t}$	234714	12.70152	4.159812	0	24.76104
$\text{FinDev}_{i,t}$	220435	64.80602	50.67577	0.198285	311.063
$\text{LGDP}_{i,t}$	228155	25.28139	1.980836	18.89006	30.27719
$\text{LGDPcap}_{i,t}$	228155	8.733019	1.563725	4.287097	11.36361
$\text{Crisis}_t$	234714	0.131726	0.338193	0	1
$\text{Crisis}_{i,t}$	197556	0.138568	0.345496	0	1
$\text{Legal}_{i,t}$	120057	5.903071	2.450406	0	10
$\text{Info}_{i,t}$	120057	3.92626	1.918311	0	6
$\text{Investor}_{i,t}$	120057	5.434099	1.598208	1	9.7
$\text{Dev}_i$	234714	1.527016	0.49927	0	1

**Table A.3.4.2.** Sector presence

Industrial Sector	ISIC Rev 2	Freq	Percent	Cum.
Food products	311	7281	3.1	3.1
Beverages	313	4971	2.12	5.22
Tobacco	314	2382	1.01	6.23
Textile	321	7949	3.39	9.62
Apparel	322	765	3.26	12.88
Leather	323	6997	2.98	15.86
Footwear	324	4741	2.02	17.88
Wood products	331	6835	2.91	20.79
Furniture	332	5886	2.51	23.3
Paper and products	341	6423	2.74	26.04
Printing and publishing	342	7142	3.04	29.08
Other Chemicals- Including Drugs	352	7566	3.22	32.3
Petroleum refineries	353	5053	2.15	34.46
Petroleum and coal products	354	2763	1.18	35.63
Rubber products	355	6616	2.82	38.45
Plastic products	356	731	3.11	41.57
Pottery	361	498	2.12	43.69
Glass	362	6047	2.58	46.27
Nonmetal products	369	5845	2.49	48.76
iron and Steel	371	6363	2.71	51.47
NonFerrous metal	372	7011	2.99	54.45
Metal products	381	8439	3.6	58.05
Machinery	382	9216	3.93	61.98
Electric Machinery	383	93	3.96	65.94
Transportation equipment	384	7353	3.13	69.07
Professional goods	385	7821	3.33	72.4
Other industries	390	7845	3.34	75.75
Spinning	3211	6926	2.95	78.7
Pulp and paper	3411	5971	2.54	81.24
Basic Exc Fertilizers	3511	7591	3.23	84.47
Synthetic resins	3513	6703	2.86	87.33
Drugs	3522	5442	2.32	89.65
Office and computing	3825	6663	2.84	92.49
Radio	3832	8053	3.43	95.92
Ship	3841	3152	1.34	97.26
Motor vehicle	3843	6428	2.74	100
Total		234714	100	

**Table A.3.4.3.** Correlations between main variables

This table provides the coefficients of correlation between variables at 0.01 significance level.

	$\text{LnM}_{i,j,s,t}$	$\text{FinDev}_{i,t}$	$\text{LGDP}_{i,t}$	$\text{LGDPcap}_{i,t}$	$\text{Crisis}_t$	$\text{Crisis}_{i,t}$	$\text{Legal}_{i,t}$	$\text{Info}_{i,t}$
$\text{LnM}_{i,j,s,t}$	1							
$\text{FinDev}_{i,t}$	0.3748*	1						
$\text{LGDP}_{i,t}$	0.5846*	0.4987*	1					
$\text{LGDPcap}_{i,t}$	0.3853*	0.6242*	0.5854*	1				
$\text{Crisis}_t$	0.0070*	0.0596*	-0.0009	0.0081*	1			
$\text{Crisis}_{i,t}$	0.0531*	0.0739*	0.0619*	0.0115*	0.1845*	1		
$\text{Legal}_{i,t}$	0.2406*	0.4205*	0.2189*	0.3077*	-0.0037	0.0592*	1	
$\text{Info}_{i,t}$	0.3868*	0.3749*	0.5570*	0.4939*	0.0200*	0.0680*	0.2213*	1
$\text{Investor}_{i,t}$	0.2622*	0.3793*	0.3310*	0.3614*	0.0065*	-0.0327*	0.4685*	0.3754*

### 3.5 Robustness Checks

Table A.3.5.1. Robustness I : Institutional Frameworks controls

Robust Standard Errors in parentheses. \*\*\*, \*\*, \* denote significance at 0.01, 0.05 and 0.1 levels, respectively. Standard Errors are clustered at country pair level. Three measures of the quality of institutions in exporting countries are introduced. Columns 1-3 refer to the quality of legal rights (Legal). Columns 4-6 concern the credit information (Info) while the last columns 7-9 focus on the quality of investor protection (Investor).

Dep. Var: LnM <sub>i,j,s,t</sub>	Legal			Info			Investor		
	ExtFin80	ExtFin90	Tang	ExtFin80	ExtFin90	Tang	ExtFin80	ExtFin90	Tang
1	2	3	4	5	6	7	8	9	
FinDev <sub>i,t</sub>	-0.00389*** (0.00103)	0.00171* (0.00092)	0.00382*** (0.00144)	-0.00420*** (0.00100)	0.00139 (0.00088)	0.00350** (0.00143)	-0.00408*** (0.00102)	0.00155* (0.00092)	0.00364** (0.00148)
	0.01593*** (0.00116)	0.00830*** (0.00065)	-0.00670* (0.00367)	0.01590*** (0.00116)	0.00830*** (0.00065)	-0.00680* (0.00367)	0.01581*** (0.00117)	0.00834*** (0.00065)	-0.00648* (0.00368)
	-0.00108*** (0.00028)	-0.00080*** (0.00022)	0.00081 (0.00070)	-0.00098*** (0.00028)	-0.00079*** (0.00022)	0.00113 (0.00069)	-0.00075*** (0.00028)	-0.00065*** (0.00022)	0.00077 (0.00070)
InstQual <sub>i,t</sub>	0.00925 (0.01717)	0.00924 (0.01708)	0.00807 (0.01699)	0.06675*** (0.01087)	0.06772*** (0.01088)	0.06797*** (0.01083)	0.08538** (0.04152)	0.08627** (0.04169)	0.08725*** (0.04182)
Constant	12.99643** (6.28754)	12.39211** (6.29565)	12.35957** (6.28168)	17.34616*** (5.65011)	16.81005*** (5.65076)	16.82329*** (5.63463)	12.65572** (6.17681)	12.19414** (6.18796)	12.32414** (6.17428)
Observations	128,788	128,788	128,788	128,788	128,788	128,788	116,137	116,137	116,137
R-squared	0.23037	0.22453	0.21925	0.23083	0.22500	0.21972	0.22578	0.22002	0.21457
Number of <i>ij</i> pairs	727	727	727	727	727	727	719	719	719
Sector and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size and income controls in <i>i</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

**Table A.3.5.2.** Robustness II: Importer-Sector Fixed Effects

Robust Standard Errors in parentheses. \*\*\*, \*\*, \* denote significance at 0.01, 0.05 and 0.1 levels, respectively. Standard Errors are clustered at country pair level. In addition to Sector, Year and Importer-Year fixed effects, I include Importer-Sector fixed effects to Eq. (3.1).

Dep. Var: $\text{LnM}_{i,j,s,t}$	ExtFin80		ExtFin90		Tang	
	1	2	3	4	5	6
FinDev $_{i,t}$	-0.00523*** (0.00096)	-0.00555*** (0.00098)	-0.00001 (0.00089)	-0.00034 (0.00091)	0.00409*** (0.00126)	0.00367*** (0.00128)
FinDev $_{i,t}$ x FinVul $_s$	0.01507*** (0.00097)	0.01499*** (0.00097)	0.00729*** (0.00055)	0.00727*** (0.00055)	-0.01369*** (0.00318)	-0.01341*** (0.00319)
FinDev $_{i,t}$ x FinVul $_s$ x Crisis $_t$	-0.00120*** (0.00031)	-0.00120*** (0.00031)	-0.00090*** (0.00024)	-0.00089*** (0.00024)	0.00259*** (0.00099)	0.00259** (0.00102)
Constant	16.84764*** (0.56339)	25.04573*** (7.25527)	16.73672*** (0.56394)	24.58449*** (7.25592)	16.65604*** (0.57089)	24.17407*** (7.27368)
Observations	220,435	218,827	220,435	218,827	220,435	218,827
R-squared	0.29337	0.29600	0.28754	0.29024	0.28417	0.28685
Number of $ij$ pairs	750	745	750	745	750	745
Sector and Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Imp-Year and Imp-Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Size and income controls in $i$	No	Yes	No	Yes	No	Yes

**Table A.3.5.3. Robustness III: Crisis 2007-2009**

Robust Standard Errors in parentheses. \*\*\*, \*\*, \* denote significance at 0.01, 0.05 and 0.1 levels, respectively. Standard Errors are clustered at country-pair level. Here, I let  $Crisis_t$  to take the value of 1 also for the year 2007; therefore, the crisis period will be 2007-2009 instead of 2008-2009 in the baseline specification.

Dep. Var: $LnM_{i,j,s,t}$	ExtFin80			RZ90			Tang		
	1	2	3	4	5	6	7	8	9
$FinDev_{i,t}$	-0.00529*** (0.00097)	-0.00525*** (0.00098)	-0.00559*** (0.00099)	0.00012 (0.00089)	0.00012 (0.00089)	-0.00024 (0.00091)	0.00386*** (0.00129)	0.00380*** (0.00129)	0.00334*** (0.00131)
$FinDev_{i,t} \times FinVul_s$	0.01538*** (0.00100)	0.01573*** (0.00101)	0.01564*** (0.00102)	0.00746*** (0.00056)	0.00768*** (0.00057)	0.00766*** (0.00057)	-0.01200*** (0.00335)	-0.01266*** (0.00343)	-0.01228*** (0.00344)
$FinDev_{i,t} \times FinVul_s \times Crisis_t$		-0.00132*** (0.00032)	-0.00132*** (0.00032)		-0.00082*** (0.00024)	-0.00081*** (0.00024)		0.00250*** (0.00096)	0.00249*** (0.00099)
Constant	14.33272*** (0.15146)	14.32539*** (0.15165)	23.12461*** (7.28683)	14.20737*** (0.15073)	14.20769*** (0.15073)	22.61900*** (7.29049)	14.18548*** (0.15214)	14.19925*** (0.15268)	22.24910*** (7.30353)
Observations	220,435	220,435	218,827	220,435	220,435	218,827	220,435	220,435	218,827
R-squared	0.23935	0.23940	0.24155	0.23313	0.23315	0.23540	0.22916	0.22920	0.23140
Number of $i,j$ pairs	750	750	745	750	750	745	750	750	745
Sector and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size and income controls in $i$	No	No	Yes	No	No	Yes	No	No	Yes



**Table A.3.5.4.** Robustness IV: Linearity of the Effects of Financial Development

Robust Standard Errors in parentheses. \*\*\*, \*\*, \* denote significance at 0.01, 0.05 and 0.1 levels, respectively. Standard Errors are clustered at country pair level. Sector, Year and Importer-Year fixed effects are included. Only the ExtFin90 proxy of external finance dependence is considered. Manufacturing sectors are splitted into groups depending on their levels of reliance on outside capital. Classification 1 considers groups with Low, Medium and High dependence levels. Sectors with Low dependence are those with a level of dependence below the 33th percentile of the value of ExtFin90. Sectors with Medium dependence are those with a level of dependence below the 66th percentile of the value of ExtFin90. Other sectors are considered to exhibit High dependence on external finance. Classification 2 considers two groups : Low and High. Sectors with Low dependence are those with a level of dependence below the median value (50th percentile) of ExtFin90. Other sectors are considered to exhibit High dependence on external finance.

Dep. Var: $\text{LnM}_{i,j,s,t}$	Classification 1			Classification 2	
	Low Dep.	Medium Dep.	High Dep.	Low Dep.	High Dep.
$\text{FinDev}_{i,t}$	0.01227*** (0.00170)	0.00164 (0.00112)	-0.00212* (0.00117)	0.00337*** (0.00113)	-0.00174* (0.00097)
$\text{FinDev}_{i,t} \times \text{ExtFin90}_s$	0.02743*** (0.00242)	0.03972*** (0.00886)	0.00509*** (0.00102)	0.01371*** (0.00163)	0.00638*** (0.00085)
$\text{FinDev}_{i,t} \times \text{ExtFin90}_s \times \text{Crisis}_t$	-0.00144* (0.00085)	-0.00346 (0.00332)	-0.00005 (0.00036)	-0.00139* (0.00073)	-0.00057* (0.00033)
Constant	17.59650** (7.37464)	25.34197*** (8.19596)	12.62491 (8.04245)	23.16155*** (6.84858)	19.53051** (8.17259)
Observations	48,532	82,458	65,858	111,271	107,556
R-squared	0.27506	0.20434	0.17438	0.29481	0.17542
Number of $ij$ pairs	720	743	743	745	744
Sector and Year FE	Yes	Yes	Yes	Yes	Yes
Importer-Year FE	Yes	Yes	Yes	Yes	Yes
Country pair FE	Yes	Yes	Yes	Yes	Yes
Size and income controls	Yes	Yes	Yes	Yes	Yes

### 3.6 Exploring exporting country heterogeneity: Further Results

In this table, I display the results when considering the heterogeneity of countries in terms of quality of institutions proxied with :Credit Information. Considering this proxy, countries with "Strong" institutions are those for which the mean value of the proxy over the period is above the median value of the proxy in the sample. The remaining countries present "Weak" institutional quality. Robust Standard Errors in parentheses. \*\*\*, \*\*, \* denote significance at 0.01, 0.05 and 0.1 levels, respectively. Standard Errors are clustered at country pair level.

Institutional Quality:	Info			
	Strong		Weak	
	ExtFin90	Tang	ExtFin90	Tang
Dep. Var: $\text{LnM}_{i,j,s,t}$	1	2	3	4
FinDev $_{i,t}$	-0.0013 (0.0009)	0.0029** (0.0014)	0.0045 (0.0028)	0.0081** (0.0037)
FinDev $_{i,t}$ xFinVul $_s$	0.0067*** (0.0007)	-0.0136*** (0.0042)	0.0072*** (0.0014)	-0.0118* (0.0070)
FinDev $_{i,t}$ xFinVul $_s$ xCrisist	-0.0006** (0.0003)	0.0012 (0.0011)	-0.0013 (0.0008)	0.0022 (0.0027)
Constant	14.197 (9.2710)	13.956 (9.3079)	11.2588 (11.9679)	11.0874 (11.8910)
Observations	146,555	146,555	62,655	62,655
R-squared	0.3121	0.3090	0.1605	0.1584
Number of $i\dot{j}$ pairs	361	361	355	355
Sector and Year FE	Yes	Yes	Yes	Yes
Importer-Year FE	Yes	Yes	Yes	Yes
Country pair FE	Yes	Yes	Yes	Yes
Size and income controls in $i$	Yes	Yes	Yes	Yes

### 3.7 Controlling for Banking and Financial Crises in Exporting Countries

Here, I consider two types of financial crises that hit exporting countries: Systemic Banking Crises (SBC) and Currency Crises (CC). Data on these crises come from Laeven and Valencia (2012). Their database covers all banking and currency crises in a large sample of countries over the period 1970-2011. Note that controls of crises are dummy variables that take the value of one for the starting date of the crisis and two years after.

**Table A.3.7.1.** Controlling for Systemic Banking Crises (SBC)

Robust Standard Errors in parentheses. \*\*\*, \*\*, \* denote significance at 0.01, 0.05 and 0.1 levels, respectively. Standard Errors are clustered at country pair level. All specifications include Sector, Year and Importer-Year fixed effects. Controls for Systemic Banking Crises (SBC) in exporting countries and simultaneous SBC in exporting and importing countries are included.

Dep. Var: $\text{LnM}_{i,j,s,t}$	ExtFin80		ExtFin90		Tang	
	1	2	3	4	5	6
$\text{FinDev}_{i,t}$	-0.00556*** (0.00108)	-0.00556*** (0.00108)	-0.00056 (0.00098)	-0.00056 (0.00097)	0.00156 (0.00139)	0.00156 (0.00138)
$\text{FinDev}_{i,t} \times \text{FinVul}_s$	0.01445*** (0.00105)	0.01445*** (0.00105)	0.00706*** (0.00060)	0.00706*** (0.00060)	-0.00722** (0.00366)	-0.00722** (0.00366)
$\text{FinDev}_{i,t} \times \text{FinVul}_s \times \text{Crisis}_t$	-0.00055 (0.00034)	-0.00055 (0.00034)	-0.00075*** (0.00025)	-0.00076*** (0.00025)	0.00438*** (0.00111)	0.00436*** (0.00110)
$\text{SBC}_{i,t}$	-0.12539*** (0.04021)	-0.10170** (0.04442)	-0.13214*** (0.03978)	-0.10818** (0.04409)	-0.15850*** (0.04147)	-0.13439*** (0.04557)
$\text{SBC}_{i,j,t}$		-0.11696 (0.10287)		-0.11847 (0.10278)		-0.11873 (0.10180)
Constant	56.06284*** (6.73990)	56.04823*** (6.73216)	55.78853*** (6.75095)	55.77330*** (6.74301)	55.34010*** (6.75469)	55.32650*** (6.74673)
Observations	186,159	186,159	186,159	186,159	186,159	186,159
R-squared	0.26414	0.26415	0.25856	0.25858	0.25472	0.25474
Number of $ij$ pairs	580	580	580	580	580	580
Sector and Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Size and income controls in $i$	Yes	Yes	Yes	Yes	Yes	Yes

**Table A.3.7.2.** Controlling for Currency Crises (CC)

Robust Standard Errors in parentheses. \*\*\*, \*\*, \* denote significance at 0.01, 0.05 and 0.1 levels, respectively. Standard Errors are clustered at country pair level. All specifications include Sector, Year and Importer-Year fixed effects. Controls for Currency Crises (CC) in exporting countries and simultaneous CC in exporting and importing countries are included.

Dep. Var: $\text{LnM}_{i,j,s,t}$	ExtFin80		ExtFin90		Tang	
	1	2	3	4	5	6
$\text{FniDev}_{i,t}$	-0.00609*** (0.00104)	-0.00609*** (0.00104)	-0.00113 (0.00094)	-0.00112 (0.00094)	0.00089 (0.00136)	0.00089 (0.00136)
$\text{FniDev}_{i,t} \times \text{FinVul}_s$	0.01450*** (0.00105)	0.01450*** (0.00105)	0.00706*** (0.00060)	0.00706*** (0.00060)	-0.00703* (0.00365)	-0.00702* (0.00365)
$\text{FniDev}_{i,t} \times \text{FinVul}_s \times \text{Crisis}_t$	-0.00080** (0.00034)	-0.00081** (0.00034)	-0.00075*** (0.00025)	-0.00075*** (0.00025)	0.00312*** (0.00102)	0.00309*** (0.00102)
$\text{CC}_{i,t}$	-0.05753 (0.06073)	-0.03627 (0.06349)	-0.05835 (0.06097)	-0.03721 (0.06383)	-0.06246 (0.06087)	-0.04156 (0.06369)
$\text{CC}_{i,j,t}$		-0.17362 (0.17790)		-0.17285 (0.17869)		-0.17058 (0.17962)
Constant	55.74328*** (6.79752)	55.75123*** (6.79832)	55.41015*** (6.80900)	55.68939*** (6.81754)	55.02298*** (6.81114)	55.03267*** (6.81233)
Observations	186,159	186,159	186,159	186,159	186,159	186,159
R-squared	0.26404	0.26405	0.25845	0.25846	0.25457	0.25458
Number of $i,j$ pairs	580	580	580	580	580	580
Sector and Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Size and income controls in $i$	Yes	Yes	Yes	Yes	Yes	Yes

# General Conclusion

**Does finance enhance trade?** The world financial crisis of 2008 raises many questions about the effects of finance on international trade.

The literature has long confirmed the positive role of financial development in enhancing trade. The quality of financial systems is generally regarded as reducing transaction costs and ensuring a better access to external finance. This issue is crucial for international trade activities. Exporting requires the payment of extra fixed and variable costs, that makes exporters in a higher need of funds provided by the financial sector compared with domestic sellers.

Today, a number of emerging economies are acquiring an increasing role as global traders. These economies are reshaping the patterns of international trade flows, notably in the manufacturing sectors. Since the late 1990s, these economies have been accelerating their financial development process. Dorucci et al (2009) confirm that a process of *convergence* of certain emerging economies towards advanced economies has already begun in the 2000s. The levels of financial development in emerging economies stay however below the levels reached by advanced economies (Sahay et al, 2015). Focusing on the BRICS group (Brazil, Russian Federation, India, China and South Africa), a heterogeneity in terms of financial development can be assessed. According to Dorucci et al (2009) Brazil lags behind China, India and South Africa in terms of domestic financial development.

The link between financial development and trade has been put into perspective in the aftermath of the crisis of 2008. While emerging markets have had a long history with financial crises, the recent crisis has particularly hit advanced economies. Despite the mature financial systems in advanced countries, their economies have been severely touched by the effects of the crisis. This fact raises doubts about the role of financial development and deepening in ensuring stability and preventing from shocks.

These concerns motivate the present thesis. I particularly discuss the role of financial development in ensuring better economic performances, notably trade performances. In this regard, several aspects are analyzed. I first measure the effects of financial underdevelopment in Brazil on the allocation of capital between sectors (Chapter 1). I then discuss the

effects of financial development on export performances, through a study of firm-level financial constraints for Brazilian exporters (Chapter 2). Finally, I examine the role of financial development in affecting sector-level exports to BRICS countries, with a focus on the effects of the crisis of 2008.

In the literature, the *causality* between financial development and trade has been discussed. While Beck (2002) stresses the positive effect of financial development on trade performances, Huang and Temple (2005) propose that trade openness permits the development of financial systems. In order to overcome the potential problem of reverse causality, Rajan and Zingales (1998) suggest that the effects of financial development on economic growth depend on the differences between sectors, in terms of reliance on funds provided by the financial sector. In their pioneering work, the authors propose a sector-level index that reflects the intersectoral heterogeneity in terms of their needs of external finance. Although this index is calculated over data from the US in the 1980s, the literature on the link finance-trade has been using it to assess sector differences in recent periods and for sectors in different countries. The US is considered to exhibit the least distorted financial market; therefore, the supply of credit will tend to just satisfy the sectors' demand of credit, based on their *technological* differences. This index is thus considered to reflect the sector-level heterogeneity in terms of *exogenous* needs of external capital. This assumption can be even more accepted given the present context of increasing interdependence between countries. This interdependence enhances technological transfers between countries, which may make sectors across countries converge in terms of technological characteristics. Only little attention has been paid to the possible effects of country-level differences on this sector-level heterogeneity. Yet, differences in terms of financial and economic development are factors that may affect sector-level technological characteristics. This issue is analyzed in Chapter 1 of this thesis.

The recent literature on determinants of international trade focuses on the heterogeneous export behaviors of firms depending on their characteristics. Building on Melitz (2003), several theoretical papers suggest that these behaviors would also be affected by the financial market imperfections that characterize the real world. In this context, the role of firm-level characteristics in explaining trade would be altered by sector- and country- levels of financial constraints (Manova, 2013). Chapter 2 contributes to the empirical literature on this issue, by *revisiting* the effects of firm size on export performances, in a context of financial market imperfections.

The recent financial crisis has raised questions about the role of financial development in increasing stability and enhancing trade. In line with the debate on the *financial channel* of the crisis, Chapter 3 provides further evidence on the differential effect of financial development in times of crisis, with a zoom on the recent financial crisis effects.

**How did we lead the analysis? What are the key results?** Overall, this thesis contributes to the literature on the financial determinants of international trade flows. As detailed earlier, a number of financial aspects are considered. These include the level of financial development of the country, the sector-level financial vulnerability, the firm-level financial constraints, as well as the international context of the recent financial crisis. I present the main findings of this thesis, chapter by chapter, in the following paragraphs.

In the first chapter, I assess the intersectoral heterogeneity of Brazilian manufacturing sectors in terms of needs of external finance in the 2000s, following the methodology of Rajan and Zingales (1998). Results show that Brazilian intersectoral differences in terms of external finance dependence do not only rely on the *inherent* technological differences. The financial underdevelopment of the Brazilian system and government actions to relax financial constraints are key determinants of the intersectoral differences in terms of reliance on external finance in Brazil. These factors seem to create distortions in the intersectoral allocation of capital. These results corroborate the findings of Fisman and Love (2004). These findings put into perspective the pertinence of Rajan and Zingales' (1998) indexes in assessing sector-level financial constraints in countries with lower levels (compared with the US) of financial development.

Chapter 2 shows, through a firm-level study, that Brazilian larger exporters perform better in terms of exports, but that the advantage related to size decreases when considering sector-level financial constraints. I consider sector-level differences in terms of access to finance given the Brazilian context, by using Brazilian measures of financial vulnerability proposed in the first chapter, and technology-driven differences as proposed by Rajan and Zingales (1998). Using both definitions of sector-level financial constraints, the importance of firm size in explaining firm's exports decreases when firms operate in sectors with high dependence on external finance and in those with high endowments of tangible assets, as well. Additional results stress the importance of sector-level BNDES disbursements (Brazilian Public Bank of Development) in boosting export performances. Overall, the findings suggest that due to the Brazilian financial context, large firms which operate in sectors with high reliance on external capital encounter problems in expanding their activities to foreign markets. This result stresses the weight of problems in access to finance in Brazil, on Brazilian export performances. While the literature usually focuses on the effects of high exchange rates when explaining Brazilian trade, this chapter provides further explanations for the relatively low Brazilian performances, based on financing problems.

The importance of financing problems in explaining trade has been stressed during the financial crisis of 2008. In this regard, Chapter 3 provides an analysis of the *financial channel* of the transmission of the crisis to trade flows. Particularly, this chapter focuses on the effects of financial development in exporting countries on their trade with BRICS countries. The findings confirm the *comparative advantage* of financial developed countries in sectors with

high external finance needs. The importance of the quality of financial systems is however reduced during the crisis of 2008. Trade with BRICS countries is therefore affected by the supply-side shocks caused by the crisis. The findings are in line with the fact that advanced economies, with well-developed financial systems, were more touched by the crisis effects, compared with less developed countries. As argued by Kose and Prasad (2010), it seems that deeper financial systems can serve as a mechanism for shocks' transmission to the real side of the economy. This finding has been also confirmed in this chapter, when considering the effects of past episodes of financial crises. The effects of the recent global crisis do not seem to affect the financial channel of transmission to trade, in a different manner compared with previous crises.

**Contributions and policy implications.** The findings of this PhD thesis contribute to the literature on the link finance-trade. Due to the recent context of globalization where financial and trade linkages are being deeper, the study of this link remains interesting.

This thesis has policy implications with regards to the Brazilian economy. Despite the size and the potential of this economy, Brazilian performances in terms of trade remain modest (Canuto et al, 2013). This thesis suggests that the quality of financial institutions matter for enhancing export performances. This thesis suggests, through Chapter 1, that the Brazilian government has to improve the allocation of capital in the Brazilian economy through at least two channels. The first is related to the quality of the financial system. Since the late 1990s, the Brazilian government has made efforts to restructure the financial sector. These efforts have accompanied the liberalization of the economy that followed the “Real Plan”. These reforms do not seem to be a result of strategic decisions. Rather, they seem to be a response to external and internal shocks (Torres Filho et al, 2014). This may have been behind the inefficiencies that continue to entail the Brazilian financial system (Goldfajn et al, 2003). In this regard, a government action is needed to enhance the access to credit for those firms and sectors that are by nature more dependent on external finance, through an improvement of the private banking system's activity. This action is even more important for Brazil, due to the high inflation rates that continue to hold over decades and translate into high costs of capital. This suggestion is in line with the findings of Fisman and Love (2004) who find that in the long run, financially developed countries tend to allocate capital towards sectors that are more reliant on funds from financial sectors. The second feature of the Brazilian financial system is the importance of public banks as suppliers of long-term loans. The Brazilian government founded in 1952 a public bank of development, intended to accompany the industrialization process of the Brazilian economy and relax financial constraints (Suzigan et al, 2007). The statistics show that BNDES disbursements go rather for large firms, which are supposed to be less credit constrained. These disbursements do not seem to target firms in need of funds, but rather those that are more likely to pay back the loans. These facts demonstrate of a problem of efficiency. In this regard, Colby et al (2012) show that while the BNDES disbursements



doubled between 2007 and 2010, investments have only increased by 2%. The authors also stress the political interests that shape the patterns of BNDES disbursements (cf. important support to Embraer). All these facts suggest that the problem with BNDES disbursement does not seem to be a problem of size (volume) but rather a problem of targeting. The present targeting of BNDES loans does not seem to permit fair access to finance and seems rather to create distortions in the financial sector. Given that, a policy implication of this thesis would be to rethink the strategies of BNDES and to target firms in sectors that are more in need of external finance. This issue is even more important for exporting firms. In fact, BNDES loans offer different credit lines to Brazilian exporters in order to enhance their exporting activities. Better targeting these loans will therefore be a key factor to relax firms' financial constraints with regards to their exporting activities (cf. Chapter 2).

A final policy implication is driven by the findings of Chapter 3. The recent crisis has led economists to rethink the benefits of deeper financial integration. The findings of Chapter 3 suggest that financially developed countries have been less export performant during the crisis, in sectors that rely more on external finance. While financial development is claimed by the literature as providing a *comparative advantage* in sectors that highly depend on external finance, the results of this chapter proposes rather that the role of financial development decreases in crisis times. This result is in line with the actual facts. Advanced economies, with well-developed financial systems, were the first to be touched by the crisis effects. Since financial development is generally associated with financial integration in the international financial market, the effects of the credit shortage were more important in financially developed countries. These results corroborate the findings of Malouche (2009) who finds that less developed countries were not affected by the drop of trade finance, during the crisis. This finding is therefore in line with the body of literature that associates financial deepening to more risks of fragility, which could increase the risks of financial crises (Rajan, 2005). Consistent with this finding, Gennaioli, Shleifer, and Vishny (2010) argue that in presence of neglected risks, financial innovation can increase financial fragility.

Given these elements, this thesis suggests a positive role of financial development in reducing financing constraints, but sheds light on the negative effects of the excessive exposure to the international financial markets and of the increased sophistication of financial instruments. These suggestions are consistent with the proposition of Arcand et al (2012) of a threshold above which the effects of financial development on the economic activity turn negative. These negative effects would be even more important when considering trade with BRICS countries, given the relatively higher fragility of their financial systems. Due to financial and trade linkages, the financial exposure of their trade partners to the international financial system has led to slowdown of their activities in the aftermath of the crisis. Even if these economies have shown signs of recovery soon after the crisis, it seems that the effects of the crisis are still present, notably through the slowdown of the Chinese economy witnessed in the beginning of 2016.

In sum, Brazil, among other BRICS and emerging economies, should balance between the importance of the financial stability and the necessity of ensuring higher levels of financial development and integration in the international financial system.

**Limitations and Future researches.** The findings of this thesis contribute to the empirical literature on the importance of financing constraints in explaining trade. A number of issues can however be presented. Rajan and Zingales' (1998) indicators of external finance dependence represent a simple way to overcome the possible problem of reverse causality between financial development and economic performances. The assumption of the stability of technological differences in time may however appear strong. Even with an increasing interdependence of local production systems and the importance of technology transfers, the technology gap between advanced and less developed remains large (UNCTAD, 2010). Even for China considered as the *technological frontier* for developing countries, we can talk about imitative technology rather than innovative technology (Zhen and Wang, 2012). This leads to raise doubts about the pertinence of Rajan and Zingales' (1998) indicators to proxy technological and financial intersectoral differences in developing and less developed countries (Fisman and Love, 2004).

While the use of the interval regression method, in the second chapter, can be seen as a contribution to the literature on international trade, it would be interesting in a future research to seek for precise information on Brazilian firm-level exports. A part from the firm size, the capital ownership does matter when studying firm-level financial constraints (Manova et al, 2011). It would be therefore interesting to include this kind of information in order to better capture firm-level financial constraints. A third remark is with regards to BNDES loans. There is a growing literature on the efficiency of these public loans on firm-level performances (Ottaviano and Souza, 2007 among others). Particularly, BNDES offers a number of financial incentives to boost foreign trade. These include:

- *Pre-shipment line*, which finances the production of internationally competitive companies established under Brazilian law,
- *Post-shipment line*, which finances the trade of goods and services abroad by refinancing the exporter, or through the buyer's credit category, in accordance with international standards, and
- *BNDES Exim Automatic line*, which provides support to trade Brazilian goods abroad, at the post-shipment phase, through a network of accredited banks (BNDES, 2015).

It would be therefore interesting to test the efficiency of these specific credit lines on the export performances of the granted exporting firms.

The findings of Chapter 3 have confirmed the importance of the trade finance channel of the transmission of the crisis to trade. The decreased effect of financial development on trade has been confirmed for the trade with BRICS. A future step would be to test these effects for other groups of countries, depending on their level of financial development, in order to make

sure of the general scope of these effects. The results of this chapter have also shown that the effects of the recent crisis on the role of financial development are similar to those of past episodes. This implicitly suggests that the unprecedented drop of international trade flows cannot be exclusively attributed to trade finance channel. Due to the increasing importance of the GVC, the magnitude of the recent crisis's effects would be attributed to demand-side shocks. It is therefore interesting to test the effects of demand-side shocks on BRICS countries' imports, with a focus on their heterogeneity in terms of roles in the international production system. This study would be of interest especially due to the recent context, where the activity of BRICS countries begins to slow, except for India.



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## Résumé

Ce travail a pour but d'approfondir l'analyse des effets des contraintes de financement sur le commerce international, en portant une attention particulière aux pays BRICS, notamment le Brésil. Cette thèse comporte trois chapitres. Le premier chapitre évalue la vulnérabilité financière des secteurs manufacturiers brésiliens dans les années 2000, en se basant sur le travail de Rajan et Zingales (1998). Ce chapitre souligne l'importance du développement financier et des crédits publics dans l'allocation intersectorielle du capital au Brésil. Le deuxième chapitre étudie les effets des contraintes financières sur les exportations des firmes brésiliennes, dans le cadre théorique de firmes hétérogènes (Manova, 2013). Il s'agit de repenser le lien entre la taille et les performances d'exportation, en présence de contraintes financières au niveau sectoriel. Ce chapitre montre l'importance des difficultés d'accès au crédit au Brésil dans l'explication des performances d'exportation. Le troisième chapitre étudie les effets du développement financier sur les exportations vers les BRICS, avec un intérêt particulier pour les effets de la crise financière de 2008. Ce chapitre confirme l'importance du développement financier comme source d'avantage comparatif dans les secteurs dépendants de la finance externe. Cet avantage lié au développement financier perd de son importance pendant la crise. Les résultats confirment l'importance du canal financier de transmission de la crise.

## Abstract

This thesis aims at deepening the analysis of the effects of financial constraints on international trade performances, with a focus on the BRICS countries, notably Brazil. This thesis includes three chapters. The first chapter aims at evaluating the level of financial vulnerability of Brazilian manufacturing sectors in the 2000s, based on the work of Rajan and Zingales (1998). This chapter stresses the importance of the financial development and of public credits in causing the inter-sectoral capital misallocation. The second chapter focuses on the link between financial constraints and the performances of Brazilian exporters, in a framework of heterogeneous firms as in Manova (2013). Specifically, I revisit the link between firm size and firm exports by focusing on the financial constraints at sector-level. Findings emphasize the importance of problems of access to credit in Brazil, in explaining Brazilian firms' export performances. The third chapter analyzes the effects of financial development in exporting countries on their exports to BRICS countries, with a focus on the recent financial crisis effects. Results confirm the role of financial development as a source of comparative advantage in sectors with high reliance on external finance. The positive effect related to financial development is lessened during the crisis. This confirms the importance of the trade finance transmission channel of the crisis.

## Mots Clés

Développement financier, Dépendance aux financements externes, Allocation du capital, Crise financière de 2008, Exportations, Brésil, BRICS

## Keywords

Financial development, External finance dependence, Resource allocation, Financial crisis of 2008, Exports, Brazil, BRICS