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LE COMMERCE INTRA-NATIONAL ET INTERNATIONAL DES ÉTATS BRÉSILIENS : DÉTERMINANTS, STRUCTURE ET INTERDÉPENDANCES

THÈSE

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Dirigée par

M. Jean-Marc SIROËN

Jury :

Directeur de Thèse:

M. Jean-Marc SIROËN
Professeur à l'Université Paris-Dauphine

Rapporteurs:

Mme Cristina TERRA
Professeur à l'Université Cergy-Pontoise

Mme Céline CARRÈRE
Professeur à l'Université de Genève

Suffragants:

M. Bernard GUILLOCHON
Professeur émérite à l'Université Paris-Dauphine

M. José de SOUSA
Professeur à l'Université Paris-Sud 11

M. Joaquim OLIVEIRA MARTINS
Chef de la Division des politiques de développement régional à l'OCDE

Anneme ve Babama,

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CHAPITRE INTRODUCTIF

Le processus de mondialisation commercial depuis les années 1990 ne se limite pas à un volume croissant des échanges, mais s'accompagne aussi une nouvelle dynamique. Aujourd'hui le commerce mondial associe à la fois des entités sub-nationales -des régions, des zones franches, des districts industriels, etc.- et une volonté d'intégration au niveau inter et supra-national. Les stratégies de développement protectionnistes fondées sur la substitution des importations ont été délaissées et la plupart des pays émergents comme la Chine, l'Inde, ou le Brésil ont diminué unilatéralement leurs droits de douane. Les pays, de plus en plus interdépendants, sont associés dans des accords de libre-échange ou d'Union douanières qui ont vu leur nombre exploser. Les organisations multilatérales et/ou intergouvernementales ont réorienté les politiques commerciales via les accords multilatéraux de l'OMC (Uruguay Round) ou les plans d'ajustement structurels du FMI. Les entreprises multinationales de taille mondiale fusionnent, s'associent, se complètent et, dans le même temps, se concurrencent en transformant la structure du commerce mondial et celle de l'appareil productif des pays.

Cependant, les instruments utilisés dans l'analyse des évolutions de la mondialisation commerciale, qu'ils soient fondés sur la théorie du commerce international ou sur les données statistiques disponibles, sont parfois désarmées face aux dynamiques micro- et macro-économiques qui sont en œuvre.

Alors même que les pays s'intégraient davantage, de nombreux travaux empiriques ont mis en évidence la grande fragmentation de certains marchés nationaux : Wolf (1997, 2000) pour les Etats-Unis, Helliwell (1998) pour Canada, Poncet (2003) pour la Chine, Daumal et Zignago (2010) pour Brésil. Ainsi, Wolf (1997, 2000), après avoir contrôlé pour la taille et la distance a montré que la fragmentation du commerce sur le marché domestique américain persistait, ce qu'il explique par des clusters géographiques avec des processus de production liés dans une chaine de production verticale. Daumal et Zignago (2010), en contrôlant pour les caractéristiques observables ou non observables des états brésiliens, trouvent que le commerce est également très fragmenté sur le marché domestique brésilien. Selon elles, des

règles administratives et législatives différentes selon les états contribuent à expliquer cette fragmentation.

Au-delà du processus de libéralisation commerciale, le développement du commerce en tâches et l'augmentation du commerce des biens intermédiaires (Baldwin, 2006) a été accéléré par la diminution des coûts de communications et d'organisation liés à la distance entre producteurs. Selon les organisations internationaux, telles que l'OMC, la Banque mondiale ou l'OCDE ; les échanges sont de plus en plus caractérisés par une fragmentation géographique des processus de production. Ainsi, les nations ou les régions trouvent la possibilité de se spécialiser en tâches plutôt qu'en des produits finaux (« spécialisation verticale »). L'émergence des zones franches de production, ou d' "export processing zones" et les implantations dispersées des entreprises multinationales ont été d'autres moteurs forts qui ont accéléré ce commerce de biens intermédiaires et de composants (WTO-IDE-JETRO, 2011), particulièrement dans certains secteurs comme l'automobile, l'électronique ou la construction aéronautique.

Cette thèse a pour ambition de transposer l'analyse du commerce au niveau sub-national en examinant le commerce entre les régions d'une même nation, préalable au commerce "inter-national" privilégié par la théorie du commerce international. Par ailleurs, nous introduisons une analyse du commerce inter-régional et international fondée sur des spécialisations en termes de "tâches" et pas seulement en termes de produits finaux qui agrègent des valeurs ajoutées en partie réalisées dans d'autres régions ou pays. Cette forme d'échange peut faire émerger de nouvelles dynamiques pour le commerce sub-national, en permettant aux régions de se spécialiser à certaines étapes de la production pour lesquelles, malgré leur plus petite dimension, qui leur permet d'atteindre une taille critique dans les tâches où elles se spécialisent et devenir compétitives sur le marché national et international.

La thèse porte sur le Brésil comme terrain d'analyse de cette nouvelle dynamique. Le Brésil est un état fédéral qui laisse une autonomie aux politiques internes aux États, notamment en matière de fiscalité. Malgré des politiques de redistribution et de transferts réalisées au niveau fédéral, le Brésil conserve de fortes diversités régionales en termes de niveau de développement, de ressources, de capital physique et humain, d'accès aux infrastructures. Si le

Brésil est un grand producteur et exportateurs de matières premières agricoles et minières, il se revendique aussi comme industriel. Le Brésil pourrait ainsi contribuer aux nouvelles dynamiques du commerce international en tirant partie de ses spécificités régionales. De fait, comme le montrera cette thèse, les États brésiliens échangent d'abord entre eux avant d'échanger avec le Monde.

Ce chapitre introductif a pour but de dresser un panorama stylisé du commerce des états brésiliens qui permettra de mieux situer le contexte de la thèse, justifiera les problématiques adoptées dans les trois chapitres et, enfin, facilitera l'interprétation des résultats. Nous rappellerons d'abord les étapes de la politique d'ouverture commerciale menée par le Brésil dans les années 1990 malgré sa forte tradition protectionniste. Nous décrirons ensuite les principales caractéristiques du commerce de chaque état brésilien avec le monde, avant de calculer et comparer leurs "avantages comparatifs révélés". Le problème de l'insuffisance et de l'obsolescence des infrastructures brésiliennes est récurrent a été la pierre angulaire de l'ambitieux *Programa de Aceleração do Crescimento* (Programme d'accélération de la croissance) lancé par le Président Lula en 2007. Nous l'analysons ici par régions et par type de transports, en tant que déterminant essentiel du commerce intra- et inter- national. Un autre sujet récurrent de préoccupation est les guerres fiscales qui contribuent à déformer les structures productives des états et donc à influencer leur intégration au marché intérieur comme au marché international. Nous terminons ce chapitre introductif par la présentation des différents chapitres de la thèse.

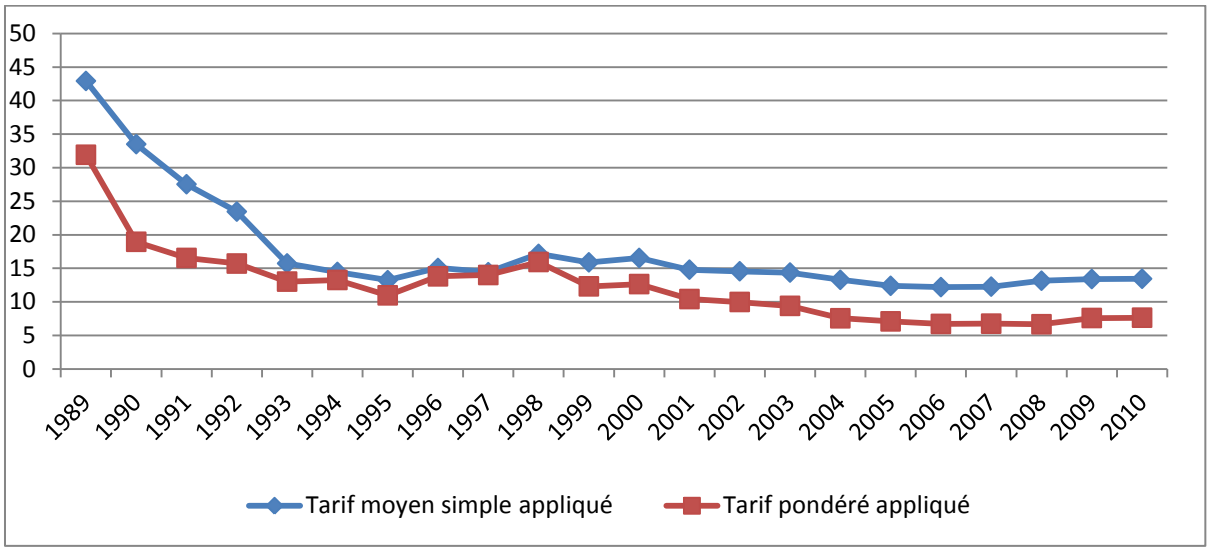
I. Étapes et ampleur de la libéralisation commerciale au Brésil

La part du commerce mondial en marchandises dans le PIB mondial est passée de 32% à 48% entre 1990-2010[1] en partie grâce aux efforts multilatéraux de l'OMC, créé en continuité du GATT par l'accord de Marrakech (1994) mais surtout grâce à la diminution unilatérale des

[1] Le chiffre à partir de World dataBank.

tarifs dans plusieurs pays en voie de développement et émergents réalisée progressivement à partir des années 1980s. Le Brésil a participé à cette évolution.

Graphique 1: Les tarifs moyens appliqués au Brésil : simples et pondérés (1989-2000)



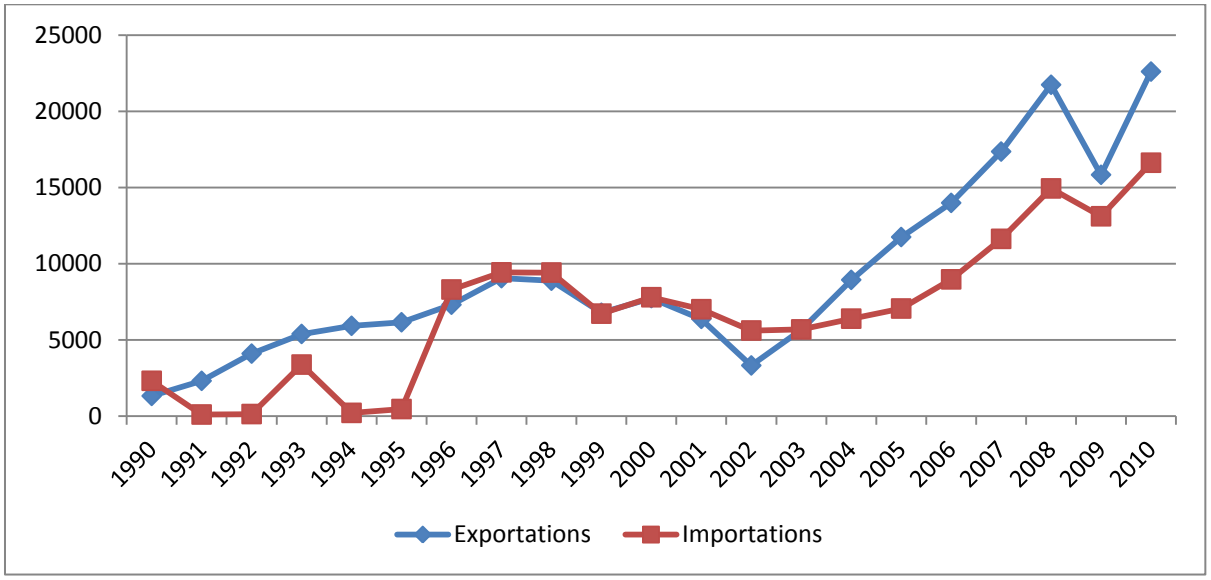
Source : World dataBank

Bien que le Brésil ait été un des fondateurs de GATT en 1947, ce pays, comme la plupart des pays en développement, a mené des politiques protectionnistes de substitution aux importations jusqu'au début des années 1990 pour des « raisons de développement » (de Paiva Abreu, 1998). Le retournement majeur a eu lieu avec la Présidence Collor (1990-1992) (Horta, Piani and Kume ; 1991), qui a accéléré la diminution des tarifs moyens dans un cadre unilatéral (Graphique1). En 1994 une autre vague de réduction tarifaire accompagne le *Plano Real* de lutte contre l'hyperinflation avec pour objectif de faire pression sur les prix domestiques (Cardoso, 2009). D'autre part, la période pré-1990 était marquée par une série de barrières non-tarifaires. L'importation des produits, pour lesquels un substitut national existait, était limitée, tandis que l'importation des produits non-substituables était réglementée par 42 régimes spéciaux différents (Hay, 2000). En 1990, la liste de 1300 produits définis par "Lei do

Similar Nacional" est abolie ainsi que les régimes spéciaux, à l'exception, néanmoins de la *Zona Franca de Manaus* (Zone Franche de Manaus) et du régime de *drawback*[2].

Ces mesures d'ouverture commerciale multilatérales et unilatérales sont complétées au niveau régional par la création du MERCOSUR entre le Brésil, l'Argentine, le Paraguay et l'Uruguay (Traité d'Asunción, mars 1991), traité d'Union douanière qui prévoit une libéralisation progressive en quatre phases (Cardoso, 2009). En 1995, un tarif extérieur commun (TEC) est appliqué à 85% des produits (Trotignon, 2001). Pendant les deux premières phases (1990-1994 et 1994-1998), le commerce brésilien de biens avec les pays du MERCOSUR est multiplié par 5 en valeur et passe de 3.6 milliards de dollars en 1990 à 18.3 milliards de dollars en 1998 (Graphique 2).

Graphique 2: Les exportations et les importations du Brésil en biens (en millions de US dollars courants) avec le MERCOSUR

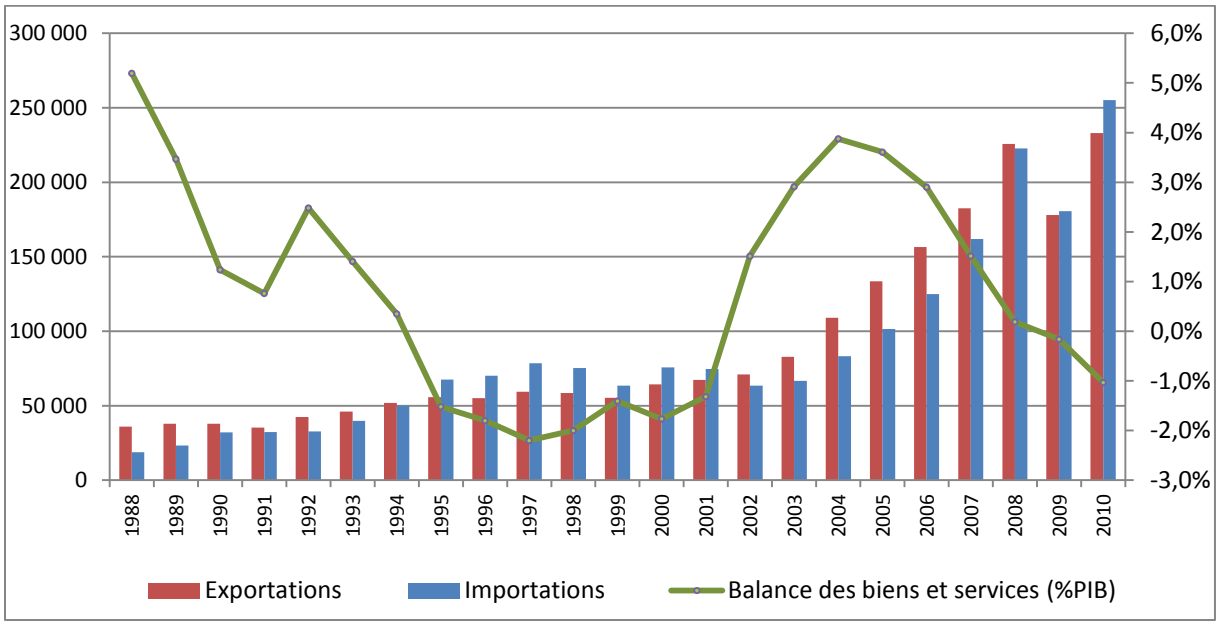


Source : AliceWeb (voir Tableau 7 en Annexe pour plus de détails)

[2] Le système de drawback permet de suspendre, d'exonérer ou de restituer les droits de douane sur l'importation. Le système permet aussi de suspendre une série de taxes (IPI, PIS, COFINS, ICMS, voir l'Annexe 6) payées sur les importations afin de produire des biens destinés à l'exportation (Décret-Loi No 4.543 du 26 Décembre 2002: Les Articles 335, 336 et 337; Décret-Loi No 4.544 du Décembre 2002: L'Article 42 ; Loi No 10.865 du 30 Avril 2004: L'Article 14).Voir *Trade Policy Review Brazil* (OMC, 2009).

Néanmoins, cette rapide augmentation du commerce intra-MERCOSUR est brisée par les crises brésilienne et argentine (1998-2003). Malgré un regain à partir de 2003[3], le MERCOSUR apparaît toujours comme une union douanière « incomplète » car plusieurs secteurs restent soumis à des régimes spéciaux, comme l'automobile, et par la persistance de désaccords sur les tarifs extérieurs communs (TEC) dus à plusieurs régimes d'exceptions qui diffèrent entre les pays membres (Cardoso, 2009).

Graphique 3: Les exportations et les importations du Brésil en biens et services (en millions de US dollars courants) et balance des biens et services (en % du PIB)



Source : World dataBank

Le Graphique 3 montre que, entre 1988 et 1997, les exportations de biens et services du Brésil avec le monde ont augmenté de 65% (de 35.9 milliards de US$ à 59.4 milliards de US$), ce qui a continué par la suite pour parvenir, en 2010, à 232 milliards de US dollars. Néanmoins, l'intégration commerciale du pays avec le marché mondial reste relativement faible si on la compare avec les autres BRIC. Le taux d'ouverture commerciale du Brésil, mesuré par le ratio commerce (exportations+importations) en biens sur le PIB, se situe autour de 18.4% en 2010,

[3] Cette augmentation a duré jusqu'en 2008 sous l'impact de la crise mondiale.

derrière la Chine (50.1%), la Russie (43.6%) et l'Inde (33.8%)[4]. Cependant, ses partenaires commerciaux apparaissent plus diversifiés comparés aux autres BRIC (de Castro, 2012). En réalité, les comparaisons, notamment avec la Chine, sont critiquables, car le Brésil, spécialisé dans les biens primaires exporte des biens à faible valeur ajoutée mais avec des contenus en importations relativement faibles et donc une part en valeur ajoutée nationale plus élevée (voir chapitre 3).

II. Le commerce des états brésiliens :

Le Brésil est un pays fédéral, qui est divisé administrativement entre 27 états[5]; dont le Distrito Federal (Brasília). Ces 27 états sont regroupés en 5 régions (Nord, Nord-est, Sud, Sud-est, et Centre-ouest) par l'institut statistique brésilien (IBGE) qui a tenté de respecter dans ce groupement les similarités entre les états d'une même région. En 1999, le Congrès national a distingué "deux" Brésil: le "Brésil un" pour sa partie riche, et le "Brésil deux" pour sa partie pauvre[6]. "Brésil un" réunissait le Sud et le Sud-est, et la partie développée du Centre-ouest (Mato Grosso do Sul et le sud de l'état de Goiás).

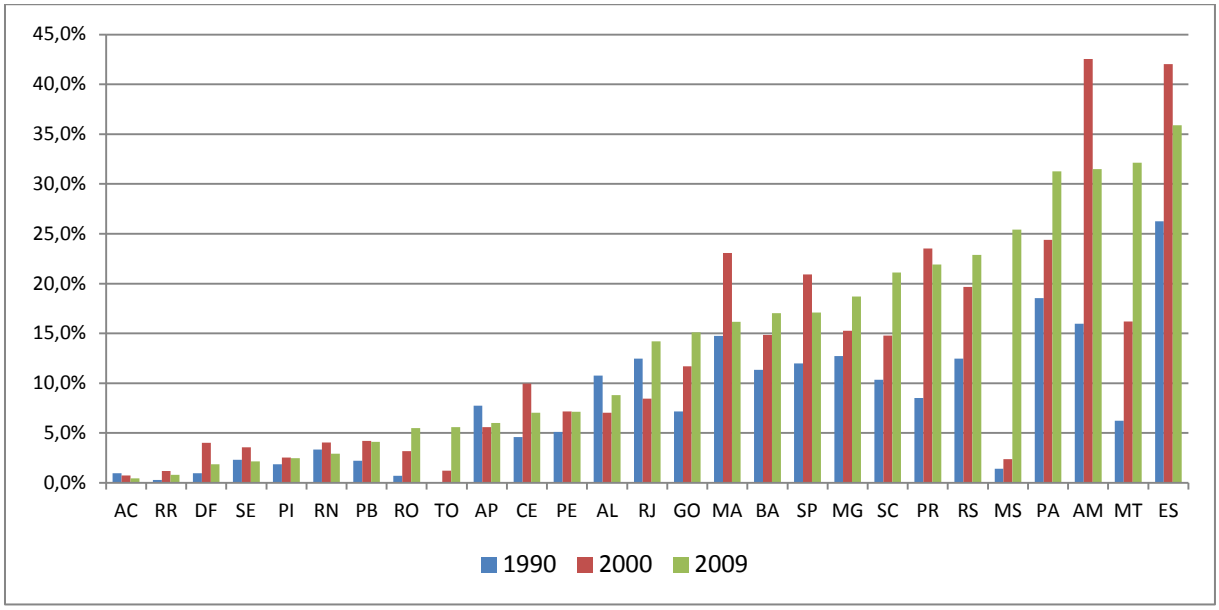
L'intégration commerciale du Brésil s'est caractérisée par des différences considérables entre les états, en niveau et en évolution, et notamment en termes de taux d'ouverture (Graphique 4) qui ne recouvrent pas, d'ailleurs, le clivage habituel avec la présence d'états du Nord parmi les états les plus ouverts : Amazonas, Pará.

[4] WDI, World dataBank (Merchandize trade (% of GDP))

[5] Avant 1989, Brésil comptait au total 26 états fédéraux. L'état de Tocantins et de Goiás constituaient un seul unique état, sous l'administration de Goiás.

[6] Inspiré par le rapport "The Brazilian Inter-Regional Economic Imbalance" a été préparé par la Commission Mixte de Congrès national en 1993 et révisée en 1999 (Lopes Neto, 2001). Accessible à partir de www.senado.gov.br/web/senador/beniver/desequilibrio

Graphique 4: L'ouverture commerciale* des états brésiliens (1990, 2000 et 2009)

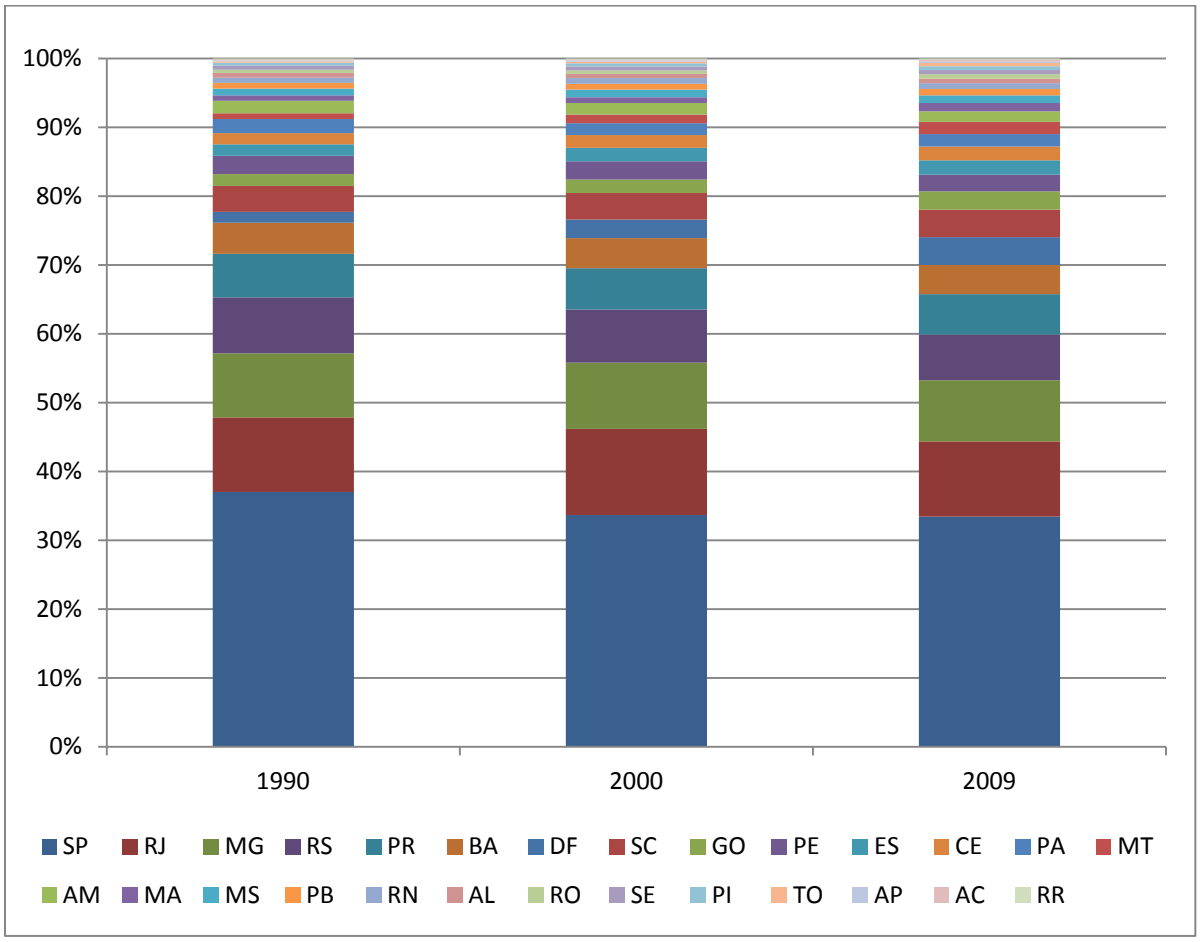


Source: Calculs de l'auteur à partir d'AliceWeb et d'IBGE.

*Somme des exportations et des importations en biens des états divisée par leur PIB et en pourcentage. Les PIB ne sont pas disponibles pour les dates antérieures à 2009. L'état de Tocantins a été créé après 1990.

Le PIB, un indicateur de la taille économique, est un élément important dans l'analyse du commerce, comme une mesure de la production et donc "proxy" de l'offre de l'état et comme mesure du revenu et "proxy" la demande. Le Graphique 5 montre les écarts spectaculaires entre les parts des états dans le PIB total brésilien. Le Graphique 5 peut ainsi être rapproché du tableau 1, qui montre une part plus élevée des états du Sud et du Sud-est dans le commerce international.

Graphique 5: La part des états dans le PIB brésilien (1990, 2000 et 2009)



Source : IPEAData

* Les PIBs en millions de US dollars courants sont accessibles à partir du Tableau 8 en Annexe.

Le tableau 1 montre, qu'en 2010, près 58% des exportations du Brésil vers le monde était réalisée par les états de sud-est, notamment São Paulo (27%). Les inégalités persistent aussi du côté des importations totales brésiliennes. Par exemple, la part de São Paulo dans l'importation totale du Brésil était de 37% en 2010 tandis que la part d'Acre était presque nulle. Les sept états du nord représentent seulement 7.5 % de l'exportation totale malgré la performance de l'état de Pará. D'autre part, les états qui exportent relativement plus ne sont pas toujours les plus importateurs. Par exemple, le Minas Gerais réalise sur l'ensemble de période une part importante de l'exportation brésilienne mais importe relativement peu. A l'inverse, la part de l'état d'Amazonas dans l'exportation du Brésil est faible malgré une part

Tableau 1: Exportations et importations en biens des états brésiliens avec le MERCOSUR et avec le Monde (en %)

	MERCOSUR						MONDE					
	1990		2000		2010		1990		2000		2010	
Nord	1,71	1,11	4,85	0,69	2,61	0,64	5,79	6,75	6,24	7,68	7,58	7,01
AC	0	0	0,01	0,01	0	0	0,01	0,02	0	0,01	0,01	0
AP	0,47	0	0,01	0	0	0	0,18	0,01	0,07	0,05	0,18	0,03
AM	0,62	0,39	4,11	0,42	2,02	0,21	0,58	5,63	1,45	7,04	0,56	6,09
PA	0,62	0,72	0,62	0,23	0,55	0,19	5	1,05	4,59	0,47	6,44	0,63
RO	0	0	0,1	0,01	0,04	0,22	0,03	0,03	0,11	0,08	0,21	0,13
RR	0	0	0	0	0	0	0	0,01	0,01	0,01	0,01	0
TO	0	0	0	0,02	0	0,02	0	0	0,02	0,02	0,17	0,13
Nord-Est	7,33	10,67	6,32	13,06	7,51	13,05	9,78	7,23	7,56	8,57	7,96	9,68
AL	0	0,92	0,04	0,28	0	0,15	0,94	0,29	0,42	0,12	0,49	0,14
BA	6,16	4,27	3,86	6,55	5,46	7,53	4,69	4,38	3,65	4,02	4,46	3,69
CE	0,35	1,11	0,78	2,33	0,7	1,15	0,74	0,55	0,93	1,29	0,64	1,19
MA	0,01	0,25	0,75	0,12	0,4	0,39	1,43	0,49	1,42	0,87	1,47	2,1
PB	0,07	0,17	0,12	0,29	0,1	0,24	0,17	0,16	0,15	0,27	0,11	0,38
PE	0,55	3,45	0,52	2,74	0,71	3,1	1,29	1,1	0,53	1,68	0,56	1,8
PI	0,04	0,02	0,01	0,02	0	0	0,1	0,03	0,12	0,03	0,06	0,1
RN	0,02	0,31	0,1	0,28	0,12	0,23	0,29	0,11	0,28	0,13	0,14	0,18
SE	0,14	0,16	0,14	0,44	0,01	0,26	0,12	0,11	0,06	0,17	0,04	0,1
Sud-Est	69,76	51,26	61,14	48,69	62,3	40,92	60,76	74,56	58,53	64,37	57,97	56,16
ES	3,97	3,58	1,22	4,35	2,87	2,09	4,57	2,89	5,24	4,5	6	4,18
MG	9,36	2,01	6,73	6,16	9,95	9,14	14,85	4,19	12,61	4,98	15,67	5,49
RJ	7,86	11,23	3,65	10,74	4,75	8,97	4,7	23,27	3,46	8,93	10,05	9,17
SP	48,57	34,45	49,55	27,44	44,74	20,71	36,65	44,22	37,22	45,96	26,25	37,31
Sud	20,27	34,7	26,73	35,96	25,6	43,63	21,84	10,63	24,22	17,34	18,64	21,58
PR	5,87	7,7	8,17	13,61	9,96	12,1	6,03	3,03	8,26	8,41	7,12	7,68
SC	3,94	5	5,47	3,41	3,79	8,23	4,7	1,58	5,1	1,72	3,81	6,59
RS	10,47	22	13,09	18,94	11,86	23,3	11,11	6,02	10,87	7,22	7,72	7,31
Centre-Ouest	0,92	2,26	0,96	1,6	1,98	1,76	1,82	0,83	3,44	2,04	7,84	5,57
DF	0	0	0	0,11	0,01	0,13	0,01	0,36	0	0,91	0,08	0,86
GO	0,2	1,44	0,22	0,91	0,34	0,41	0,65	0,36	1,02	0,67	2,03	2,3
MT	0,07	0,82	0,16	0,24	0,08	0,21	0,82	0,11	1,94	0,16	4,25	0,54
MS	0,65	0	0,58	0,34	1,55	1,01	0,34	0	0,48	0,29	1,49	1,86
Total	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00

Source: Calculs de l'auteur à partir des données d'AliceWeb.

importante dans les importations. Le Mato Grosso aussi suit l'exemple du Minas Gerais, puisque ses exportations augmentent considérablement en 2010 sans changement du côté des importations. Cependant sur l'ensemble de la période, on remarque une certaine convergence entre les parts à l'exportation des états du Sud-est, du Centre-ouest et de certains états du nord, notamment le Pará.

L'intégration commerciale des états avec le MERCOSUR, diffère également avec une structure qui ne recoupe pas celle de leur commerce avec le monde. Par exemple, les états du Sud-est exportent plus qu'ils n'importent du MERCOSUR, à l'inverse de leurs exportations et importations avec le monde. L'état de São Paulo est un cas extrême : en 2010, il réalisait 45% des exportations brésiliennes vers le MERCOSUR contre 21% des importations alors que sa part était de 26 % et de 37% respectivement dans les exportations du Brésil et les importations. Au contraire, les états de Centre-ouest commercent davantage relativement avec le reste du monde qu'avec les pays du MERCOSUR.

III. Les avantages comparatifs révélés des états

Les théories classiques du commerce, lorsqu'elles situent les avantages comparatifs au niveau des nations et non à celui des régions, ne s'intéressent pas aux différences dans les performances commerciales des régions d'un même pays. La théorie des avantages comparatifs, en centrant son analyse au niveau des pays, ignore alors les différences de productivité à l'intérieur d'un pays. De même, la théorie néoclassique, de type Hecksher-Ohlin-Samuelson, s'applique au commerce "inter-national" et analyse la structure de commerce sous l'hypothèse de l'intégration parfaite du marché des facteurs et/ou du marché des biens à l'intérieur d'un pays. Les théories d'économie géographique introduisent néanmoins la localisation comme élément déterminant dans l'analyse commerciale en soulignant l'impact des coûts de commerce et de transport sur le commerce.

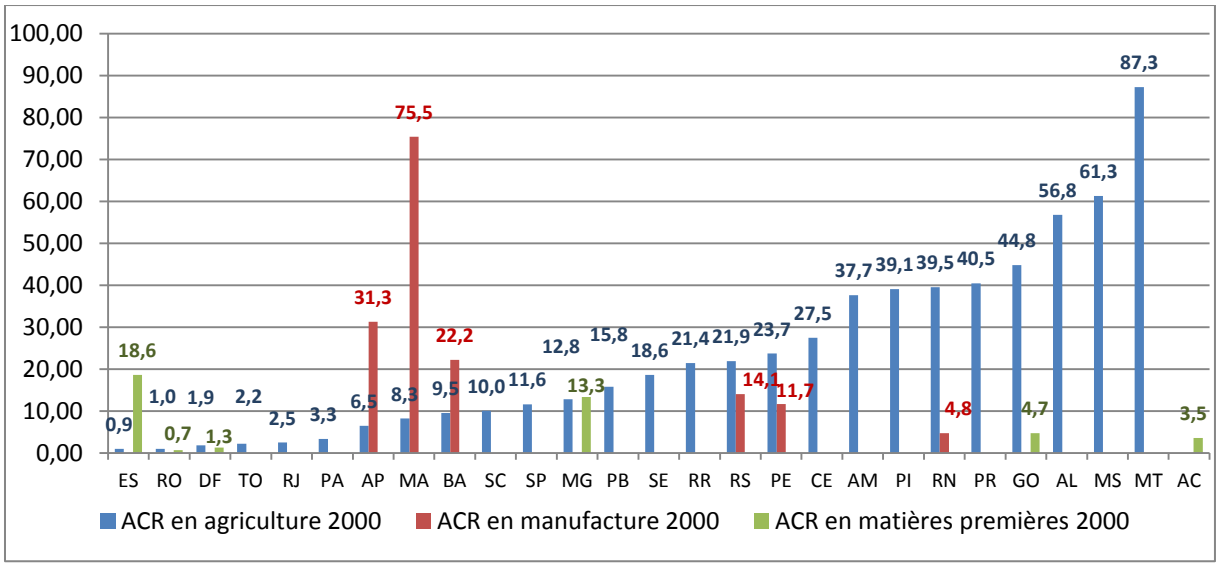
Dans les faits, il peut y avoir des différences persistantes à l'intérieur d'un pays qui sont liées aux imperfections du marché, à la localisation (accès aux marchés), aux infrastructures (ports, routes, etc.), aux tailles économiques des régions, etc. et qui déterminent les spécialisations

des régions, simultanément avec celles des pays. Nous vérifions ici que les états brésiliens disposent d'avantages comparatifs révélés contrastés (Graphiques 6 et 7). L'indicateur des avantages comparatifs révélés (ACR) des états brésiliens est calculé à partir de la définition suivante (Neven, 1995) :

$$ACR_{i,n} = \left(\frac{X_{i,n}}{\sum_n X_{i,n}} - \frac{M_{i,n}}{\sum_n M_{i,n}}\right) * 100 \quad ; \qquad \sum_n ACR_{i,n} = 0 \qquad (1)$$

où X et M sont égales aux exportations et aux importations de l'état i, et n indique le secteur. Les ACR ont été calculés en suivant la méthode de Neven (1995), plutôt que par la méthode traditionnelle de Balassa (1965), car elle permet de prendre en compte de l'importation des entités. Selon Oliveira Martins et Price (2004), la méthode de Neven (1995) est préférable du fait de l'existence d'un commerce intra-branche qui représente aujourd'hui une partie importante du commerce mondiale avec des volumes d'importation et d'exportation élevés pour le même produit.

Graphique 6: Les avantages comparatifs révélés (ACR) des états brésiliens en 2000*



Source: Calculs de l'auteur à partir des données AliceWeb.

* Pour des raisons de lisibilité, seulement les secteurs pour lesquels les états ont un ACR positif sont montrés dans le tableau. La somme des avantages comparatifs révélés étant égale à "0" pour chaque état, un état ayant une valeur positive élevée de ACR dans un secteur a nécessairement une valeur négative de la même hauteur dans les secteurs où il n'a pas l'avantage.

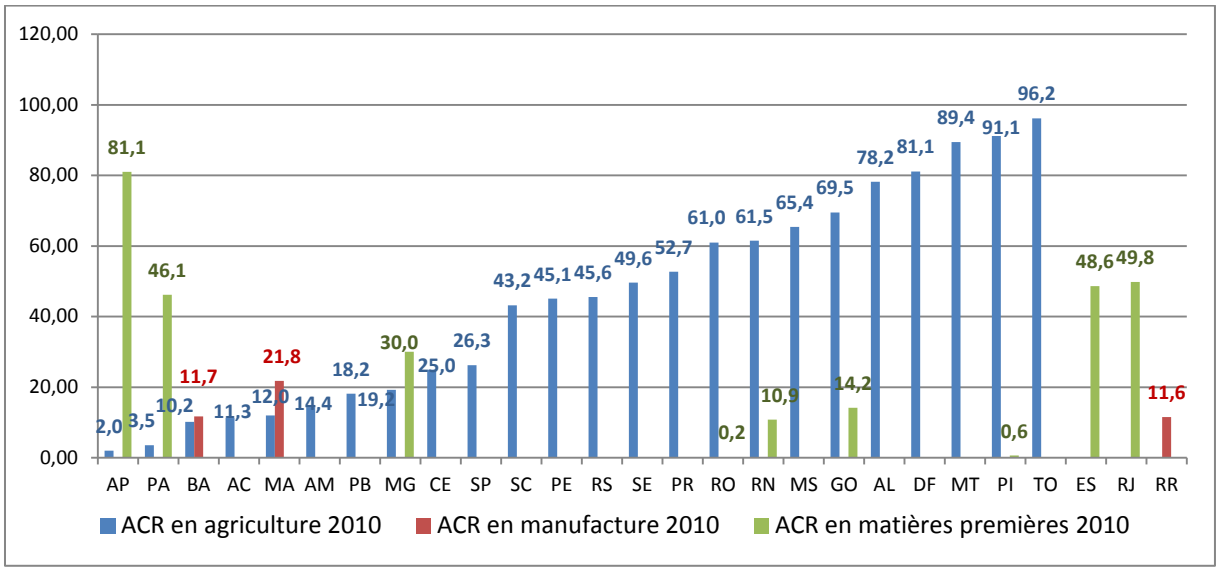
On calcule les valeurs d'ACR dans les Graphiques 6 et 7, à partir des données d'exportation et d'importation de la nomenclature définie selon Système harmonisé de niveau 2 (SH2), accessible depuis le SECEX (*Secreteria de Comércio Exterior*) . Le système harmonisé de niveau 2 (SH2) regroupe les produits en 99 secteurs. En utilisant l'agrégation de de Sá Port et dos Santos (2011), on les a regroupés sous trois grandes catégories: l'agriculture, les produits manufacturiers, les matières premières (voir Tableau 9 en Annexe pour la liste des produits et la catégorisation).

Le Graphique 6 montre que les états brésiliens ont ensemble un avantage comparatif révélé dans les produits agricoles. C'est également vrai pour les états les plus industrialisés comme São Paulo, Rio de Janeiro ou Amazonas. Les autres états, moins spécialisés dans l'agriculture, ont parfois un avantage comparatif dans les matières premières : Espírito Santo, Minas Gerais et Acre. Les niveaux élevés d'ACR dans les produits manufacturiers pour les états d'Amapá, Bahia et Maranhão sont dus au fait que les produits du « bois » pour Amapá et Bahia et les produits d' « aluminium » pour Maranhão sont classés dans le secteur manufacturier[7].

L'analyse répétée pour 2010, montre que cette structure évolue au profit des produits agricoles ce qui marque une certaine "désindustrialisation" des exportations brésiliennes, accélérée par la hausse du prix des produits primaires dans les années 2000. Dans le Graphique 7, on observe une augmentation considérable dans l'avantage comparatif de l'état de Tocantins dans les produits agricoles. On peut l'expliquer par la hausse de sa production en « graines de l'huile» qui inclut la production de soja (Tableau 2).

[7] On pense que l'agrégation de Sá Port et dos Santos (2011) pose des problèmes pour quelques catégories de produits. Mais la gamme des produits catégorisés par le SH2 étant plutôt large, il n'est pas évident de faire un ré catégorisation. On a donc choisi d'utiliser leur catégorisation qui nous permet comparer nos résultats avec ces auteurs.

Graphique 7: Les avantages comparatifs révélés (ACR) des états brésiliens en 2010*



Source: Calculs de l'auteur à partir des données AliceWeb.

* Pour des raisons de lisibilité, seulement les secteurs pour lesquels les états ont un ACR positif sont montrés dans le tableau. La somme des avantages comparatifs révélés étant égale à "0" pour chaque état, un état ayant une valeur positive élevée de ACR dans un secteur a nécessairement une valeur négative de la même hauteur dans les secteurs où il n'a pas l'avantage.

Dans le tableau 2, on montre pour chaque état les trois premières catégories de produits pour lesquelles les avantages comparatifs révélés sont les plus élevés selon la nomenclature SH2. On remarque que les états d'une même région ont en général des ACR similaires. C'est particulièrement vérifié dans les états du Nord qui ont des avantages comparatifs dans la production de « bois », à l'exception d'Amazonas, dont l'avantage se situe davantage dans les produits de « véhicules » (en fait : les deux-roues) et les « miscellaneous edible preperations ». Cette différence de l'état d'Amazonas par rapport aux autres états de la région tient au statut particulier de la Zone franche de Manaus. Les états de Pará et Amapá montrent des avantages comparatifs dans les ressources naturelles. Pour les états du Nord-est le « sucre » apparait comme le produit à avantage comparatif, cependant on relève une augmentation importante des avantages comparatifs dans le secteur « chaussure » en 2010 grâce à délocalisation de cette industrie depuis des états du Sud. Les états du Centre-ouest gardent leurs avantages dans les produits agricoles, surtout dans « les graines d'huile » (soja). « viande » et « tabac » sont deux produits agricoles pour lesquels les états du Sud ont un avantage. Les états du Sud-est sont riches en ressources naturelles alors que São Paulo a un

avantage important dans les produits « véhicules » et « aéronautique ». Néanmoins, cette concentration géographique des états ayant les avantages comparatifs pour les produits similaires ne se vérifie pas toujours quand on prolonge la liste en y incluant tous les produits pour lesquels les états ont des avantages (voir Tableau 10 en Annexe). De plus, une nomenclature plus fine pourrait également remettre en cause cette relative homogénéité.

Tableau 2: Les trois premiers secteurs de SH2 selon les Avantages comparatifs révélés (ACR) des états (2000 et 2010)

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
Nord						
AC	44	Wood and articles of wood; Wood charcoal	61,22	44	Wood and articles of wood; Wood charcoal	70,88
AC	41	Raw Hides and Skins (Other Than Furskins) and Leather	13,72	08	Edible fruit and nuts; Peel of citrus fruits or Melons	12,36
AC	64	Footwear, gaiters and the like; Parts of such articles	7,67	10	Cereals	4,95
AP	44	Wood and articles of wood; Wood charcoal	59,71	26	Ores, slag and ash	81,72
AP	26	Ores, slag and ash	32,62	44	Wood and articles of wood; Wood charcoal	14,03
AP	20	Preparations of vegetables, fruit, nuts or other parts of plants	7,54	20	Preparations of vegetables, fruit, nuts or other parts of plants	2,23
AM	21	Miscellaneous edible preparations	37,19	21	Miscellaneous edible preparations	13,99
AM	87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof	6,88	87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof	9,82
AM	82	Tools, implements, cutlery, spoons and forks, of base metal; Parts thereof of base metal	2,85	82	Tools, implements, cutlery, spoons and forks, of base metal; Parts thereof of base metal	6,68
PA	26	Ores, slag and ash	33,74	26	Ores, slag and ash	63,05
PA	76	Aluminium and articles thereof	22,91	76	Aluminium and articles thereof	6,53
PA	44	Wood and articles of wood; Wood charcoal	12,52	01	Live animals	5,00
RO	44	Wood and articles of wood; Wood charcoal	92,64	02	Meat and edible meat offal	46,61
RO	68	Articles of stone, plaster, cement, asbestos, mica or similar materials	2,09	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	31,73
RO	09	Coffee, tea, maté and spices	1,64	44	Wood and articles of wood; Wood charcoal	10,06
RR	44	Wood and articles of wood; Wood charcoal	84,66	44	Wood and articles of wood; Wood charcoal	43,17
RR	71	Natural or cultured pearls, precious or semi-precious stones, Others	2,73	41	Raw Hides and Skins (Other Than Furskins) and Leather	14,32

RR	64	Footwear, gaiters and the like; Parts of such articles	0,58	22	Beverages, spirits and vinegar	1,26
TO	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	45,31	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	74,85
TO	71	Natural or cultured pearls, precious or semi-precious stones, Others	44,62	02	Meat and edible meat offal	23,95
TO	02	Meat and edible meat offal	9,16	05	Products of animal origin, not elsewhere specified or included	0,83
Nord-est						
AL	17	Sugars and sugar confectionery	77,43	17	Sugars and sugar confectionery	87,84
AL	29	Organic chemicals	17,82	22	Beverages, spirits and vinegar	3,36
AL	24	Tobacco and manufactured tobacco substitutes	1,73	29	Organic chemicals	2,45
BA	29	Organic chemicals	17,87	47	Pulp of wood or of other fibrous cellulosic material, Others	17,39
BA	47	Pulp of wood or of other fibrous cellulosic material, Others	11,97	29	Organic chemicals	12,69
BA	39	Plastics and articles thereof	4,84	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	7,04
CE	08	Edible fruit and nuts; Peel of citrus fruits or Melons	26,99	64	Footwear, gaiters and the like; Parts of such articles	31,18
CE	64	Footwear, gaiters and the like; Parts of such articles	16,17	08	Edible fruit and nuts; Peel of citrus fruits or Melons	22,15
CE	03	Fish and crustaceans, molluscs and other aquatic invertebrates	11,38	41	Raw Hides and Skins (Other Than Furskins) and Leather	12,62
MA	76	Aluminium and articles thereof	60,08	26	Ores, slag and ash	50,37
MA	72	Iron and steel	17,19	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	14,09
MA	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	11,73	28	Inorganic chemicals; Organic or inorganic compounds of precious metals, Others	12,89
PB	64	Footwear, gaiters and the like; Parts of such articles	21,60	64	Footwear, gaiters and the like; Parts of such articles	29,02
PB	63	Other Made-Up Textile Articles; Sets; Rags, Others	18,48	63	Other Made-Up Textile Articles; Sets; Rags, Others	27,96
PB	03	Fish and crustaceans, molluscs and other aquatic invertebrates	18,35	17	Sugars and sugar confectionery	19,77
PE	17	Sugars and sugar confectionery	25,87	17	Sugars and sugar confectionery	44,77
PE	85	Electrical machinery and equipment and parts thereof; Others	7,40	39	Plastics and articles thereof	12,05
PE	08	Edible fruit and nuts; Peel of citrus fruits or Melons	7,29	08	Edible fruit and nuts; Peel of citrus fruits or Melons	11,52
PI	15	Animal or vegetable fats and oils; Others	25,66	15	Animal or vegetable fats and oils; Others	44,60
PI	29	Organic chemicals	18,57	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	35,12
PI	08	Edible fruit and nuts; Peel of citrus fruits or Melons	12,78	04	Dairy produce; Birds' eggs; Natural honey; Others	7,44

RN	08	Edible fruit and nuts; Peel of citrus fruits or Melons	32,69	08	Edible fruit and nuts; Peel of citrus fruits or Melons	44,05
RN	61	Articles of Apparel and Clothing Accessories, Knitted Or Crocheted	23,76	17	Sugars and sugar confectionery	14,45
RN	03	Fish and crustaceans, molluscs and other aquatic invertebrates	15,17	63	Other Made-Up Textile Articles; Sets; Rags, Others	8,79
SE	20	Preparations of vegetables, fruit, nuts or other parts of plants	49,39	20	Preparations of vegetables, fruit, nuts or other parts of plants	51,91
SE	83	Miscellaneous articles of base metal	14,57	64	Footwear, gaiters and the like; Parts of such articles	22,80
SE	63	Other Made-Up Textile Articles; Sets; Rags, Others	7,99	17	Sugars and sugar confectionery	12,42
Centre-ouest						
DF	02	Meat and edible meat offal	71,99	71	Natural or cultured pearls, precious or semi-precious stones, Others	25,06
DF	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	8,68	84	Nuclear reactors, boilers, machinery and mechanical appliances; Others	16,35
DF	10	Cereals	1,08	97	Works of art, collectors' pieces and antiques	5,21
GO	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	32,55	02	Meat and edible meat offal	25,11
GO	23	Residues and waste from the food industries; Others	28,34	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	20,65
GO	72	Iron and steel	10,16	23	Residues and waste from the food industries; Others	13,19
MT	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	53,48	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	38,95
MT	23	Residues and waste from the food industries; Others	25,00	23	Residues and waste from the food industries; Others	18,36
MT	44	Wood and articles of wood; Wood charcoal	6,86	10	Cereals	15,91
MS	23	Residues and waste from the food industries; Others	5,87	02	Meat and edible meat offal	22,82
MS	02	Meat and edible meat offal	22,82	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	17,49
MS	26	Ores, slag and ash	10,04	47	Pulp of wood or of other fibrous cellulosic material, Others	13,56
Sud						
PR	23	Residues and waste from the food industries; Others	14,50	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	12,83
PR	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	12,83	02	Meat and edible meat offal	6,25
PR	44	Wood and articles of wood; Wood charcoal	10,34	17	Sugars and sugar confectionery	3,27
RS	64	Footwear, gaiters and the like; Parts of such articles	22,70	02	Meat and edible meat offal	12,56
RS	24	Tobacco and manufactured tobacco substitutes	12,19	24	Tobacco and manufactured tobacco substitutes	11,32
RS	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	4,53	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	11,32
SC	02	Meat and edible meat offal	18,11	02	Meat and edible meat offal	27,67

SC	44	Wood and articles of wood; Wood charcoal	10,63	24	Tobacco and manufactured tobacco substitutes	11,50
SC	94	Furniture; Bedding, mattresses, cushions and similar stuffed furnishings; Others	8,34	16	Preparations of meat, of fish or of crustaceans, Others	5,49
Sud-Est						
ES	72	Iron and steel	34,86	02	Meat and edible meat offal	25,11
ES	26	Ores, slag and ash	25,06	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	20,65
ES	47	Pulp of wood or of other fibrous cellulosic material, Others	20,38	23	Residues and waste from the food industries; Others	13,19
MG	26	Ores, slag and ash	22,38	26	Ores, slag and ash	41,85
MG	72	Iron and steel	19,59	09	Coffee, tea, maté and spices	13,13
MG	09	Coffee, tea, maté and spices	14,84	72	Iron and steel	10,35
RJ	72	Iron and steel	20,95	27	Mineral fuels, mineral oils, bituminous substances; Mineral waxes	49,94
RJ	40	Rubber and articles thereof	3,21	83	Miscellaneous articles of base metal	0,95
RJ	76	Aluminium and articles thereof	2,40	40	Rubber and articles thereof	0,61
SP	88	Aircraft, spacecraft, and parts thereof	10,21	17	Sugars and sugar confectionery	16,61
SP	87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof	9,26	87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof	6,77
SP	20	Preparations of vegetables, fruit, nuts or other parts of plants	4,91	88	Aircraft, spacecraft, and parts thereof	6,15

Source: Calculs de l'auteur à partir des données de SECEX.

IV. Les facilités de transport et l'intégration commerciale du marché intérieur

Les coûts domestiques de transport agissent directement sur les coûts de commerce dans le marché domestique et indirectement dans la compétitivité des états sur les deux marchés, domestiques ou internationaux. Compte tenu de sa taille et de sa topographie, le transport est un enjeu important pour le Brésil. Selon Castro (2004), des programmes de construction des routes entre 1950 et 1980, ont permis de diminuer des coûts de transport interrégionaux au Brésil, favorisant ainsi l'augmentation de la productivité agricole notamment dans les régions du Nord et Centre-ouest. Néanmoins, l'insuffisance des équipements est une des faiblesses les plus souvent soulevées de l'économie brésilienne.

La matrice de transport brésilien est dominée par le transport routier par lequel 58% du transport des frets se réalise (en TKU, Tonne-Km de Cargo). Selon la Banque Mondiale

(2012), le Brésil est le troisième pays du monde par l'extension de son réseau routier, approximativement de 1.6 million de kilomètres. Mais seulement 12% des routes sont pavées et le réseau se concentre à l'est du pays (voir Carte 1 en Annexe). Le transport se fait par quelques lignes majeures pour 45% du volume total de fret: BR116 et BR101 entre les états de Nord-est et le Sud-est, BR487 et BR163 entre le Centre-ouest et le Sud, BR116, BR101, BR153, BR158 entre le Sud-est et le Sud et BR 354, BR040, BR364 et BR 262 entre le Centre-ouest et le Sud-est (Banque Mondiale, 2012).

Tableau 3: Les routes par les régions brésiliennes, pavées et totales en 2010

		Routes (km)	
Région	**Surface (km^2)**	**Totales**	**Pavées**
Brésil (Total)	8.502.728,3	1.581.104	213.909
Nord	3.853.575,6	113.039	18.122
Nord-est	1.554.387,7	420.311	56.309
Sud-est	924.596,1	525.754	70.197
Sud	563.802,1	334.966	40.316
Centre-ouest	1.606.366,8	187.034	28.966

Source: Boletim Pesquisa CNT de Rodovias 2011

Le tableau 3 montre que les régions du nord et du Centre-ouest, en grande partie occupées par la forêt amazonienne, restent relativement isolées. Pour les états qui sont éloignés des grands marchés centraux, et où les conditions naturelles rendent difficiles la construction et l'entretien des routes, les voies ferrées auraient pu être une solution. Mais, en ce qui concerne les infrastructures ferroviaires, le Brésil reste loin des pays de la taille similaire comme la Chine, la Russie ou encore les États-Unis (Resende, 2006)[8]. En plus, l'infrastructure ferroviaire est encore plus concentrée géographiquement que les autres modes de transport, les voies ferrées se concentrant sur la moitié est du pays (voir Carte 2 en Annexe).

[8] Selon la Banque mondiale (2012), 22-26% des frets totaux sont transportés par la voie ferrière au Brésil même si ça augmente depuis la privatisation en 1996.

Tableau 4: Le transport de fret par voies fluviales intérieures* (en milliers de tonnes, 2010)

Origine	Destination														
	AM	**AP**	**BA**	**CE**	**ES**	**MA**	**PA**	**PE**	**PR**	**RN**	**RS**	**SC**	**SE**	**SP**	**Total**
AM	-	-	532	64	0	207	-	81	29	15	11	14	20	413	1384
AP	-	-	-	-	-	46	-	38	-	-	-	-	-	-	84
BA	692	5	-	-	-	-	63	-	-	-	7	-	-	-	766
CE	325	27	-	-	-	-	12	-	-	-	-	-	-	-	363
ES	84	-	-	-	-	-	-	-	-	-	-	-	-	-	84
MA	883	41	-	-	-	-	144	-	-	-	-	-	-	-	1067
PA	-	-	0	-	22	6348	7408	25	39	9	-	-	-	62	13913
PB	-	-	-	-	-	-	4	-	-	-	-	-	-	-	4
PE	328	-	-	-	-	-	12	-	-	-	16	-	-	-	355
PR	162	-	-	-	-	-	118	-	-	-	-	-	-	-	280
RJ	512	4	-	-	-	-	-	-	-	-	215	-	-	-	731
RN	-	-	-	-	-	-	11	-	-	-	64	-	-	-	74
RS	208	-	-	-	-	-	68	-	-	-	-	-	-	-	-
SC	69	-	-	-	-	-	-	-	-	-	-	-	-	-	69
SP	1164	-	-	-	-	-	609	-	-	-	-	-	-	-	1773
Total	4427	76	532	64	22	6601	8447	143	68	24	312	14	20	475	21225

Source: Estatísticas da Navegação Interior 2010, ANTAQ.

* Le mot utilisé dans les sources brésiliennes est le "cabotagem". Il est ainsi défini par la loi n° 9432, de 8 janvier 1997: "le transport maritime ou par voie intérieure, d'un point ou d'un port brésilien à un autre dans le territoire brésilien"[9].

Les voies fluviales intérieures deviennent alors un moyen important d'accès aux marchés des états isolés. 82% des cargos transitant par la voie fluviale (Banque Mondiale, 2012) passent par le bassin d'Amazonas (voir Carte 3 en Annexe). Le tableau 4 montre que le transport des biens, entre les états brésiliens, pour lesquels la destination finale est un autre point au Brésil, utilise à un moment donné le transport fluvial, même si celui-ci s'enchaîne avec les autres modes de transport. Le tableau montre aussi que les voies fluviales sont une mode de transport vital pour l'accès des états du nord et du nord-est avec le reste du marché intérieur. Les chiffres pour l'état d'Amazonas et l'état de Pará sont ainsi très élevés. Il est important

[9] "a realizada entre portos ou pontos do território brasileiro, utilizando a via marítima ou esta e as vias navegáveis interiores"

surtout depuis São Paulo vers l'Amazonas. Dans le cas de l'état de Pará, les frets transportés par les voies fluviales restent plutôt à l'intérieur de l'état.

Tableau 5: Le transport des frets par voies intérieures fluviales pour la destination internationale (en milliers de tonnes, 2010)

Origine	Destination								
	Afrique	**Amérique centrale**	**Amérique du nord**	**Amérique du sud**	**Asie**	**Europe**	**Océan**	**Non-identifié**	**Total**
PA	305	275	6787	1221	1245	6130	0	464	16427
RS	942	387	672	794	7459	3759	5	0	14019
RO	-	-	-	1	-	-	-	-	1
AM	242	88	5	170	1	-	0	-	2141
SP	-	-	-	-	-	-	-	-	-
Total	1489	750	7630	2186	13060	11956	5	464	37541

Source: Estatísticas da Navegação Interior 2010, ANTAQ

Le tableau 5 souligne l'importance des transports fluviaux pour les destinations internationales. On observe que pour l'état de Rio Grande do Sul, le transport fluvial est particulièrement important pour accéder aux marchés internationaux. Les états de Pará et Amazonas exportent aussi en utilisant les voies fluviales. Par contre, le chiffre pour l'état d'Amazonas est relativement faible, celui-ci utilisant les voies aériennes pour accéder aux marchés internationaux, et même nationaux. (voir Carte 4 en Annexe).

V. Régulation ou « guerre » fiscale ?

La régulation fiscale au Brésil conduit à une concurrence fiscale entre les états brésiliens avec des conséquences sur leur intégration commerciale dans le marché intérieur et extérieur. Depuis la constitution de 1988, les états brésiliens profitent d'une autonomie administrative et fiscale renforcée, qui leur permet de pouvoir instituer, exiger et collecter des taxes (Ministério da Fazenda, 2002). La décentralisation du pouvoir, a élargi les assiettes fiscales des entités infranationales (États, Municipalités) avec un diminution du pouvoir fiscal de l'Union conduisant à affaiblir le pouvoir fédéral comme régulateur des conflits interrégionaux (Além et Giambiagi, 2000 ; Amaro, 2006), même si le plan Real (1993) et la crise de 1999 (Ley de

Responsabilidad Fiscal de 2000) ont conduit à une certaine recentralisation fiscale (Brami-Celentano et Siroën, 2007). Cette concurrence fiscale entre les états, connue sous le nom de « guerre fiscale », crée une source de fragmentation dans le marché intérieur mais aussi des conséquences négatives sur la compétitivité des états, par ses conséquences sur les recettes et donc sur les dépenses et la qualité des infrastructures publiques qui dépendent de l'assiette fiscale de l'état.

Le Brésil comprend trois échelons administratifs, et donc fiscaux ; le niveau fédéral (l'Union), les unités fédératives (26 états et le Distrito Federal) et les municipalités (plus de 5 500). La ressource fiscale la plus importante pour les états est l'ICMS (impôt sur la circulation des marchandises et services) qui est le principal impôt sur la valeur ajoutée avec l'IPI (impôt sur les produits industriels) qui est, quant à lui, collecté par l'Union (voir Figure 1 en Annexe pour les compétences fiscales de l'Union, des états et des municipalités). Les états transfèrent 25% de l'ICMS collecté vers les municipalités qui contribue en moyenne à 83% des recettes fiscales des états avec de fortes inégalités (Brami-Celentano et Siroën, 2007).

L'ICMS est prélevé dans l'état d'origine ce qui crée un jeu non-coopératif « perdant-perdant » selon la litérature (Brami-Celentano et Siroën, 2007 ; de Mello, 2007). Ainsi les états ayant pour objectif d'augmenter leurs recettes fiscales, essaient d'attirer le plus d'investissement possible souvent par des incitations fiscales. Mais l'impact final sur les recettes est ambigu, car ces incitations pousseraient les autres états à accorder les mêmes incitations. de Mello (2007) montre que les politique fiscales incitatives des états brésiliens provoquent des mesures fiscales dans les autres états surtout quand ils se trouvent dans le même région géo-économique. Même si les pratiques sont encadrées par la loi fédérale, les procédures de recours peuvent durer plusieurs années.

Ainsi, les règles relatives à l'ICMS et les taux changent d'un état à l'autre, entre les états et à l'intérieur des états, ainsi qu'un secteur à l'autre, en fonction, notamment de l'élasticité-prix de la demande. Par exemple, l'industrie automobile est taxée au niveau de 12-18% et bénéficie souvent des politiques industrielles des états, tandis que les biens de luxe ou le tabac peuvent être taxés jusqu'à 30-35% (de Mello, 2007).

Le taux d'ICMS appliqué dans l'état devrait être au moins égal à 12% selon le Sénat (ce qui n'est pas toujours respecté), mais le niveau de base est actuellement de 17%, avec quelques exceptions comme São Paulo (18%) et Rio de Janeiro (19%) (voir Graphique 8 pour les recettes totales d'ICMS collectées par les états). Dans le commerce entre états, le taux est de 12%, sauf pour les états de Nord, Nord-est, Centre-ouest et Espirito Santo où le taux est fixé à 7% par la loi fédérale et sans réciprocité. Par principe, L'ICMS est un impôt non-cumulatif. Il permet aux entreprises qui transforment le bien de déduire l'ICMS payé à l'état d'origine de l'ICMS dû dans l'état de destination. Les consommateurs finaux payent le prix incluant l'ICMS payé dans l'état d'origine. Les taux moins élévés des ICMS inter-états qui s'appliquent aux états "pauvres" sont ainsi un canal des transfert des états "exportateurs" vers les états "importateurs" des régions du Nord, Nord-est et Centre-ouest[10]. Par ailleurs, l'importation est assujetti à un ICMS de 18% payé en douane.

Un autre difficulté du système, est qu'il introduit un système de crédits. Les entreprises en liquidant l'ICMS peuvent cumuler les crédits du fait de la déductibilité de l'ICMS. Ces crédits peuvent être ainsi déduits de l'ICMS dus sur les ventes (dans l'Etat ou vers d'autres États). Mais les exportations vers le Monde étant exonérées de l'ICMS, les entreprises exportatrices cumulent des credits d'ICMS dont la contrepartie n'est pas évidente et doit souvent être négocié. En plus, ces exonérations fiscales considèrent toute la ligne de production jusqu'à l'exportation, et peuvent bénéficier des régimes spéciaux de *drawback* (voir Tableau 11 en Annexe pour les incitations fiscales sur le commerce).

Le régime d'ICMS laisse ainsi la porte ouverte à des pratiques différéntes et souvent peu transparentes : taux, exonérations, liquidation des crédits, régimes spéciaux, etc. Cette complexité impose des coûts supplémentaires aux entreprises pour accéder aux informations sur le marché intérieur ainsi que sur le marché extérieur ce qui peut créer des rigidités et des distorsions dans leurs orientations commerciales. Daumal et Zignago (2010) expliquent que les pratiques fiscales différentes des états favorisent la fragmentation du marché intérieur au

[10] Voir de Mello (2007), Afonso et de Mello (2002) pour un résumé des relations fiscales intergouvernementales au Brésil.

niveau des états. Brami-Celentano et Siroën (2007) discutent aussi du fait que l'origine et la destination de commerce ne sont pas neutres sur les recettes d'ICMS des états. Ceux-ci peuvent alors cibler des politiques industrielles et commerciales qui entretiennent le "chacun pour soi" par exemple, en attirant les entreprises qui ont tendance à importer du marché extérieur (18% d'ICMS conservé par l'état importateur) plutôt que du marché intérieur (ICMS conservé par l'état exportateur mais déductible dans l'état importateur) ou en attirant les industries qui exportent davantage vers les états "riches" avec un taux d'ICMS inter-états de 12% au lieu de 7% vers les états "pauvres".

Une autre exception fiscale est la Zone franche de Manaus (ZFM). ZFM est présentée en 1967 comme un projet de développement qui se trouve aujourd'hui sous l'autorité de la SUFRAMA (Superintendance de la zone franche de Manaus) qui a un statut fédéral. Elle est exceptionelle par sa localisation, dans la région du Nord et au cœur de la forêt amozonienne ce qui limite son accès aux marchés exterieurs et intérieurs. Au-delà de préccupations géopolitiques d'occupation de l'espace amazonien, la zone a été créée pour favoriser l'intégration économique et commerciale de la région avec le reste du territoire et comme un appui à la stratégie de substitution aux importations. Elle s'est poursuivie pendant la période de libéralisation brésilienne à partir des années 1990, par une volonté d'intégration au marché mondial. Le tableau 6 montre toutefois que son orientation reste encore focalisée sur le marché intérieur, ce qui contraste avec les zones franches des autres pays émergents orientés vers l'exportation (Chine, Mexique etc.).

Tableau 6: Commerce de la Zone franche de Manaus vers le marché intérieur et extérieur (en milliers de US dollars)

	Marché extérieur			Marché intérieur			
Années	Exportations	Importations	Solde	Exportations	Importations	Solde	Solde final
2007	1 044 794	6 299 076	-5 254 282	24 623 539	6 598 410	18 025 129	12 770 847
2008	1 192 004	8 555 323	-7 363 319	28 907 158	7 918 106	20 989 052	13 625 733
2009	857 448	6 344 656	-5 487 208	25 099 646	5 481 101	19 618 545	14 131 337
2010	1 037 497	10 181 266	-9 143 769	34 180 766	7 222 665	26 958 101	17 814 332
2011	838 679	11 250 193	-10 411 514	40 402 284	9 060 602	31 341 682	20 930 168
2012(*)	542 181	7 366 140	-6 823 959	23 858 109	5 047 904	18 810 205	11 986 246

Source : SUFRAMA (COISE/CGPRO/SAP)

* Jusqu'en août.

Les entreprises de la zone profitent ainsi d'une série d'exonérations fiscales et douanières uniques à la zone. Les deux instruments de base utilisés pour les incitations fiscales sont basées sur l'ICMS et l'IPI. La référence juridique qui définit les incitations est le Décret-Loi No 288 du 28 Fevrier 1967 qui a été modifié à plusieurs reprises, notamment pour perpétuer le statut de la zone. Cette loi donne des incitations sur la production c'est-à-dire des exonérations d'ICMS à l'entrée des machines et d'équipement. D'autre part, elle introduit des incitations fiscales à l'importation, avec des limitations dans ces incitations si le produit est ré-exporté vers le marché intérieur et modulé selon le niveau de transformation dont le produit importé a fait l'objet dans la zone.

Les entreprises sont éxonérées de l'IPI quand elles exportent vers le marché extérieur, comme dans les autres États, mais également vers l'intérieur, ce qui est spécifique à la ZFM (voir Tableau 11 en Annexe pour comparer les incitations fiscales de Manaus et du reste du Brésil). En effet, les incitations données aux entreprises de la ZFM pour l'exportation sont plus ou moins accessibles aux entreprises des autres états par un régime de *drawback*, tandis que les avantages fiscaux de la Zone pour les exportations vers les autres états restent spécifiques à la ZFM. De ce fait, si les coûts de transport élevés sont plus que compensés par les avantages fiscaux et douaniers, ils ne permettent pas d'être compétitifs sur les marchés étrangers ce qui explique la part très faible de la zone dans les exportations brésiliennes, comme nous le verrons dans la suite de la thèse.

VI. Plan de la thèse

L'importante hétérogénéité entre les états, dont certains éléments viennent d'être décrits, s'expliquent notamment par des différences persistantes et structurelles dans leurs dotations factorielles, leurs ressources naturelles, leurs infrastructures ou encore leur localisation sur le territoire. Les états sont donc confrontés à situations plus ou moins favorables selon les marchés, qu'ils soient domestiques, internationaux et/ou régionaux. D'une part, les états se trouvent en concurrence sur le marché domestique avec des acteurs internationaux sur un marché qui s'est ouvert avec les politiques de libéralisation commerciale engagées dans les années 1990 ; d'autre part, ils se trouvent également en compétition avec les autres états pour

accéder aux marchés internationaux et pour capter l'investissement, national ou étranger, qui détermine dans le long terme la structure de l'appareil de production et de l'échange. Les dynamiques du commerce domestique et du commerce international s'imbriquent alors pour créer des interdépendances entre les états, amplifiées par des « spécialisations verticales » qui créent des complémentarités sur la chaine de production entre des états par ailleurs concurrents pour attirer les investissements[11]. Ainsi, l'exportation de São Paulo peut inclure des composants originaires de la Zone franche de Manaus (Amazonas) qui elle-même peut importer un composant du Japon qu'il "réexportera", après transformation, pour être consommé à Rio de Janeiro. L'analyse du commerce doit alors sortir d'un cadre strictement national pour mieux comprendre comment ces forces contradictoires de complémentarité et de concurrence structurent les relations d'échange entre les états, et des états brésiliens –et donc du Brésil- avec le monde.

Dans cette perspective, les trois chapitres de la thèse analysent le commerce des états brésilien entre eux et avec le reste du monde en recherchant les déterminants à partir de modèles gravitaires. Dans tous les cas, nous considérons les états comme des entités à part entière, c'est-à-dire comme des nations au sens de la théorie du commerce international. Le terme d'exportation s'applique aussi bien aux exportations de l'état de São Paulo vers l'état d'Amazonas que vers l'Argentine ou l'Allemagne. Cette approche a été rendue possible par la disponibilité de données du commerce des états avec le Monde (base de donnée AliceWeb) et entre les états pour les années 1990 d'une part (chapitres 1 et 2), et pour 2008 d'autre part. Chaque chapitre constitue un travail à part entière. Néanmoins, même si les chapitres peuvent être lus séparément ils constituent une suite logique fondée sur la volonté d'affiner progressivement l'analyse.

Dans un premier chapitre, intitulé "*Brazilian states' domestic-foreign export capacities and the market orientations in the 1990s*", on analyse les capacités d'exportation des états brésiliens vers le marché domestique et vers le marché extérieur. Dans cette perspective on

[11] Par exemple la récente installation de Foxconn à São Paulo alors qu'elle était déjà installée à Manaus (Amazonas) ou le départ de Samsung de Manaus pour Campinas (SP) et … son récent retour.

utilise la méthodologie d'analyse introduite par Redding et Venables (2004a, 2004b) qui décomposent les déterminants des performances d'exportation en deux ; le côté d'offre et celui de demande. Cette méthodologie nous permet ainsi de comparer les niveaux d'intégration des états en fonction de leurs propres caractéristiques qu'elles soient observables (PIB, distance par rapport aux marchés) ou non-observables grâce à l'introduction d'effets fixes.

Ce chapitre nous permet de mettre en évidence l'orientation géographique des exportations de chaque état, certains plus orientés vers le marché intérieur, d'autres vers les marchés étrangers. Les données inter-états étant disponibles uniquement pour les années 1991, 1997, 1998 et 1999 ; on limite notre analyse aux années 1990s. Cependant, ces années coïncidant avec la période de rapide libéralisation brésilienne, donc on sépare les données disponibles en deux sous-périodes (1991 et 1997-99). On analyse aussi l'évolution des orientations des états. Enfin, le chapitre met en évidence les différences d'orientation du commerce des états.

Le deuxième chapitre intitulé, «*The impact of MERCOSUR on the trade of Brazilian states*» souligne des liens éventuels entre le commerce inter-états, le commerce régional des états brésiliens avec les partenaires du MERCOSUR et le commerce avec le reste du monde. En effet, le MERCOSUR a créé un choc sur les coûts relatifs du commerce sur le marché intérieur, avec les pays partenaires du MERCOSUR et avec le reste du monde. Grâce à l'abolition des droits de douane, les coûts de commerce sont devenus moins chers avec les pays du MERCOSUR relativement au commerce entre les états brésiliens et avec le reste du monde. Depuis Viner (1950), la littérature et les études empiriques isolent bien l'impact négatif des accords commerciaux sur le commerce multilatéral, c'est-à-dire le « détournement de commerce ». Néanmoins, leur impact sur le commerce intérieur du pays reste négligé. Dès lors que nous considérons les états brésiliens comme des nations, nous pouvons assimiler cet impact sur le commerce à un effet d' "érosion des préférences", aujourd'hui intégré, notamment dans les négociations commerciales menées à l'OMC. En effet, l'ouverture multilatérale (ou régionale) d'un pays ou d'une région, même si elle est bénéfique au niveau mondial, est défavorable aux pays ou régions (ici, les états brésiliens) qui bénéficiaient auparavant de préférences (ici, l'absence de droits de douane entre les états).

Ces deux premiers chapitres utilisent les données d'exportation des états vers les autres états et vers le monde comme convenu dans la littérature traditionnelle d'économie internationale, c'est-à-dire en valeurs brutes. Néanmoins, vu l'évolution de commerce en composants, les statistiques de commerce en termes bruts donnent très peu d'indication sur la "vraie" origine et destination du produit échangé. Une exportation de 100 dollars ne donne aucune information sur l'origine de la valeur ajoutée lorsque des biens intermédiaires, composants, services sont importés tout au long du processus de production. Ce bien exporté peut lui-même être transformé pour être réexporté ailleurs ou… dans le pays d'origine (par exemple, les composants électroniques exportés par les États-Unis vers la Chine et intégrés dans des ordinateurs ou téléphones portables exportés vers l'Europe et… les États-Unis). Ainsi, les analyses, statistiques ou économétriques peinent à définir correctement les déterminants du commerce et à mesurer leur impact non seulement sur les structures de production et la spécialisation, mais également sur la croissance, l'emploi ou la balance des paiements.

Dans cette perspective, nous mettons en œuvre une méthodologie dans le troisième chapitre intitulé "*Vertical Specialization in the Domestic Market and the Foreign Trade Structure of Brazilian States – A New Approach to Gravity Models*" qui permet d'estimer les données du commerce en valeur ajoutée pour chaque état brésilien. Le commerce en valeur ajoutée, n'est pas une donnée immédiate de la comptabilité nationale. Dans cette perspective, les organisations internationales, comme l'OMC, l'OCDE ou la Banque mondiale, ont lancé des initiatives dont l'objectif est de construire des tableaux Input-Output inspirés des anciens travaux de Leontief (1986), mais étendus à l'identification de l'origine et de la destination de la production nationale. L'objectif du chapitre est alors de décomposer l'origine (intra-état, inter-états, internationale) de la valeur ajoutée de leur production et exportations. On identifie ainsi l'origine de la valeur ajoutée des biens directement exportés par un état: São Paulo exporte des biens qui incorporent des importations d'autres états brésiliens et du monde. Mais la méthode permet également de mesurer les exportations directes et indirectes: São Paulo exporte directement une partie de sa production mais aussi indirectement, via Rio de Janeiro par exemple, qui a transformé les biens qu'il a exporté. Cette méthode a été menée à partir de la manipulation d'un tableau Input-Output inter-états pour l'année 2008 en collaboration avec le laboratoire NEREUS à l'Université de São Paulo (USP). Dans ce chapitre, nous

développons également un modèle de gravité adapté au "nouveau paradigme" d'une spécialisation verticale de plus en plus prégnante.

ANNEXE

Tableau 7: Exportations et importations en biens du Brésil avec le MERCOSUR et avec le monde (en millions de US dollars courants)

	MERCOSUR Total					Monde Total				
	Exp	**Croissance (en %)**	**Imp**	**Croissance (en %)**	**Solde**	**Exp**	**Croissance (en %)**	**Imp**	**Croissance (en %)**	**Solde**
1990	1 320	-	2 312	-	-992	31414	-	20661	-	10 753
1991	2 309	74,92	101	-95,65	2 209	31620	0,66	21040	1,83	10 580
1992	4 097	77,43	131	29,98	3 967	35793	13,20	20554	-2,31	15 239
1993	5 387	31,47	3 378	2485,12	2 009	38555	7,72	25256	22,88	13 299
1994	5 921	9,92	208	-93,84	5 713	43545	12,94	33079	30,97	10 466
1995	6 154	3,92	460	121,14	5 693	46506	6,80	49972	51,07	-3 466
1996	7 305	18,71	8 302	1703,48	-996	47747	2,67	53346	6,75	-5 599
1997	9 047	23,84	9 426	13,55	-380	52983	10,97	59747	12,00	-6 764
1998	8 878	-1,86	9 416	-0,11	-538	51140	-3,48	57763	-3,32	-6 623
1999	6 778	-23,65	6 719	-28,64	59	48013	-6,11	49302	-14,65	-1 289
2000	7 740	14,18	7 796	16,03	-57	55119	14,80	55851	13,28	-732
2001	6 374	-17,64	7 010	-10,09	-635	58287	5,75	55602	-0,45	2 685
2002	3 319	-47,94	5 612	-19,94	-2 293	60439	3,69	47243	-15,03	13 196
2003	5 684	71,28	5 685	1,31	-1	73203	21,12	48326	2,29	24 877
2004	8 935	57,19	6 390	12,41	2 544	96677	32,07	62836	30,03	33 841
2005	11 746	31,46	7 054	10,38	4 692	118529	22,60	73600	17,13	44 929
2006	13 986	19,07	8 967	27,13	5 018	137807	16,26	91351	24,12	46 456
2007	17 354	24,08	11 625	29,63	5 729	160649	16,58	120617	32,04	40 032
2008	21 737	25,26	14 934	28,47	6 803	197942	23,21	172985	43,42	24 957
2009	15 829	-27,18	13 107	-12,23	2 722	152995	-22,71	127722	-26,17	25 273
2010	22 602	42,79	16 620	26,80	5 981	201915	31,97	181768	42,32	20 147

Source: AliceWeb

Tableau 8: Les PIB des états en millions de US dollars courant (1990, 2000 et 2009)

Etats	1990	2000	2009
Acre	639,856	996,756	3 697,686
Alagoas	3 264,091	4 111,393	10 630,320
Amazonas	8 401,821	11 048,653	24 837,136
Amapá	743,656	1 152,330	3 706,673
Bahia	20 759,313	28 215,816	68 620,250
Ceará	7 480,801	12 176,569	32 891,624
Distrito Federal	7 442,030	17 321,041	65 823,169
Espírito Santo	7 660,565	12 604,339	33 421,890
Goiás	8 096,417	12 683,435	42 859,460
Maranhão	3 686,105	5 389,914	19 951,446
Minas Gerais	42 935,965	62 153,795	143 701,010
Mato Grosso do Sul	4 433,533	6 943,821	18 206,046
Mato Grosso	3 856,449	7 861,252	28 681,753
Pará	9 506,195	11 072,538	29 236,241
Paraíba	3 904,846	5 407,999	14 376,671
Pernambuco	12 283,741	17 051,546	39 261,595
Piauí	2 069,128	3 120,042	9 527,845
Paraná	29 311,599	38 619,715	95 110,898
Rio de Janeiro	50 157,762	80 716,328	177 153,125
Rio Grande do Norte	3 317,964	5 440,539	13 969,374
Rondônia	2 262,744	3 292,993	10 130,338
Roraima	518,021	653,674	2 800,129
Rio Grande do Sul	37 574,536	49 841,621	108 062,513
Santa Catarina	17 248,325	24 838,402	64 981,647
Sergipe	2 655,936	3 466,139	9 895,512
São Paulo	171 009,898	217 086,600	542 832,659
Tocantins	730,487	1 434,582	7 294,497

Source: Calculs de l'auteur à partir des données de l'IPEA Data et WDI Databank.

Tableau 9: Les secteurs dans la nomenclature de SH2

Catégorie de chapitre	La Code SH2	Secteur
Agriculture	01	Live animals
Agriculture	02	Meat and edible meat offal
Agriculture	03	Fish and crustaceans, molluscs and other aquatic invertebrates
Agriculture	04	Dairy produce; Birds' eggs; Natural honey; Others
Agriculture	05	Products of animal origin, not elsewhere specified or included
Agriculture	06	Live trees and other plants; Others
Agriculture	07	Edible vegetables and certain roots and tubers
Agriculture	08	Edible fruit and nuts; Peel of citrus fruits or Melons
Agriculture	09	Coffee, tea, maté and spices
Agriculture	10	Cereals
Agriculture	11	Products of the milling industry; Malt; Starches; Inulin; Wheat gluten
Agriculture	12	Oil seeds and oleaginous fruits; Grains, seeds; Others
Agriculture	13	Lac, gums, resins and other vegetable saps and extracts
Agriculture	14	Vegetable plaiting materials; Vegetable products not elsewhere specified or included
Agriculture	15	Animal or vegetable fats and oils; Others
Agriculture	16	Preparations of meat, of fish or of crustaceans, Others
Agriculture	17	Sugars and sugar confectionery
Agriculture	18	Cocoa and cocoa preparations
Agriculture	19	Preparations of cereals, flour, starch or milk; Pastrycooks' Products
Agriculture	20	Preparations of vegetables, fruit, nuts or other parts of plants
Agriculture	21	Miscellaneous edible preparations
Agriculture	22	Beverages, spirits and vinegar
Agriculture	23	Residues and waste from the food industries; Others
Agriculture	24	Tobacco and manufactured tobacco substitutes
M. premières	25	Salt; Sulphur; Earths and stone; Plastering materials, Lime and cement
M. premières	26	Ores, slag and ash
M. premières	27	Mineral fuels, mineral oils, bituminous substances; Mineral waxes
Manufacture	28	Inorganic chemicals; Organic or inorganic compounds of precious metals, Others
Manufacture	29	Organic chemicals
Manufacture	30	Pharmaceutical products
Manufacture	31	Fertilisers
Manufacture	32	Tanning or dyeing extracts; Tannins and their derivatives; Others
Manufacture	33	Essential oils and resinoids; Perfumery, cosmetic or toilet preparations
Manufacture	34	Soap, organic surface-active agents, Others
Manufacture	35	Albuminoidal substances; Modified starches; Glues; Enzymes
Manufacture	36	Explosives; Pyrotechnic products; Matches; Others
Manufacture	37	Photographic or cinematographic goods
Manufacture	38	Miscellaneous chemical products

Manufacture	39	Plastics and articles thereof
Manufacture	40	Rubber and articles thereof
Manufacture	41	Raw Hides and Skins (Other Than Furskins) and Leather
Manufacture	42	Articles of Leather; Articles of Animal Gut (Other Than Silkworm Gut), Others
Manufacture	43	Furskins and artificial fur; Manufactures thereof
Manufacture	44	Wood and articles of wood; Wood charcoal
Manufacture	45	Cork and articles of cork
Manufacture	46	Manufactures of straw, of esparto or of other plaiting materials
Manufacture	47	Pulp of wood or of other fibrous cellulosic material, Others
Manufacture	48	Paper and paperboard; Articles of paper pulp, of paper or of paperboard
Manufacture	49	Books, Newspapers, Pictures and Other Products of The Printing Industry; Others
Manufacture	50	Silk
Manufacture	51	Wool, fine or coarse animal hair; Horsehair yarn and woven fabric
Manufacture	52	Cotton
Manufacture	53	Other vegetable textile fibres; Paper yarn and woven fabrics of paper yarn
Manufacture	54	Man-made filaments
Manufacture	55	Man-Made staple fibres
Manufacture	56	Wadding, felt and nonwovens; Others
Manufacture	57	Carpets and other textile floor coverings
Manufacture	58	Special woven fabrics; Tufted textile fabrics; Lace; Tapestries; Others
Manufacture	59	Impregnated, Coated, Covered Or Laminated Textile Fabrics; Others
Manufacture	60	Knitted or crocheted fabrics
Manufacture	61	Articles of Apparel and Clothing Accessories, Knitted Or Crocheted
Manufacture	62	Articles of Apparel and Clothing Accessories, Not Knitted Or Crocheted
Manufacture	63	Other Made-Up Textile Articles; Sets; Rags, Others
Manufacture	64	Footwear, gaiters and the like; Parts of such articles
Manufacture	65	Headgear and parts thereof
Manufacture	66	Umbrellas, Sun Umbrellas, Walking-Sticks, Seat-Sticks, Whips, Riding-Crops, Others
Manufacture	67	Prepared feathers and articles made of feathers or of down; Others
Manufacture	68	Articles of stone, plaster, cement, asbestos, mica or similar materials
Manufacture	69	Ceramic products
Manufacture	70	Glass and glassware
Manufacture	71	Natural or cultured pearls, precious or semi-precious stones, Others
Manufacture	72	Iron and steel
Manufacture	73	Articles of iron or steel
Manufacture	74	Copper and articles thereof
Manufacture	75	Nickel and articles thereof
Manufacture	76	Aluminium and articles thereof
Manufacture	78	Lead and articles thereof
Manufacture	79	Zinc and articles thereof

Manufacture	80	Tin and articles thereof
Manufacture	81	Other base metals; Cermets; Articles thereof
Manufacture	82	Tools, implements, cutlery, spoons and forks, of base metal; Parts thereof of base metal
Manufacture	83	Miscellaneous articles of base metal
Manufacture	84	Nuclear reactors, boilers, machinery and mechanical appliances; Others
Manufacture	85	Electrical machinery and equipment and parts thereof; Others
Manufacture	86	Railway or tramway locomotives, rolling-stock and parts thereof; Others
Manufacture	87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof
Manufacture	88	Aircraft, spacecraft, and parts thereof
Manufacture	89	Ships, boats and floating structures
Manufacture	90	Optical, photographic, cinematographic instruments; Others
Manufacture	91	Clocks and watches and parts thereof
Manufacture	92	Musical instruments; Parts and accessories of such articles
Manufacture	93	Arms and ammunition; parts and accessories thereof
Manufacture	94	Furniture; Bedding, mattresses, cushions and similar stuffed furnishings; Others
Manufacture	95	Toys, games and sports requisites; Parts and accessories thereof
Manufacture	96	Miscellaneous manufactured articles
Manufacture	97	Works of art, collectors' pieces and antiques
Manufacture	98	Agric, construction, trans, electric/ gas/ sanitary, eng & mgmt & envir.quality
Manufacture	99	Business services, health, financial/insur. Legal/real estate, hotels, and misc repairs business services

Source: http://www.foreign-trade.com/reference/hscode.htm

Tableau 10: Les dix premiers secteurs de SH2 selon les Avantages comparatifs révélés (ACR) des états (2000 et 2010)

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
AC	44	Wood and articles of wood; Wood charcoal	61,22	44	Wood and articles of wood; Wood charcoal	70,88
AC	41	Raw Hides and Skins (Other Than Furskins) and Leather	13,72	08	Edible fruit and nuts; Peel of citrus fruits or Melons	12,36
AC	64	Footwear, gaiters and the like; Parts of such articles	7,67	10	Cereals	4,95
AC	94	Furniture; Bedding, mattresses, cushions and similar stuffed furnishings; Others	5,72	41	Raw Hides and Skins (Other Than Furskins) and Leather	2,32
AC	25	Salt; Sulphur; Earths and stone; Plastering materials, Lime and cement	3,55	39	Plastics and articles thereof	1,58
AC	08	Edible fruit and nuts; Peel of citrus fruits or Melons	2,69	15	Animal or vegetable fats and oils; Others	1,05
AC	40	Rubber and articles thereof	1,63	68	Articles of stone, plaster, cement, asbestos, mica or similar materials	0,50
AC	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	0,33	38	Miscellaneous chemical products	0,43
AC	71	Natural or cultured pearls, precious or semi-precious stones, Others	0,18	94	Furniture; Bedding, mattresses, cushions and similar stuffed furnishings; Others	0,30
AC	43	Furskins and artificial fur; Manufactures thereof	0,15	17	Sugars and sugar confectionery	0,23

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
AP	44	Wood and articles of wood; Wood charcoal	59,71	26	Ores, slag and ash	81,72
AP	26	Ores, slag and ash	32,62	44	Wood and articles of wood; Wood charcoal	14,03
AP	20	Preparations of vegetables, fruit, nuts or other parts of plants	7,54	20	Preparations of vegetables, fruit, nuts or other parts of plants	2,23
AP	04	Dairy produce; Birds' eggs; Natural honey; Others	0,00	47	Pulp of wood or of other fibrous cellulosic material, Others	1,39
AP	17	Sugars and sugar confectionery	0,00	71	Natural or cultured pearls, precious or semi-precious stones, Others	0,19
AP	22	Beverages, spirits and vinegar	0,00	02	Meat and edible meat offal	0,05
AP	29	Organic chemicals	0,00	13	Lac, gums, resins and other vegetable saps and extracts	0,01
AP	24	Tobacco and manufactured tobacco substitutes	0,00	08	Edible fruit and nuts; Peel of citrus fruits or Melons	0,00
AP	09	Coffee, tea, maté and spices	0,00	04	Dairy produce; Birds' eggs; Natural honey; Others	0,00
AP	06	Live trees and other plants; Others	0,00	17	Sugars and sugar confectionery	0,00

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
AM	21	Miscellaneous edible preparations	37,19	21	Miscellaneous edible preparations	13,99
AM	87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof	6,88	87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof	9,82
AM	82	Tools, implements, cutlery, spoons and forks, of base metal; Parts thereof of base metal	2,85	82	Tools, implements, cutlery, spoons and forks, of base metal; Parts thereof of base metal	6,68

AM	44	Wood and articles of wood; Wood charcoal	2,46	96	Miscellaneous manufactured articles	1,98
AM	08	Edible fruit and nuts; Peel of citrus fruits or Melons	0,80	81	Other base metals; Cermets; Articles thereof	1,49
AM	96	Miscellaneous manufactured articles	0,45	28	Inorganic chemicals; Organic or inorganic compounds of precious metals, Others	1,26
AM	03	Fish and crustaceans, molluscs and other aquatic invertebrates	0,31	37	Photographic or cinematographic goods	1,17
AM	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	0,07	44	Wood and articles of wood; Wood charcoal	0,94
AM	37	Photographic or cinematographic goods	0,06	34	Soap, organic surface-active agents, Others	0,42
AM	30	Pharmaceutical products	0,04	80	Tin and articles thereof	0,39

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
PA	26	Ores, slag and ash	33,74	26	Ores, slag and ash	63,05
PA	76	Aluminium and articles thereof	22,91	76	Aluminium and articles thereof	6,53
PA	44	Wood and articles of wood; Wood charcoal	12,52	01	Live animals	5,00
PA	47	Pulp of wood or of other fibrous cellulosic material, Others	5,67	44	Wood and articles of wood; Wood charcoal	3,01
PA	25	Salt; Sulphur; Earths and stone; Plastering materials, Lime and cement	5,56	72	Iron and steel	1,87
PA	71	Natural or cultured pearls, precious or semi-precious stones, Others	4,02	47	Pulp of wood or of other fibrous cellulosic material, Others	1,57
PA	09	Coffee, tea, maté and spices	2,46	02	Meat and edible meat offal	0,95
PA	72	Iron and steel	1,09	09	Coffee, tea, maté and spices	0,63
PA	03	Fish and crustaceans, molluscs and other aquatic invertebrates	1,03	71	Natural or cultured pearls, precious or semi-precious stones, Others	0,37
PA	08	Edible fruit and nuts; Peel of citrus fruits or Melons	0,87	03	Fish and crustaceans, molluscs and other aquatic invertebrates	0,29

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
RO	44	Wood and articles of wood; Wood charcoal	92,64	02	Meat and edible meat offal	46,61
RO	68	Articles of stone, plaster, cement, asbestos, mica or similar materials	2,09	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	31,73
RO	09	Coffee, tea, maté and spices	1,64	44	Wood and articles of wood; Wood charcoal	10,06
RO	05	Products of animal origin, not elsewhere specified or included	1,03	41	Raw Hides and Skins (Other Than Furskins) and Leather	3,21
RO	02	Meat and edible meat offal	0,85	05	Products of animal origin, not elsewhere specified or included	2,66
RO	25	Salt; Sulphur; Earths and stone; Plastering materials, Lime and cement	0,70	10	Cereals	1,48
RO	10	Cereals	0,34	80	Tin and articles thereof	1,45
RO	34	Soap, organic surface-active agents, Others	0,08	26	Ores, slag and ash	1,20
RO	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	0,05	25	Salt; Sulphur; Earths and stone; Plastering materials, Lime and cement	0,12
RO	94	Furniture; Bedding, mattresses, cushions and similar stuffed furnishings; Others	0,03	06	Live trees and other plants; Others	0,06

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
RR	44	Wood and articles of wood; Wood charcoal	84,66	44	Wood and articles of wood; Wood	43,17

					charcoal	
RR	71	Natural or cultured pearls, precious or semi-precious stones, Others	2,73	41	Raw Hides and Skins (Other Than Furskins) and Leather	14,32
RR	64	Footwear, gaiters and the like; Parts of such articles	0,58	22	Beverages, spirits and vinegar	1,26
RR	87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof	0,04	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	0,68
RR	57	Carpets and other textile floor coverings	0,01	05	Products of animal origin, not elsewhere specified or included	0,44
RR	65	Headgear and parts thereof	0,01	19	Preparations of cereals, flour, starch or milk; Pastrycooks' Products	0,41
RR	56	Wadding, felt and nonwovens; Others	0,00	02	Meat and edible meat offal	0,39
RR	39	Plastics and articles thereof	0,00	48	Paper and paperboard; Articles of paper pulp, of paper or of paperboard	0,08
RR	48	Paper and paperboard; Articles of paper pulp, of paper or of paperboard	0,00	21	Miscellaneous edible preparations	0,06
RR	96	Miscellaneous manufactured articles	0,00	01	Live animals	0,04

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
TO	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	45,31	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	74,85
TO	71	Natural or cultured pearls, precious or semi-precious stones, Others	44,62	02	Meat and edible meat offal	23,95
TO	02	Meat and edible meat offal	9,16	05	Products of animal origin, not elsewhere specified or included	0,83
TO	41	Raw Hides and Skins (Other Than Furskins) and Leather	0,92	41	Raw Hides and Skins (Other Than Furskins) and Leather	0,06
TO	20	Preparations of vegetables, fruit, nuts or other parts of plants	0,00	20	Preparations of vegetables, fruit, nuts or other parts of plants	0,02
TO	64	Footwear, gaiters and the like; Parts of such articles	0,00	08	Edible fruit and nuts; Peel of citrus fruits or Melons	0,00
TO	17	Sugars and sugar confectionery	0,00	64	Footwear, gaiters and the like; Parts of such articles	0,00
TO	33	Essential oils and resinoids; Perfumery, cosmetic or toilet preparations	0,00	33	Essential oils and resinoids; Perfumery, cosmetic or toilet preparations	0,00
TO	63	Other Made-Up Textile Articles; Sets; Rags, Others	0,00	09	Coffee, tea, maté and spices	0,00
TO	68	Articles of stone, plaster, cement, asbestos, mica or similar materials	0,00	01	Live animals	0,00

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
AL	17	Sugars and sugar confectionery	77,43	17	Sugars and sugar confectionery	87,84
AL	29	Organic chemicals	17,82	22	Beverages, spirits and vinegar	3,36
AL	24	Tobacco and manufactured tobacco substitutes	1,73	29	Organic chemicals	2,45
AL	28	Inorganic chemicals; Organic or inorganic compounds of precious metals, Others	1,12	24	Tobacco and manufactured tobacco substitutes	0,47
AL	08	Edible fruit and nuts; Peel of citrus fruits or Melons	0,00	28	Inorganic chemicals; Organic or inorganic compounds of precious metals, Others	0,09
AL	69	Ceramic products	0,00	44	Wood and articles of wood; Wood charcoal	0,07
AL	44	Wood and articles of wood; Wood charcoal	0,00	09	Coffee, tea, maté and spices	0,01

AL	06	Live trees and other plants; Others	0,00	92	Musical instruments; Parts and accessories of such articles	0,00
AL	58	Special woven fabrics; Tufted textile fabrics; Lace; Tapestries; Others	0,00	97	Works of art, collectors' pieces and antiques	0,00
AL	71	Natural or cultured pearls, precious or semi-precious stones, Others	0,00	06	Live trees and other plants; Others	0,00

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
BA	29	Organic chemicals	17,87	47	Pulp of wood or of other fibrous cellulosic material, Others	17,39
BA	47	Pulp of wood or of other fibrous cellulosic material, Others	11,97	29	Organic chemicals	12,69
BA	39	Plastics and articles thereof	4,84	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	7,04
BA	74	Copper and articles thereof	4,58	74	Copper and articles thereof	5,39
BA	23	Residues and waste from the food industries; Others	4,01	71	Natural or cultured pearls, precious or semi-precious stones, Others	3,43
BA	72	Iron and steel	3,76	52	Cotton	3,27
BA	48	Paper and paperboard; Articles of paper pulp, of paper or of paperboard	2,42	23	Residues and waste from the food industries; Others	3,26
BA	71	Natural or cultured pearls, precious or semi-precious stones, Others	2,41	09	Coffee, tea, maté and spices	1,50
BA	18	Cocoa and cocoa preparations	2,38	08	Edible fruit and nuts; Peel of citrus fruits or Melons	1,40
BA	56	Wadding, felt and nonwovens; Others	1,57	48	Paper and paperboard; Articles of paper pulp, of paper or of paperboard	1,22

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
CE	08	Edible fruit and nuts; Peel of citrus fruits or Melons	26,99	64	Footwear, gaiters and the like; Parts of such articles	31,18
CE	64	Footwear, gaiters and the like; Parts of such articles	16,17	08	Edible fruit and nuts; Peel of citrus fruits or Melons	22,15
CE	03	Fish and crustaceans, molluscs and other aquatic invertebrates	11,38	41	Raw Hides and Skins (Other Than Furskins) and Leather	12,62
CE	41	Raw Hides and Skins (Other Than Furskins) and Leather	9,43	03	Fish and crustaceans, molluscs and other aquatic invertebrates	4,95
CE	15	Animal or vegetable fats and oils; Others	3,98	52	Cotton	2,94
CE	13	Lac, gums, resins and other vegetable saps and extracts	1,13	15	Animal or vegetable fats and oils; Others	2,48
CE	63	Other Made-Up Textile Articles; Sets; Rags, Others	0,81	20	Preparations of vegetables, fruit, nuts or other parts of plants	2,47
CE	73	Articles of iron or steel	0,70	83	Miscellaneous articles of base metal	1,10
CE	68	Articles of stone, plaster, cement, asbestos, mica or similar materials	0,62	21	Miscellaneous edible preparations	0,93
CE	61	Articles of Apparel and Clothing Accessories, Knitted Or Crocheted	0,55	68	Articles of stone, plaster, cement, asbestos, mica or similar materials	0,77

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
MA	76	Aluminium and articles thereof	60,08	26	Ores, slag and ash	50,37
MA	72	Iron and steel	17,19	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	14,09
MA	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	11,73	28	Inorganic chemicals; Organic or inorganic compounds of precious metals, Others	12,89

MA	28	Inorganic chemicals; Organic or inorganic compounds of precious metals, Others	6,32	76	Aluminium and articles thereof	9,41
MA	29	Organic chemicals	1,63	72	Iron and steel	7,77
MA	44	Wood and articles of wood; Wood charcoal	0,55	52	Cotton	0,58
MA	41	Raw Hides and Skins (Other Than Furskins) and Leather	0,20	71	Natural or cultured pearls, precious or semi-precious stones, Others	0,54
MA	94	Furniture; Bedding, mattresses, cushions and similar stuffed furnishings; Others	0,19	29	Organic chemicals	0,29
MA	03	Fish and crustaceans, molluscs and other aquatic invertebrates	0,16	02	Meat and edible meat offal	0,19
MA	02	Meat and edible meat offal	0,05	41	Raw Hides and Skins (Other Than Furskins) and Leather	0,14

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
PB	64	Footwear, gaiters and the like; Parts of such articles	21,60	64	Footwear, gaiters and the like; Parts of such articles	29,02
PB	63	Other Made-Up Textile Articles; Sets; Rags, Others	18,48	63	Other Made-Up Textile Articles; Sets; Rags, Others	27,96
PB	03	Fish and crustaceans, molluscs and other aquatic invertebrates	18,35	17	Sugars and sugar confectionery	19,77
PB	56	Wadding, felt and nonwovens; Others	11,13	59	Impregnated, Coated, Covered Or Laminated Textile Fabrics; Others	1,79
PB	17	Sugars and sugar confectionery	4,81	26	Ores, slag and ash	1,68
PB	22	Beverages, spirits and vinegar	4,69	22	Beverages, spirits and vinegar	1,67
PB	57	Carpets and other textile floor coverings	4,63	08	Edible fruit and nuts; Peel of citrus fruits or Melons	1,47
PB	20	Preparations of vegetables, fruit, nuts or other parts of plants	1,37	56	Wadding, felt and nonwovens; Others	1,28
PB	59	Impregnated, Coated, Covered Or Laminated Textile Fabrics; Others	0,67	68	Articles of stone, plaster, cement, asbestos, mica or similar materials	1,10
PB	61	Articles of Apparel and Clothing Accessories, Knitted Or Crocheted	0,49	20	Preparations of vegetables, fruit, nuts or other parts of plants	1,05

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
PE	17	Sugars and sugar confectionery	25,87	17	Sugars and sugar confectionery	44,77
PE	85	Electrical machinery and equipment and parts thereof; Others	7,40	39	Plastics and articles thereof	12,05
PE	08	Edible fruit and nuts; Peel of citrus fruits or Melons	7,29	08	Edible fruit and nuts; Peel of citrus fruits or Melons	11,52
PE	03	Fish and crustaceans, molluscs and other aquatic invertebrates	7,16	40	Rubber and articles thereof	2,67
PE	39	Plastics and articles thereof	4,88	20	Preparations of vegetables, fruit, nuts or other parts of plants	1,82
PE	61	Articles of Apparel and Clothing Accessories, Knitted Or Crocheted	4,32	83	Miscellaneous articles of base metal	1,70
PE	41	Raw Hides and Skins (Other Than Furskins) and Leather	3,38	55	Man-Made staple fibres	0,91
PE	58	Special woven fabrics; Tufted textile fabrics; Lace; Tapestries; Others	2,31	76	Aluminium and articles thereof	0,60
PE	40	Rubber and articles thereof	2,30	64	Footwear, gaiters and the like; Parts of such articles	0,58
PE	83	Miscellaneous articles of base metal	1,82	52	Cotton	0,50

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010

PI	15	Animal or vegetable fats and oils; Others	25,66	15	Animal or vegetable fats and oils; Others	44,60
PI	29	Organic chemicals	18,57	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	35,12
PI	08	Edible fruit and nuts; Peel of citrus fruits or Melons	12,78	04	Dairy produce; Birds' eggs; Natural honey; Others	7,44
PI	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	8,83	29	Organic chemicals	3,34
PI	03	Fish and crustaceans, molluscs and other aquatic invertebrates	8,40	23	Residues and waste from the food industries; Others	2,21
PI	62	Articles of Apparel and Clothing Accessories, Not Knitted Or Crocheted	6,01	08	Edible fruit and nuts; Peel of citrus fruits or Melons	1,31
PI	68	Articles of stone, plaster, cement, asbestos, mica or similar materials	0,57	52	Cotton	1,27
PI	05	Products of animal origin, not elsewhere specified or included	0,28	41	Raw Hides and Skins (Other Than Furskins) and Leather	1,14
PI	21	Miscellaneous edible preparations	0,00	25	Salt; Sulphur; Earths and stone; Plastering materials, Lime and cement	0,71
PI	61	Articles of Apparel and Clothing Accessories, Knitted Or Crocheted	0,00	68	Articles of stone, plaster, cement, asbestos, mica or similar materials	0,61

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
RN	08	Edible fruit and nuts; Peel of citrus fruits or Melons	32,69	08	Edible fruit and nuts; Peel of citrus fruits or Melons	44,05
RN	61	Articles of Apparel and Clothing Accessories, Knitted Or Crocheted	23,76	17	Sugars and sugar confectionery	14,45
RN	03	Fish and crustaceans, molluscs and other aquatic invertebrates	15,17	63	Other Made-Up Textile Articles; Sets; Rags, Others	8,79
RN	17	Sugars and sugar confectionery	11,05	03	Fish and crustaceans, molluscs and other aquatic invertebrates	7,33
RN	25	Salt; Sulphur; Earths and stone; Plastering materials, Lime and cement	5,92	25	Salt; Sulphur; Earths and stone; Plastering materials, Lime and cement	7,17
RN	41	Raw Hides and Skins (Other Than Furskins) and Leather	2,25	27	Mineral fuels, mineral oils, bituminous substances; Mineral waxes	3,29
RN	15	Animal or vegetable fats and oils; Others	1,24	15	Animal or vegetable fats and oils; Others	2,66
RN	13	Lac, gums, resins and other vegetable saps and extracts	0,57	05	Products of animal origin, not elsewhere specified or included	1,70
RN	63	Other Made-Up Textile Articles; Sets; Rags, Others	0,47	04	Dairy produce; Birds' eggs; Natural honey; Others	0,65
RN	56	Wadding, felt and nonwovens; Others	0,32	13	Lac, gums, resins and other vegetable saps and extracts	0,43

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
SE	20	Preparations of vegetables, fruit, nuts or other parts of plants	49,39	20	Preparations of vegetables, fruit, nuts or other parts of plants	51,91
SE	83	Miscellaneous articles of base metal	14,57	64	Footwear, gaiters and the like; Parts of such articles	22,80
SE	63	Other Made-Up Textile Articles; Sets; Rags, Others	7,99	17	Sugars and sugar confectionery	12,42
SE	31	Fertilisers	7,71	33	Essential oils and resinoids; Perfumery, cosmetic or toilet preparations	3,57
SE	62	Articles of Apparel and Clothing Accessories, Not Knitted Or Crocheted	7,52	08	Edible fruit and nuts; Peel of citrus fruits or Melons	3,34
SE	41	Raw Hides and Skins (Other Than	4,51	41	Raw Hides and Skins (Other Than	2,38

		Furskins) and Leather			Furskins) and Leather	
SE	33	Essential oils and resinoids; Perfumery, cosmetic or toilet preparations	1,12	63	Other Made-Up Textile Articles; Sets; Rags, Others	0,25
SE	64	Footwear, gaiters and the like; Parts of such articles	0,55	68	Articles of stone, plaster, cement, asbestos, mica or similar materials	0,20
SE	89	Ships, boats and floating structures	0,16	21	Miscellaneous edible preparations	0,05
SE	94	Furniture; Bedding, mattresses, cushions and similar stuffed furnishings; Others	0,11	88	Aircraft, spacecraft, and parts thereof	0,00

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
DF	02	Meat and edible meat offal	71,99	71	Natural or cultured pearls, precious or semi-precious stones, Others	25,06
DF	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	8,68	84	Nuclear reactors, boilers, machinery and mechanical appliances; Others	16,35
DF	10	Cereals	1,08	97	Works of art, collectors' pieces and antiques	5,21
DF	16	Preparations of meat, of fish or of crustaceans, Others	0,73	04	Dairy produce; Birds' eggs; Natural honey; Others	3,93
DF	09	Coffee, tea, maté and spices	0,37	61	Articles of Apparel and Clothing Accessories, Knitted Or Crocheted	3,12
DF	76	Aluminium and articles thereof	0,18	87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof	2,07
DF	64	Footwear, gaiters and the like; Parts of such articles	0,05	25	Salt; Sulphur; Earths and stone; Plastering materials, Lime and cement	1,72
DF	49	Books, Newspapers, Pictures and Other Products of The Printing Industry; Others	0,03	42	Articles of Leather; Articles of Animal Gut (Other Than Silkworm Gut), Others	1,17
DF	06	Live trees and other plants; Others	0,01	68	Articles of stone, plaster, cement, asbestos, mica or similar materials	0,32
DF	72	Iron and steel	0,00	96	Miscellaneous manufactured articles	0,26

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
GO	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	32,55	02	Meat and edible meat offal	25,11
GO	23	Residues and waste from the food industries; Others	28,34	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	20,65
GO	72	Iron and steel	10,16	23	Residues and waste from the food industries; Others	13,19
GO	71	Natural or cultured pearls, precious or semi-precious stones, Others	9,52	26	Ores, slag and ash	12,83
GO	02	Meat and edible meat offal	6,69	17	Sugars and sugar confectionery	4,82
GO	25	Salt; Sulphur; Earths and stone; Plastering materials, Lime and cement	5,03	71	Natural or cultured pearls, precious or semi-precious stones, Others	4,78
GO	41	Raw Hides and Skins (Other Than Furskins) and Leather	1,55	10	Cereals	3,16
GO	21	Miscellaneous edible preparations	1,04	72	Iron and steel	3,06
GO	05	Products of animal origin, not elsewhere specified or included	0,28	52	Cotton	1,55
GO	34	Soap, organic surface-active agents, Others	0,25	41	Raw Hides and Skins (Other Than Furskins) and Leather	1,51

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
MT	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	53,48	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	38,95
MT	23	Residues and waste from the food industries; Others	25,00	23	Residues and waste from the food industries; Others	18,36
MT	44	Wood and articles of wood; Wood charcoal	6,86	10	Cereals	15,91
MT	15	Animal or vegetable fats and oils; Others	3,99	02	Meat and edible meat offal	12,67
MT	02	Meat and edible meat offal	3,46	52	Cotton	4,76
MT	16	Preparations of meat, of fish or of crustaceans, Others	2,35	15	Animal or vegetable fats and oils; Others	3,27
MT	52	Cotton	1,36	71	Natural or cultured pearls, precious or semi-precious stones, Others	1,56
MT	41	Raw Hides and Skins (Other Than Furskins) and Leather	1,01	44	Wood and articles of wood; Wood charcoal	1,50
MT	71	Natural or cultured pearls, precious or semi-precious stones, Others	0,55	41	Raw Hides and Skins (Other Than Furskins) and Leather	1,10
MT	17	Sugars and sugar confectionery	0,35	47	Pulp of wood or of other fibrous cellulosic material, Others	0,75

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
MS	23	Residues and waste from the food industries; Others	5,87	02	Meat and edible meat offal	22,82
MS	02	Meat and edible meat offal	22,82	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	17,49
MS	26	Ores, slag and ash	10,04	47	Pulp of wood or of other fibrous cellulosic material, Others	13,56
MS	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	17,49	17	Sugars and sugar confectionery	12,86
MS	44	Wood and articles of wood; Wood charcoal	0,05	26	Ores, slag and ash	10,04
MS	41	Raw Hides and Skins (Other Than Furskins) and Leather	1,93	23	Residues and waste from the food industries; Others	5,87
MS	25	Salt; Sulphur; Earths and stone; Plastering materials, Lime and cement	0,15	10	Cereals	4,40
MS	17	Sugars and sugar confectionery	12,86	15	Animal or vegetable fats and oils; Others	2,09
MS	05	Products of animal origin, not elsewhere specified or included	0,75	41	Raw Hides and Skins (Other Than Furskins) and Leather	1,93
MS	72	Iron and steel	-3,85	48	Paper and paperboard; Articles of paper pulp, of paper or of paperboard	1,11

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
PR	23	Residues and waste from the food industries; Others	14,50	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	12,83
PR	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	12,83	02	Meat and edible meat offal	6,25
PR	44	Wood and articles of wood; Wood charcoal	10,34	17	Sugars and sugar confectionery	3,27
PR	02	Meat and edible meat offal	6,25	23	Residues and waste from the food industries; Others	14,50
PR	15	Animal or vegetable fats and oils; Others	4,21	44	Wood and articles of wood; Wood charcoal	10,34
PR	17	Sugars and sugar confectionery	3,27	15	Animal or vegetable fats and oils; Others	4,21

PR	21	Miscellaneous edible preparations	2,68	10	Cereals	-2,27
PR	48	Paper and paperboard; Articles of paper pulp, of paper or of paperboard	2,04	21	Miscellaneous edible preparations	2,68
PR	41	Raw Hides and Skins (Other Than Furskins) and Leather	1,66	48	Paper and paperboard; Articles of paper pulp, of paper or of paperboard	2,04
PR	09	Coffee, tea, maté and spices	0,96	22	Beverages, spirits and vinegar	0,04

Etat	**Code SH**	**Secteur**	**ACR 2000**	**Code SH**	**Secteur**	**ACR 2010**
RS	64	Footwear, gaiters and the like; Parts of such articles	22,70	02	Meat and edible meat offal	12,56
RS	24	Tobacco and manufactured tobacco substitutes	12,19	24	Tobacco and manufactured tobacco substitutes	11,32
RS	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	4,53	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	11,32
RS	02	Meat and edible meat offal	4,25	23	Residues and waste from the food industries; Others	5,58
RS	23	Residues and waste from the food industries; Others	3,46	64	Footwear, gaiters and the like; Parts of such articles	5,36
RS	39	Plastics and articles thereof	2,89	39	Plastics and articles thereof	4,51
RS	94	Furniture; Bedding, mattresses, cushions and similar stuffed furnishings; Others	2,62	41	Raw Hides and Skins (Other Than Furskins) and Leather	2,57
RS	47	Pulp of wood or of other fibrous cellulosic material, Others	1,99	15	Animal or vegetable fats and oils; Others	2,47
RS	15	Animal or vegetable fats and oils; Others	1,20	16	Preparations of meat, of fish or of crustaceans, Others	1,87
RS	82	Tools, implements, cutlery, spoons and forks, of base metal; Parts thereof of base metal	1,10	94	Furniture; Bedding, mattresses, cushions and similar stuffed furnishings; Others	1,31

Etat	**Code SH**	**Secteur**	**ACR 2000**	**Code SH**	**Secteur**	**ACR 2010**
SC	02	Meat and edible meat offal	18,11	02	Meat and edible meat offal	27,67
SC	44	Wood and articles of wood; Wood charcoal	10,63	24	Tobacco and manufactured tobacco substitutes	11,50
SC	94	Furniture; Bedding, mattresses, cushions and similar stuffed furnishings; Others	8,34	16	Preparations of meat, of fish or of crustaceans, Others	5,49
SC	63	Other Made-Up Textile Articles; Sets; Rags, Others	5,79	44	Wood and articles of wood; Wood charcoal	5,25
SC	69	Ceramic products	4,59	94	Furniture; Bedding, mattresses, cushions and similar stuffed furnishings; Others	3,27
SC	24	Tobacco and manufactured tobacco substitutes	3,04	84	Nuclear reactors, boilers, machinery and mechanical appliances; Others	2,72
SC	61	Articles of Apparel and Clothing Accessories, Knitted Or Crocheted	2,97	48	Paper and paperboard; Articles of paper pulp, of paper or of paperboard	1,80
SC	48	Paper and paperboard; Articles of paper pulp, of paper or of paperboard	2,78	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	1,69
SC	16	Preparations of meat, of fish or of crustaceans, Others	1,14	69	Ceramic products	0,93
SC	62	Articles of Apparel and Clothing Accessories, Not Knitted Or Crocheted	1,04	63	Other Made-Up Textile Articles; Sets; Rags, Others	0,56

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
ES	72	Iron and steel	34,86	02	Meat and edible meat offal	25,11
ES	26	Ores, slag and ash	25,06	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	20,65
ES	47	Pulp of wood or of other fibrous cellulosic material, Others	20,38	23	Residues and waste from the food industries; Others	13,19
ES	09	Coffee, tea, maté and spices	7,10	26	Ores, slag and ash	12,83
ES	68	Articles of stone, plaster, cement, asbestos, mica or similar materials	3,50	17	Sugars and sugar confectionery	4,82
ES	18	Cocoa and cocoa preparations	0,71	71	Natural or cultured pearls, precious or semi-precious stones, Others	4,78
ES	25	Salt; Sulphur; Earths and stone; Plastering materials, Lime and cement	0,33	10	Cereals	3,16
ES	53	Other vegetable textile fibres; Paper yarn and woven fabrics of paper yarn	0,25	72	Iron and steel	3,06
ES	21	Miscellaneous edible preparations	0,22	52	Cotton	1,55
ES	02	Meat and edible meat offal	0,20	41	Raw Hides and Skins (Other Than Furskins) and Leather	1,51

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
MG	26	Ores, slag and ash	22,38	26	Ores, slag and ash	41,85
MG	72	Iron and steel	19,59	09	Coffee, tea, maté and spices	13,13
MG	09	Coffee, tea, maté and spices	14,84	72	Iron and steel	10,35
MG	47	Pulp of wood or of other fibrous cellulosic material, Others	5,48	71	Natural or cultured pearls, precious or semi-precious stones, Others	3,97
MG	71	Natural or cultured pearls, precious or semi-precious stones, Others	3,00	17	Sugars and sugar confectionery	3,19
MG	28	Inorganic chemicals; Organic or inorganic compounds of precious metals, Others	2,06	47	Pulp of wood or of other fibrous cellulosic material, Others	2,27
MG	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	1,09	02	Meat and edible meat offal	2,19
MG	68	Articles of stone, plaster, cement, asbestos, mica or similar materials	0,79	28	Inorganic chemicals; Organic or inorganic compounds of precious metals, Others	1,05
MG	41	Raw Hides and Skins (Other Than Furskins) and Leather	0,66	12	Oil seeds and oleaginous fruits; Grains, seeds; Others	0,80
MG	73	Articles of iron or steel	0,62	23	Residues and waste from the food industries; Others	0,47

Etat	Code SH	Secteur	ACR 2000	Code SH	Secteur	ACR 2010
RJ	72	Iron and steel	20,95	27	Mineral fuels, mineral oils, bituminous substances; Mineral waxes	49,94
RJ	40	Rubber and articles thereof	3,21	83	Miscellaneous articles of base metal	0,95
RJ	76	Aluminium and articles thereof	2,40	40	Rubber and articles thereof	0,61
RJ	90	Optical, photographic, cinematographic instruments; Others	2,34	89	Ships, boats and floating structures	0,33
RJ	71	Natural or cultured pearls, precious or semi-precious stones, Others	1,35	72	Iron and steel	0,20

RJ	73	Articles of iron or steel	1,33	16	Preparations of meat, of fish or of crustaceans, Others	0,14
RJ	68	Articles of stone, plaster, cement, asbestos, mica or similar materials	1,27	71	Natural or cultured pearls, precious or semi-precious stones, Others	0,05
RJ	63	Other Made-Up Textile Articles; Sets; Rags, Others	0,94	97	Works of art, collectors' pieces and antiques	0,01
RJ	70	Glass and glassware	0,86	59	Impregnated, Coated, Covered Or Laminated Textile Fabrics; Others	0,01
RJ	17	Sugars and sugar confectionery	0,71	41	Raw Hides and Skins (Other Than Furskins) and Leather	0,00

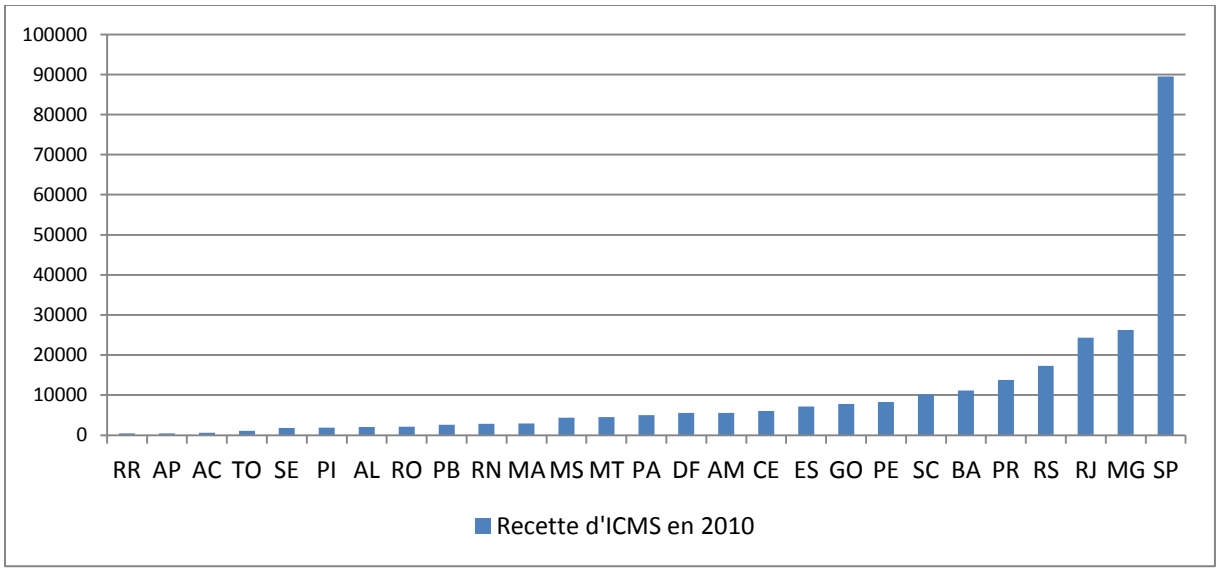
Etat	**Code SH**	**Secteur**	**ACR 2000**	**Code SH**	**Secteur**	**ACR 2010**
SP	88	Aircraft, spacecraft, and parts thereof	10,21	17	Sugars and sugar confectionery	16,61
SP	87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof	9,26	87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof	6,77
SP	20	Preparations of vegetables, fruit, nuts or other parts of plants	4,91	88	Aircraft, spacecraft, and parts thereof	6,15
SP	17	Sugars and sugar confectionery	4,01	02	Meat and edible meat offal	3,58
SP	02	Meat and edible meat offal	1,49	20	Preparations of vegetables, fruit, nuts or other parts of plants	3,13
SP	48	Paper and paperboard; Articles of paper pulp, of paper or of paperboard	1,28	22	Beverages, spirits and vinegar	1,14
SP	09	Coffee, tea, maté and spices	1,22	41	Raw Hides and Skins (Other Than Furskins) and Leather	0,94
SP	76	Aluminium and articles thereof	1,16	09	Coffee, tea, maté and spices	0,91
SP	40	Rubber and articles thereof	1,12	48	Paper and paperboard; Articles of paper pulp, of paper or of paperboard	0,86
SP	41	Raw Hides and Skins (Other Than Furskins) and Leather	1,03	47	Pulp of wood or of other fibrous cellulosic material, Others	0,76

Figure 1: Les compétences fiscales des pouvoirs fiscaux selon la constitution :

Tax competence	Taxes
UNION	• On foreign trade – on imports (**II**) and exports (**IE**) of goods and services • On income and earnings (**IR**) • On industrialized products (**IPI**), a value added tax levied on manufactured goods • On financial operations (**IOF**) • On rural land property (**ITR**)
STATES AND THE FEDERAL DISTRICT	• On inheritance and gifts (**ITCD**) • On the circulation of goods and transportation and communication services (**ICMS**), a value added tax levied on goods in general and some services • On motor vehicles (**IPVA**)
MUNICIPALITIES AND THE FEDERAL DISTRICT	• On urban land property (**IPTU**) • On real estate conveyance (**ITBI**) • On services (**ISS**), except those subject to ICMS

Source : Tax system and Administration in Brazil, Ministry of Finance (August 2002)

Graphique 8: Les recettes d'ICMS des états en 2010 (en milliards de R$)



Source : Ministério da Fazenda - Secretaria do Tesouro Nacional – REICMSE

Tableau 11: Les avantages fiscaux de la Zone franche de Manaus et le reste du Brésil

Origin	Manaus	The rest of Brazil
Fiscal Incentives to produce	- ICMS deferral in the import of raw and secondary materials - no ICMS in the entry of machines and equipment - reduction on the basis of ICMS for raw and secondary material - ICMS credit stimulus on certain products of Manaus - no IPI in buys and sales in Manaus (Art. 9, Decree Law 288) -PIS and COFINS (zero rated) in commercialization of raw materials, intermediary products and packaging materials -Special Rates on PIS and COFINS	There are industrial incentives (e.g. IT technologies, research & development etc.) motivated by federal government, as well as the state level incentives.
Incentives to import other than tariffs	- may be exempted from ICMS on imports conditioned on exports (**Special Amazon Export Program**) - no IPI on imports (Art. 3 ; "Caput", Decree Law 288) - suspension of PIS-import, COFINS-import	- may be suspension of IPI on imports conditioned on exports (**Drawback regime**) - may be suspension of ICMS on imports conditioned on exports (**Drawback regime**)
Transformed and Exported by Manaus	- no ICMS on sales to world (common rule) - no IPI on sales to world (common rule, and Art. 9, Decree Law 288) - exemption on export tax (Art. 5, Decree Law 288) - exemption on import tax (Art.3, Decree Law 288)	- no ICMS in sales from Brazil to Manaus (Art. 4, Decree Law 288) - no IPI in sales from Brazil to Manaus for consumption/industrialization (Art. 4, Decree Law 288) - exemption on export tax (Art. 5, Decree Law 288) - no ICMS on sales to world (common rule) - no IPI on sales to world (common rule, and Art. 9, Decree Law 288) - may be exemption on Import tax conditioned on exports (**Drawback regime**)
Transformed and Exported from the rest of Brazil	- no ICMS into Brazil in the outflow of goods when they are intended for the integration of the establishment -ICMS Tax credits are possible on interstate transactions - no IPI on sales to Brazil (Art.9, Decree Law 288) - no ICMS on sales to world (common rule, Decree Law 288) - no IPI on sales to world (common rule, and Art. 9, Decree Law 288) -an 88% reduction in import duty tax for raw, intermediary and secondary materials, and for the packaging of foreign products that are used during the manufacture of industrialized products in the free trade zone (Art. 7, §4, Decree Law 288)	- no ICMS on sales to world (common rule) - no IPI on sales to world (common rule, and Art. 9, Decree Law 288) - may be suspension or exemption of import tax conditioned on exports (**Drawback regime**)

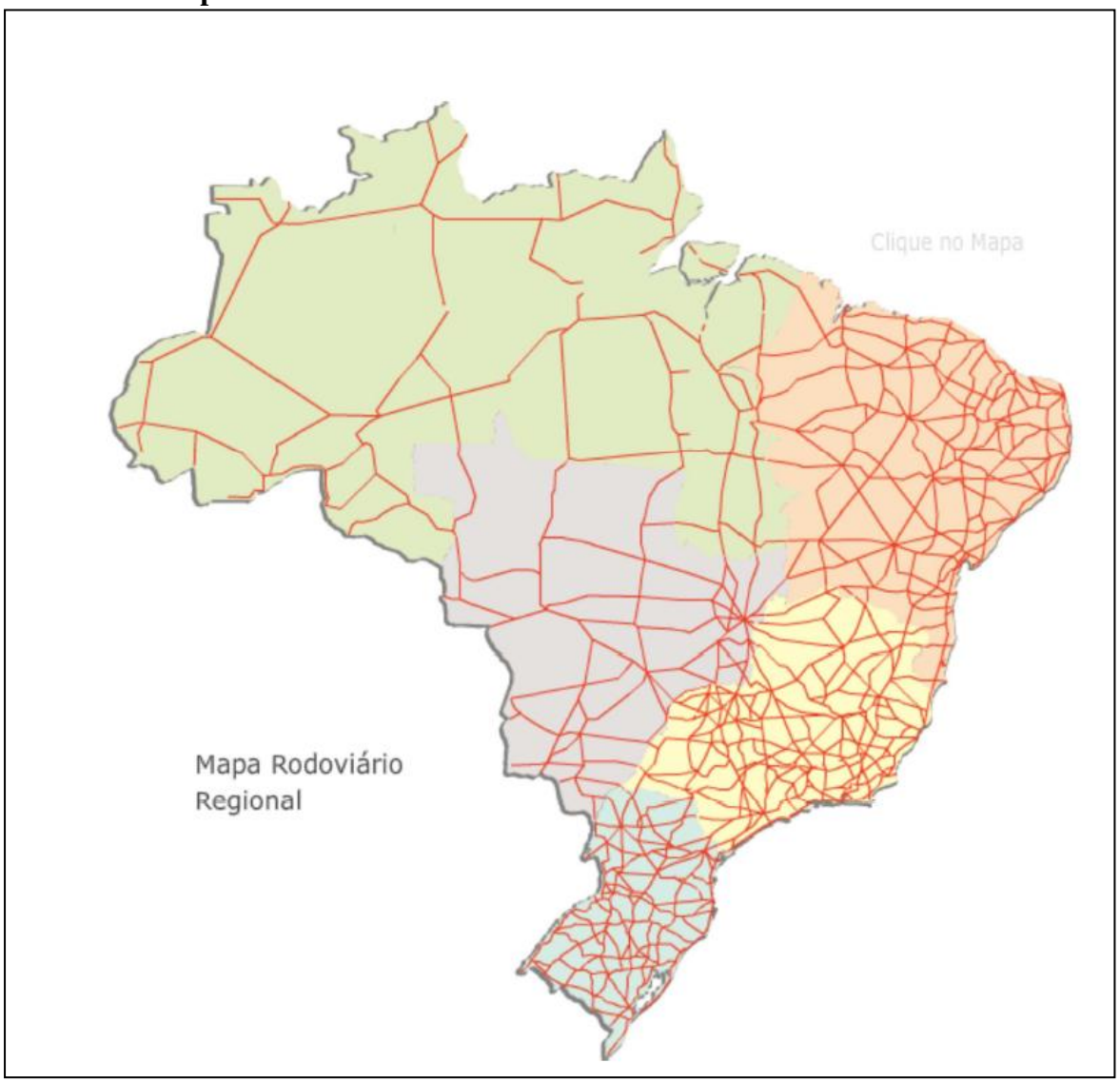
Source: Synthèse de l'auteur

Tableau 12: Liste des Etats brésiliens par la région

Région Nord		**Région Centre-ouest**	
ACRE	AC	MATO GROSSO	MT
AMAZONAS	AM	MATO GROSSO DO SUL	MS
AMAPA	AP	GOIAS	GO
PARA	PA	DISTRITO FEDERAL	DF
RONDONIA	RO	**Région Sudest**	
RORAIMA	RR	ESPIRITO SANTO	ES
TOCANTINS	TO	MINAS GERAIS	MG
Région Nord-est		RIO DE JANEIRO	RJ
ALAGOAS	AL	SAO PAULO	SP
BAHIA	BA	**Région Sud**	
CEARA	CE	PARANA	PR
MARANHAO	MA	RIO GRANDE DO SUL	RS
PARAIBA	PB	SANTA CATARINA	SC
PERNAMBUCO	PE		
PIAUI	PI		
RIO GRANDE DO NORTE	RN		
SERGIPE	SE		

LES CARTES

Carte 1: Transport routier au Brésil



Source: BIT (Banco de Informações e Mapas de Transportes); Ministério dos Transportes (2012)

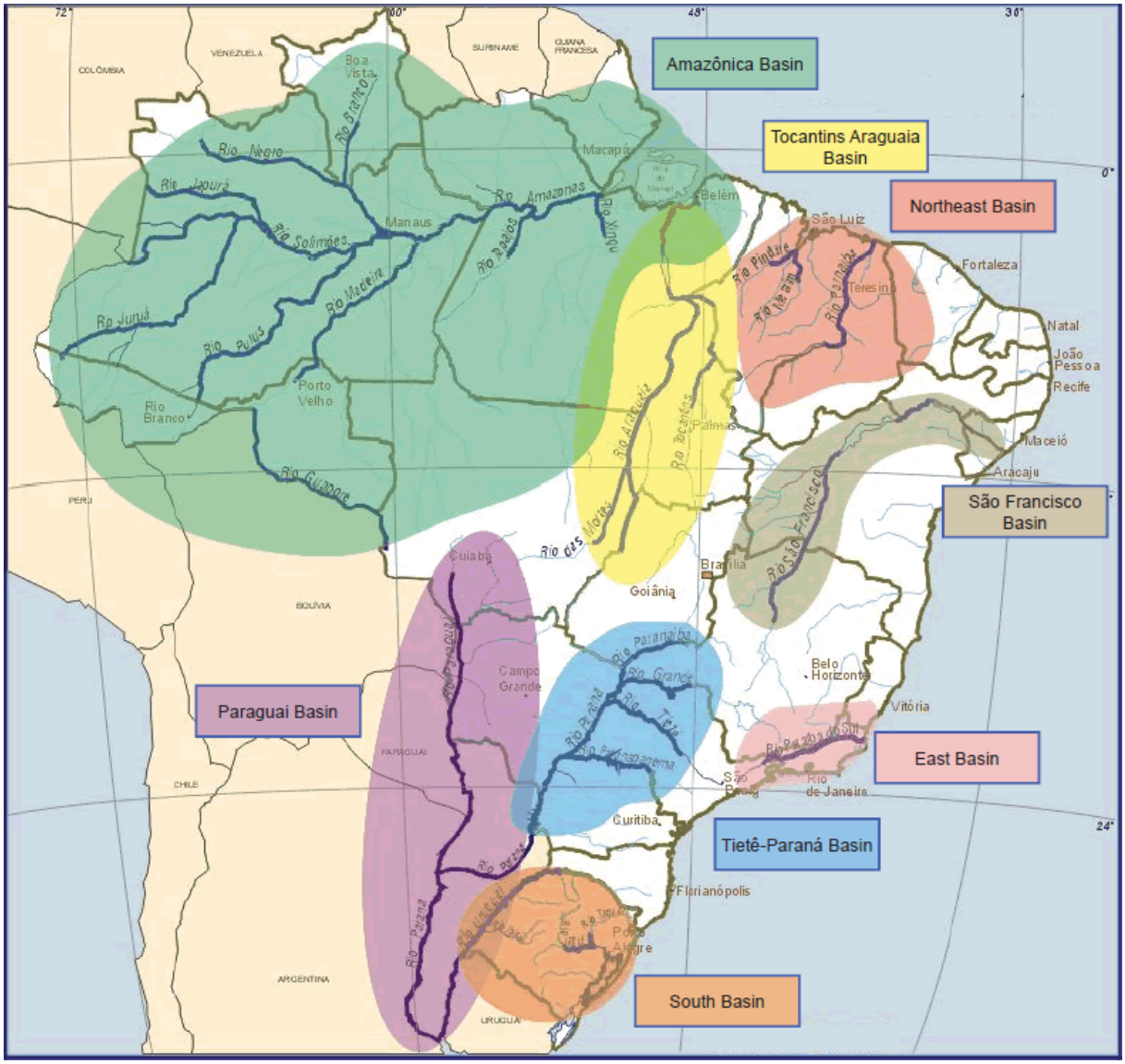
Carte 2: Les Voies ferrées



EFTVoie ferrière Trombetas
EFJ Voie ferrière Jari
EFAVoie ferrière do Amapá
EFCVoie ferrière Carajás
FNSVoie ferrière Norte-Sul
TLSA Transnordestina Logística S.A.
FCACentro-Atlântica S.A.
EFVMVitória a Minas
MRSMRS Logística S.A.
ALL-Norte América Latina Logística Malha Norte S.A.
ALL-Oeste América Latina Logística Malha Oeste S.A.
All-Paulista América Latina Logística Malha Paulista S.A.
All-Sul América Latina Logística Malha Sul S.A.
FERROESTEParaná Oeste S.A.
FTCFerrovia Tereza Cristina S.A.

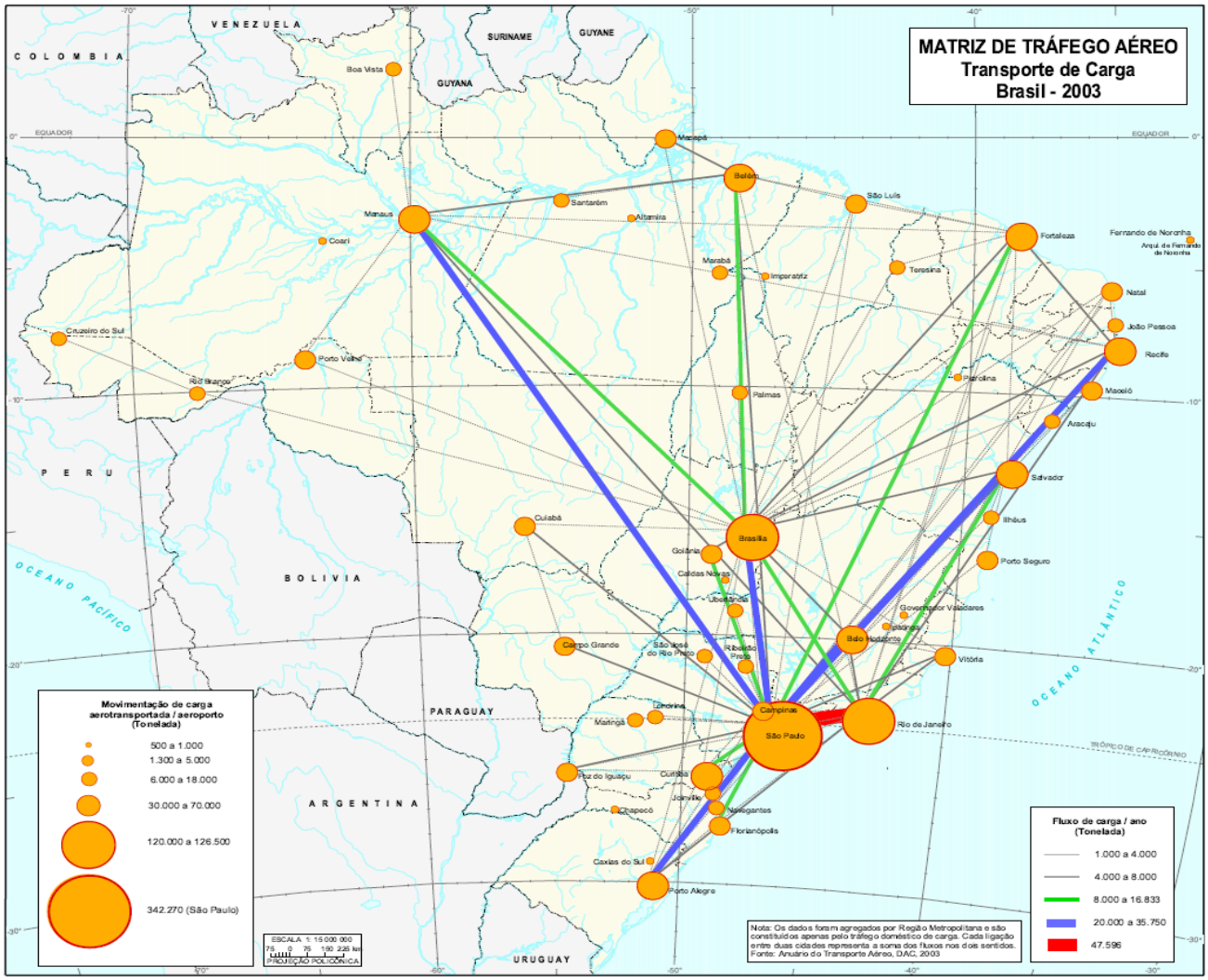
Source: Pesquisa CNT de Ferrovias 2011

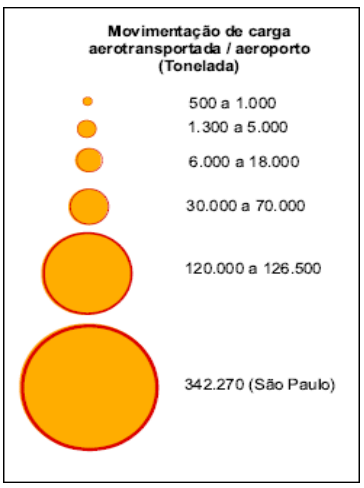
Carte 3: Les bassins fluviaux



Source: ANTAQ; Ministério dos Transportes

Carte 4 : Le transport aérien







Source : IBGE (Infra-estrutura de Transportes 2005)

CHAPITRE 1: Brazilian states' domestic-foreign export capacities and market orientations in the 1990s

Résumé:

On analyse l'intégration des états brésiliens au marché domestique et international du point de vue de leurs capacités d'offre dans les années d'ouverture commerciale. Les données disponibles permettent de caractériser l'évolution entre 1991 (la seule année disponible pour le début de période) et les années 1997-1998-1999. Notre modèle de gravité, inspiré de Redding et Venables (2004a, 2004b), estime séparément les capacités d'exportation des états vers le marché domestique et international. Les résultats montrent que les états les mieux classés en termes de capacités d'exportation vers le marché international ne se confondent pas avec les plus orientés vers le marché domestique., c'est-à-dire dans le commerce entre les états brésiliens.

Abstract:

We analyze the integration of Brazilian states into domestic and foreign markets from the point of view of their supply conditions. The study period takes in the country's fast liberalization process with its two sub-periods (1991 and 1997-99). We estimate the states' domestic and foreign market export capacities by a gravity model of trade in keeping with the work of Redding and Venables (2004a, 2004b). Results show that the states with better foreign export capacities are not necessarily the same as those with better domestic export capacities, where domestic market trade is measured in terms of inter-state trade.

I. Introduction

The weak, uneven integration of Brazilian regions into both the world markets and their own national territory is a policy concern for the national authorities, which have historically perceived integration into the domestic and foreign markets in turn as rivals to and complementary forces for economic development. In the 1990s, Brazil sharply reduced its tariffs (the WTO reports that average tariff rates decreased from 45.6 in 1989 to 13.7 in 2010) in order to become integrated into the world markets. However; the trade openness of Brazil measured as (Export+Import)/GDP remained relatively low compared to other BRIC countries and similar sized countries. In 2010, Brazil posted some 23.29% behind China (55.22%), Russia (51.74%) and India (46.31%)[12].

Domestic market integration was the prime target in 1950s and remained so even when the policy measures for greater openness picked up speed in the 1990s. There is clearly a negative impact of high transport costs on the domestic market integration given Brazil's huge size and forest cover along with country's limited capital endowments. Another hindrance is the decentralized structure of political power across the 27 federative states characterized by concurring market and fiscal policies within the territory. Afonso and de Mello (2002) and de Mello (2007) discuss the impact of the states' diversified fiscal measures to attract investment to their domestic markets and mention that the different application of ICMS - a value-added tax levied, regulated and administered by the states' federal authorities - across the states creates distortions and extra costs in the domestic business environment.

Nevertheless, international trade theories and the empirical literature assume and estimate intra-country trade as the level of trade in a frictionless world and use it as a reference for "perfect integration" in order to evaluate the country's foreign trade integration level. In this regard, McCallum (1995) found trade between Canadian provinces to be 22 times higher than trade between provinces and US states in 1988. He called this the *Border Effect.* Further

[12] Trade Visualizer, World Bank.

research has confirmed this effect for countries other than the US (for China: Poncet, 2003; for Brazil: Paz *et al.*, 2003; and for OECD countries: Wei, 1996; Helliwell, 1998), even though recent theoretical and empirical studies (Anderson and van Wincoop, 2003; Balistreri and Hillberry, 2007) point to a narrower gap between domestic and foreign trade values. In reality, specialization and other trade drivers come into play in both external trade and domestic "trade" due to spatial non-uniformities, since production factors such as land and labor are not perfectly mobile even at national level. Many empirical studies find also the national markets to be fragmented. Wolf (1997, 2000) posits that spatial production process clusters in the US are responsible for the high border effect and that this border effect extends even to sub-national level. Helliwell (1998) finds for Canada that intra-province trade is 2.1 times higher than inter-province trade.

The domestic market is then one of the "trade" destination options among other foreign destinations and regions' trade with the national market and with the world markets are inter-related through the supply channels in the exporter region. More successful domestic market exporters probably have more of a chance of also exporting to the foreign market due to their better production and export conditions or vice versa. However, this is not necessarily always true. Poncet (2003) finds that the greater global integration of the Chinese provinces in international trade goes hand in hand with domestic market disintegration.

At a closer look, two kinds of marginal forces can place the exporter region in a relatively better or worse position on one market. First, "substitution forces" will prompt domestic agents to make a trade-off between different markets. For a given production possibility frontier, they will allocate their resources to the market (domestic or foreign) that offers the better trade opportunities in terms of higher trade profits, easier access due to better infrastructure, more advantageous tax and/or tariff policies and/or high demand for goods in which the exporter is specialized, etc. Second, any improvement in the supply conditions for exports on a given market, domestic or foreign, may be preceded by "complementary forces" that improve the supply conditions on both markets due to positive externalities. For example, infrastructure investments may be beneficial to different destination markets, without

distinguishing domestic or foreign. Similarly, enhanced vertical production channels across industries may decrease production costs irrespective of their market orientation.

Brazilian regions are highly diversified in terms of their infrastructure levels and factor endowments, elements that are behind their different economic development levels and specializations. Milanovic (2005) finds that Brazil had the highest level of regional income inequalities of the world's five most highly populated countries (China, India, USA, Indonesia and Brazil) over the 1980-2000 period. The clustering of demand in large centers in the south-east and the relatively poor transport facilities in the north and north-eastern regions have created unequal trade opportunities and market access across the territory. Daumal and Zignago (2010) focus on the sub-national structure of trade by measuring the state-specific border effects in Brazil and find that intra-state trade was considerably greater than inter-state and international trade in 1991, 1997, 1998 and 1999.

The Brazilian states' "trade" integration into the domestic and foreign markets depends then on a state's supply side conditions for these two markets – its production structure (factor endowments, infrastructure, etc.) and its average trade costs for the domestic and foreign markets (geographic location, transport facilities, policy-related costs, etc.) – and on the demand side, not forgetting the role of the destination markets. In this paper, we aim to quantify and compare the Brazilian states' integration into the domestic and foreign markets independently of the demand conditions on the destination markets. In other words, we explain their integration based on their own performance and not that of their trading partners.

We estimate the states' *Supply Capacities* using a gravity model of trade, in keeping with the theoretical and empirical work by Redding and Venables (2004a, 2004b), dividing export performances into their demand and supply side. In our study, supply capacities indicate the relative integration level of the Brazilian states on the domestic and foreign markets (*Domestic* and *Foreign Supply Capacities*), after controlling for the impact of destination markets and bilateral geographic distances. We then use these estimated measurements of domestic and foreign supply capacities - which we refer to as *domestic* and *foreign export capacities* in the rest of the paper - to identify the states' relative market orientations and find out which states have different market orientations to the general pattern in Brazil. Our use of

the term *Export* instead of *Supply* is a semantic choice since we prefer to accentuate the *impact on exports,* which can differ on the domestic and foreign markets, rather than the absolute nature of *supply conditions.*

The empirical and theoretical framework provided by Redding and Venables (2004a, 2004b) is used mostly in the economic geography literature to evaluate the impact of supplier and market access on wages measured as the distance-weighted sum of supply capacities for the former and market capacities for the latter[13]. Escobar (2010) uses a gravity model whose structure is again inspired by Redding and Venables (2004a, 2004b) to decompose the Mexican states' trade performances on the US market into their demand and supply side conditions, and compares the supply side determinants of their export performance differences. However, the use of supply capacities to understand the integration structure on the domestic market and in interaction with the foreign market is a first in the literature to our knowledge.

Our work is also interesting in terms of the data period of the 1990s. The rapid liberalization of Brazil in the 1990s may have had an impact on the market orientation of the states by intensifying specialization due to economies of scale and easier access to new markets. This impact could be especially large for certain states with more or less of a net switch to the domestic or foreign markets. The existence of this shock in the period of analysis increases the number of possible outliers, where a trade-off between domestic and foreign market oriented production is more likely to occur given that the production possibility frontier curve is rigid in the short term.

We proceed as follows; in the next section, we present the theoretical work inspired by Redding and Venables (2004a, 2004b). Section III presents the empirical model and the computation method for the domestic and foreign export capacities. In section IV, we present our results and compare the states in terms of their domestic and foreign export capacities. We also look at how they have changed over the two periods spanning four years for which our

[13] Fally, Pillacar & Terra (2010) for Brazil; Knaap (2006) for the US and Hering and Poncet (2010) for the Chinese provinces show how wages differ at national level depending on access to market and supply centers.

data are available (1991 for *Period 1*; and 1997-1998-1999 for *Period 2*). Section V focuses on the switch in states' market orientations in the 1990s and highlights those states whose orientation is different to the general trend in Brazil. Lastly, we summarize and conclude our results.

II. Theoretical Framework:

Redding and Venables (2004a, 2004b) use the Dixit-Stiglitz (1977) CES utility function under monopolistic competition to decompose bilateral exports into their demand and supply side conditions. The demand function calculated for each variety is then as follows[14];

$$x_{ij} = p_{ij}^{-\sigma} E_j G_j^{\sigma-1} \quad , \quad \sigma > 1 \qquad (i)$$

Where x_{ij} is *j*'s demand for the good produced in *i*, E_j is *j*'s given total expenditure and σ is the elasticity of substitution between products. p_{ij} is the price of the good on market *j* and G_j is the price index in each destination country, which is an aggregate measure of individual prices multiplied by the number of varieties (n_i) produced in each *i* and exported to *j*.

$$G_j = \left(\sum_i^R n_i p_{ij}^{1-\sigma}\right)^{1/(1-\sigma)} \qquad (ii)$$

Trade costs take the iceberg form and the market price in *j* is as follows,

$$p_{ij} = p_i t_i T_{ij} t_j \qquad (iii)$$

Thus, the value of total exports from *i* to *j* is

$$n_i p_i x_{ij} = n_i p_i^{1-\sigma} \left(t_i T_{ij} t_j\right)^{1-\sigma} E_j G_j^{\sigma-1} \qquad (iv)$$

[14] Please see Redding and Venables (2004a, 2004b) for further details.

p_i is the production price and equal for all varieties produced in *i*, reflecting also the production technology of exporter *i* among its other production conditions. Iceberg trade costs include *ad valorem* cost factors (t_i and t_j) of getting the product to and from the border respectively in *i* and *j* and the cost of shipping T_{ij}. Redding and Venables (2004a, 2004b) consider the characteristics of *i* to be the supply side conditions, calling them "supply capacity (s_i)", and the characteristics of *j* to be the demand side conditions, calling them "market capacity (m_j)".

$$s_i \equiv n_i(p_i t_i)^{1-\sigma} \quad ; \quad m_j \equiv E_j\left(G_j/t_j\right)^{\sigma-1} \qquad \textit{(v; vi)}$$

Bilateral trade flows are therefore,

$$n_i p_i x_{ij} = s_i\left(T_{ij}\right)^{1-\sigma} m_j \qquad (vii)$$

In the original work by Redding and Venables (2004a, 2004b), t_i and t_j are considered among supply and market capacity elements and T_{ij} is the cost of transportation between borders. The authors use a gravity model of trade to estimate the parameters for the above bilateral trade equation (*vii*), in which transportation/shipping costs (T_{ij}) between borders are proxied by distance and contiguity. Therefore, the bilateral trade costs concern solely geographical determinants and the trade policy impacts, omitted from the theoretical model and empirical estimation, are assumed implicitly as the supply and market capacity elements.

III. Empirical Methods and Data:

The gravity model has become a workhorse in trade economics due to its great power in explaining bilateral trade flows and its well-developed foundation working under different theoretical underpinnings (Anderson, 1979; Deardorff, 1998; Eaton and Kortum, 2002; Anderson and van Wincoop, 2003). In line with the literature and Redding and Venables

(2004a, 2004b), we also use a gravity model of trade in order to measure the Brazilian states' export capacities.[15]

Redding and Venables (2004b) use separate fixed dummies for the exporter and importer country in order to measure *supply capacities* and *market capacities*. These fixed effects estimate the impact of all, observable and unobservable, country specific characteristics such as economic size, infrastructure and production structure, and internal trade cost elements such as internal geography conditions and transport facilities. They define the country's trade capacities with their different implications depending on whether the country is an importer or an exporter, or more precisely from the demand side or the supply side.

The estimation model (Redding and Venables, 2004b) is as follows:

$$\ln X_{ij} = \alpha_i + \delta_1 \ln distance_{ij} + \delta_2 contiguity_{ij} + \beta_j + u_{ij} \qquad (1)$$

where X_{ij} is exports from i to j and α_i and β_j are dummy variables measuring the trade impact of exporter country *i'*s characteristics *(supply capacity* of *i)* and importer country *j'*s characteristics (*market capacity* of *j*). u_{ij} is the error term.

In our study, we focus on the states' export patterns separately for domestic and foreign markets. We use a specific empirical structure, treating Brazilian states as if they were individual countries trading between each other and with other world countries. Hence, the domestic and foreign markets with their different trade conditions become possible destination choices for the exporter state where the heterogeneity of the states' characteristics responds relatively better or worse to the existing trade opportunities. For example, the industrial specialization of a Brazilian state may be more or less in line with the demand structure on the foreign markets than the domestic markets. In other words, the domestic and

[15] The use of the term "export capacities" instead of "supply capacities" is solely a semantic choice as discussed in the introduction. These capacities are measured empirically using a similar method to Redding and Venables (2004b).

foreign market integration of the Brazilian states differs depending on the heterogeneity of their characteristics and the differences between the domestic and foreign destination markets.

To this end, we use real export values between 26 Brazilian states[16] and 118 countries. This gives us country exports to countries (118*117) and to states (118*26) along with Brazilian states' exports to other states (26*25) and to countries (26*118). Unfortunately, inter-state trade data are available only for 1991, 1997, 1998 and 1999, which we divide into two periods of analysis: 1991 for *Period 1* (early 1990s) and *Period 2* (late 1990s) from 1997 to 1999. Since we are concerned with the long-term equilibrium, export flows in *Period 2* are the average real exports of trade pair *ij* over three years (1997, 1998 and 1999). Therefore, the exporter dummy for *i* in our data structure can be either a state or a country and decomposed when the exporter is a Brazilian state in order to separately measure its domestic and foreign export capacities.

$$\ln X_{ij} = \delta_1 \ln distance_{ij} + \delta_2\, contiguity_{ij} + \alpha_i + \alpha_i^{*} + \beta_j + u_{ij} \qquad (2)$$

We estimate equation *2* in cross-section for the two periods available (*Period 1* & *Period 2*). X_{ij} is the real average export flow from country/state i to country/state j. $distance_{ij}$ is the geodesic distance measured by the great-circle formula and $contiguity_{ij}$ is a dummy variable taking the value 1 if the trade pair *ij* (state or country) shares a common border. We introduce also exporter (α_i) and importer fixed dummies (β_j) for countries and states.

However, exporter fixed effects of states are decomposed by destination market, domestic or foreign. Dummy α_i takes the value 1 when the exporter state i ($i \in states$) trades with a country (e.g. São Paulo-Argentina) or when it is country i ($i \in countries$) irrespective of the importing partner – state or another country – no need to decompose by destination since both import partners are from foreign markets (e.g. Argentina-France or Argentina-São Paulo).

[16] Brazil today has 27 federal states, including Tocantins. However, Goias and Tocantins were part of the same administrative division through to 1989. Hence, we merge the two for a total of 26 states in our data.

Dummy α_i^* ($i \in states$) is equal to 1 when the exporter is state *i* and the partner is another state (e.g. São Paulo-Rio de Janeiro). So the star exponent discerns inter-state trade. The importer fixed effects of the countries and states (β_j) control for the market conditions assumed to be equal for all export partners (for all *i*), whether they are countries or states. Notice that Brazil does not come into the model as a single country, but through the trade of its 26 states.

Equation *2*, in line with Redding and Venables (2004a, 2004b), measures the export capacities of states by exporter fixed effects, which are in our work further decomposed for the domestic and foreign markets. Empirically, the exporter fixed effects of the states for the domestic market (α_i^*) will measure the impact of all the observable and unobservable characteristics of the Brazilian states on their exports to the domestic market. Likewise, the exporter fixed effects of the states for the foreign market ($\alpha_i;\ i \in states$) will measure the impact of all the observed and unobserved characteristics of the states on their exports to the foreign market. Therefore, the differences in the domestic and foreign export capacities of the Brazilian states are defined by their own characteristics, but their impact differs between the domestic and foreign markets.

We estimate equation *2*, not in log-linear form, but in its multiplicative form using the PPML (*Poisson Pseudo Maximum of Likelihood*) estimator, which has been commonly used in the gravity literature since Santos Silva and Tenreyro (2006) put forward that estimating parameters by logarithmic transformation raises efficiency problems and increases inconsistency where the error terms are heteroscedastic, which is the case with gravity models. Known as *Jensen's inequality*, the expected value of the logarithm of a random variable depends on its mean, but also on its higher moments. Therefore, error terms are correlated with the model regressors since they are heteroscedastic. Second, the PPML estimator is a useful tool for dealing with zero trade values. The log-linearization returns zero trade values to missing data points, which can cause a bias in the estimation, especially when the zero trade outcomes are not randomly distributed. However, this estimator does not solve the heteroscedasticity problem itself, and Santos Silva and Tenreyro (2006) recommend estimating statistical inferences based on an Eicker-White robust covariance matrix.

The stochastic form of the equation *2* estimated with PPML is therefore as follows;

$$\mathrm{E}\left[X_{ij}|distance_{ij}, contiguity_{ij}, \alpha_i, \alpha_i^*, \beta_j\right] = \exp\left(\hat{\delta}_1 \ln distance_{ij} + \hat{\delta}_2 contiguity_{ij} + \hat{\alpha}_i + \hat{\alpha}_i^* + \hat{\beta}_j\right)$$

According to equation *2* and the theoretical definition (equation *vii*) of export (supply) capacities by above mentioned), the domestic and foreign export capacities of the states will be equal to the Naperian exponential of the exporter fixed effects. The model is estimated in cross-section separately for two periods.

Domestic Export Capacity of state *i* in *Period t*;

$$\widehat{XC}_{i,t}^{\ *} = \exp(\hat{\alpha}_{i,t}^*) \quad (3)$$

Foreign Export Capacity of state *i* in *Period t* ;

$$\widehat{XC}_{i,t} = \exp(\hat{\alpha}_{i,t}) \quad (4)$$

For comparison purposes, we also compute the export capacities for some exporter countries:

$$\widehat{XC}_{i,t} = \exp(\hat{\alpha}_{i,t}) \quad (5)$$

Where $i \in$ countries

As generally acknowledged in the gravity literature, the economic size of the partners (e.g. GDP) explains a large part of the bilateral trade and the export capacities are largely driven by the heterogeneity of their size. This impact is not individually regressed in equation *2*. It is captured by the exporter fixed effects along with the country/state's other characteristics. However, since size impact is the main determinant of exports, it dominates other state specific information explaining export side conditions. We also estimate the states' export capacities, controlled for size impact, to compare states. Nevertheless, in a cross-sectional gravity structure, fixed effects are collinear with size proxies, with any GDP, population or

area, and it is not possible to estimate the size impact together with exporter fixed effects in a single model. Thus, we use a second stage regression in keeping with the existing empirical literature.[17]

In the second stage empirical model, we use real GDP values to measure economic size and we estimate the impact of size by regressing the *Export Capacities* ($\widehat{XC}_{i,t}$)[18] of the states and countries -these are already computed from the equation ***2*** estimates using ***(3)***, ***(4)*** and ***(5)*** - on the real exporter GDP values. Equation *6* is estimated pooled for both periods (*Period 1* and *Period 2*) since the impact of size is assumed to be constant over time in keeping with trade theory[19].

$$\ln\widehat{XC}_{i,t} = \hat{\gamma}_0 + \hat{\gamma}_1 \ln GDP_{i,t} + \hat{u}_{i,t} \qquad (6)$$

The model is again estimated by the PPML estimator in its multiplicative form,

$$\mathrm{E}\left[\widehat{XC}_{i,t} \mid GDP_{i,t}\right] = \exp\left(\hat{\gamma}_0 + \hat{\gamma}_1 \ln GDP_{i,t}\right)$$

$\ln GDP_{i,t}$ is the logarithm of exporter *i* (country or state) real GDP values. $\hat{\gamma}_0$ is the coefficient of the constant term and $\hat{u}_{i,t}$ is the error term. The share unexplained by real GDP values gives us the export capacities controlled for size impact.

GDP-controlled *Domestic Export Capacity* of state *i* in Period *t*:

$$\widehat{XC}_{i,t}^{\,GDP\ controlled^*} = \frac{\widehat{XC}_{i,t}^{\,*}}{\exp(\hat{\gamma}_1 * \ln GDP_{i,t})} = \exp(\hat{\alpha}_{i,t}^*) / \exp(\hat{\gamma}_1 * \ln GDP_{i,t}) \qquad (7)$$

GDP-controlled *Foreign Export Capacity* of state *i* in Period *t*:

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[17] Head and Mayer (2000); Martinez-Zarsoso and Nowak-Lehmann (2003), Duc *et al.* (2008)

[18] Please note that $\widehat{XC}_{i,t}$ are predicted measures from equation *2*.

[19] They are also estimated separately. However, the results do not change a great deal over the two periods.

$$\widehat{XC}_{i,t}^{\ GDP\ controlled} = \frac{\widehat{XC}_{i,t}}{\exp(\hat{\gamma}_1 * \ln GDP_{i,t})} = \exp(\hat{\alpha}_{i,t}) / \exp(\hat{\gamma}_1 * \ln GDP_{i,t}) \quad (8)$$

where $\hat{\gamma}_1$ is the time-independent parameter of the real GDP impact and $\widehat{XC}_{i,t}^{\ *}$; $\widehat{XC}_{i,t}$ are the domestic and foreign export capacities of the states computed from the estimates of equation *2* and used as dependent variable values in equation *6* for the second stage estimation.

The Brazilian states' international trade flows are taken from *ALICEWEB*, which presents the export and import values of Brazilian states to and from each country. The export values of the 118 countries trading with one another are taken from the *Directory of Trade Statistics* (*DOTs*) published by the *International Monetary Fund*. Both sources concur and can be combined since they present similar total export volumes for all Brazilian trade with sample countries. Our empirical study also draws on Brazilian interstate export flows available for just four years: 1991, 1997, 1998 and 1999. The Brazilian authorities use the information from the *ICMS* tax accounts to measure interstate trade flows. The *ICMS* tax (*Imposto sobre Circulação de Mercadorias e Serviços*) is a type of value-added tax (VAT) collected by the exporting state. This information provided by the Brazilian Ministry of Finance is available in database form for 1997 (*Ministério de Fazenda*, 2000), 1998 and 1999 (Vasconcelos, 2001a, 2001b). The 1991 data come from *SEFAZ-PE* (1993), measured and extrapolated by the *Pernambuco Finance Ministry* on the basis of the 1987 interstate database. Unfortunately, the lack of data on recent time periods places limitations on the study.

The distance and contiguity variables are taken from *CEPII*'s Distances database. For the most part, the capital cities are the main unit of the distance measurements. However, the data occasionally also use the economic capital as the geographic center of the country. *The World Gazetteer* website furnishes the state capital's geographical coordinates, from which we have calculated the states' bilateral distances from one another and the other countries. The author has taken the information on state contiguity from the Brazilian map.

IV. Results:

Cross-section PPML estimates of the gravity model parameters from equation *2* are given in Table 1 for *Period 1* and *Period 2*. The results for the exporter fixed effects are presented only for Brazilian states in the main. Readers can find estimates for some landmark countries in the sample for information about the size of states' exporter fixed effects. In gravity models, the colinearity of the constant term with exporter and importer fixed effects is a well-known problem and the standard procedure is to drop one exporter and one importer fixed effect. However, since we are interested in precise measurements of exporter fixed effects, we have dropped one importer fixed effect and the constant term of the model instead. As mentioned in methodological section, the estimates of the exporter fixed effects are then used to compute domestic and foreign export capacities for the states.

Table 1: PPML estimates of exporter fixed effects and gravity equation parameters (Equation *2*)

Dependent Variable: X_{ij}	*Period 1* (1991)		*Period 2* (1997-1999)	
	$\hat{\alpha}_i$	$\hat{\alpha}_i^*$	$\hat{\alpha}_i$	$\hat{\alpha}_i^*$
Brazilian States:				
Acre (AC)	13.673***	20.21***	12.075***	20.561***
	(0.517)	(0.508)	(0.497)	(0.646)
Alagoas (AL)	18.483***	22.379***	17.63***	21.078***
	(0.481)	(0.446)	(0.351)	(0.320)
Amazonas (AM)	17.503***	24.71***	17.996***	24.395***
	(0.459)	(0.673)	(0.484)	(0.487)
Amapá (AP)	16.762***	19.597***	16.413***	18.821***
	(0.539)	(0.518)	(0.562)	(0.421)
Bahia (BA)	20.04***	23.791***	19.839***	23.376***
	(0. 455)	(0.572)	(0.372)	(0.375)
Ceará (CE)	18.475***	23.461***	18.291***	23.025***
	(0.484)	(0.417)	(0.389)	(0.311)
Distrito Federal (DF)	14.356***	22.107***	13.776***	21.11***
	(0.686)	(0. 493)	(0.763)	(0.392)
Espírito Santo (ES)	20.333***	23.407***	20.219***	22.985***
	(0.445)	(0. 404)	(0.333)	(0.297)
Goiás (GO)	18.24***	23.192***	18.456***	22.946***
	(0.587)	(0.456)	(0.544)	(0.293)
Maranhão (MA)	18.95***	22.048***	18.771***	21.356***
	(0.686)	(0.437)	(0.476)	(0.312)
Minas Gerais (MG)	21.358***	24.678***	21.311***	24.186***
	(0.467)	(0.432)	(0.381)	(0.329)
Mato Grosso do Sul (MS)	17.563***	22.713***	18.011***	22.087***
	(0.61)	(0.478)	(0.528)	(0.340)
Mato Grosso (MT)	18.227***	23.306***	19.077***	22.136***
	(0.611)	(0.566)	(0.623)	(0.334)
Pará (PA)	20.117***	22.579***	19.936***	22.07***
	(0.556)	(0.434)	(0.452)	(0.317)
Paraíba (PB)	16.909***	21.929***	16.583***	21.672***
	(0.538)	(0.418)	(0.369)	(0.332)
Pernambuco (PE)	18.661***	23.978***	17.981***	23.168***
	(0.474)	(0.417)	(0.386)	(0.318)
Piauí (PI)	16.524***	20.477***	16.414***	20.407***
	(0.509)	(0.441)	(0.366)	(0.357)
Paraná (PR)	20.375***	24.563***	20.718***	23.597***
	(0.508)	(0.559)	(0.435)	(0.423)
Río de Janeiro (RJ)	20.339***	24.63***	19.874***	23.502***
	(0.456)	(0.464)	(0.360)	(0.368)
Rio Grande do Norte (RN)	17.256***	21.877***	17.068***	21.6***
	(0.478)	(0.447)	(0.376)	(0.334)
Rondônia (RO)	15.88***	21.536***	16.073***	21.468***
	(0. 488)	(0.466)	(0.363)	(0.362)
Roraima (RR)	8.982***	20.474***	13.006***	20.086***
	(1.105)	(0.558)	(0.831)	(0.353)
Rio Grande do Sul (RS)	21.05***	24.764***	21.025***	24.512***
	(0.434)	(0.419)	(0.327)	(0.294)
Santa Catarina (SC)	20.293***	24.345***	20.328***	23.808***

	(0.454)	(0.416)	(0.342)	(0.296)
Sergipe (SE)	16.157***	22.953***	15.871***	22.604***
	(0.845)	(0.461)	(0.588)	(0.442)
São Paulo (SP)	22.289***	26.334***	22.236***	26.094***
	(0.435)	(0.415)	(0.398)	(0.296)
Top Five Countries[a]:				
United States (USA)	25.739***	-	25.773***	-
	(0.418)		(0.316)	
Japan (JPN)	25.504***	-	25.262***	-
	(0.439)		(0.336)	
Germany (DEU)	24.571***	-	24.4***	-
	(0.431)		(0.332)	
Hong Kong (HKG)	24.149***	-	24.256***	-
	(0.464)		(0.350)	
China (CHN)	23.684***	-	24.206***	-
	(0.468)		(0.318)	
Bottom Three Countries[a]:				
Sierra Leone (SLE)	17.451***	-	13.622***	-
	(0.507)		(0.520)	
Comoros (COM)	16.407***	-	14.543***	-
	(0.621)		(0.585)	
Cape Verde (CPV)	14.29***	-	14.765***	-
	(0.785)		(0.933)	
MERCOSUR Countries:				
Argentina (ARG)	22.307***	-	22.5***	-
	(0.470)		(0.399)	
Uruguay (URY)	20.246***	-	20.126***	-
	(0.475)		(0.397)	
Paraguay (PRY)	19.538***	-	19.445***	-
	(0.530)		(0.481)	
Constant	*No Constant*		*No Constant*	
Ln(*distanceij)*	-0.706***		-0.723***	
	(0.034)		(0.029)	
contiguityij	0 .662***		0.722***	
	(0.136)		(0.109)	
Estimator	*PPML*		*PPML*	
Importer Fixed Effects	*Yes*		*Yes*	
Number of Observations	19379		19379	

[a] The rankings of the sample countries are determined by the value of their exporter fixed effects estimated for Period 2.

The constant term and importer fixed effect for Zimbabwe have been dropped due to colinearity issues. The robust standard errors are in parentheses: all inferences are based on a Huber-White sandwich estimate of variance. *** Significant at 1%.

The estimated coefficients for ln$distance_{ij}$ and $contiguity_{ij}$ do not change between periods and are concordant in size and sign with the literature. The coefficients of the states' exporter fixed effects for the domestic market ($\hat{\alpha}_i^*$) are higher than the states' exporter fixed effects for the foreign market ($\hat{\alpha}_i$) in both periods and for all states, reflecting the higher domestic market integration of states. This finding is in line with the *Border Effect* literature. On the

other hand, the foreign export capacity estimates indicate that some states are even better off than many countries on the world markets (e.g. "Bottom Three Countries"). Only the state of São Paulo (SP) competes in its foreign export capacity with Argentina, which is the second leading member of MERCOSUR behind Brazil.

From *Period 1* to *Period 2*, we observe a decrease in the size of $\hat{\alpha}_i^*$ for almost all the states. Nevertheless, the change is very small and does not yield a clear result on the evolution of states' domestic export capacities. The evolution of foreign export capacity (computed from $\hat{\alpha}_i$) varies across the states and it is positive for some of them (Amazonas (AM), Goiás (GO), Mato Grosso (MT), Mato Grosso do Sul (MS), Paraná (PR), Rondônia (RO), Roraima (RR), and Santa Catarina (SC)) albeit slightly (except for Roraima).

However, the states' export capacities estimated by the exporter fixed effects in equation *2* are largely driven by their size and the results are almost mechanical. Change in export capacities from *Period 1* to *Period 2* is also highly dependent on the growth in states' sizes. Therefore, in the next step we control for a size impact on trade and concentrate on the states' GDP-controlled domestic and foreign export capacities. The second stage estimates (equation *6*) are used to control for GDP impact. Table 2 gives the results of the second stage estimation.

Table 2: Estimates of GDP impact from equation *6*

Dependent Variable[a]: $\widehat{XC}_{i,t}$	**PPML**
constant	8.729*** (0.854)
Ln(*GDPi)*	0.566*** (0.854)
Observations	340
Pseudo-R2	0.4904

[a] $\widehat{\mathrm{XC}}_{\mathrm{i,t}}$ is the export capacities of the states and countries. They are computed as the Naperian exponential of exporter fixed effects estimated by equation *2* in Table 1.

*** Significant at 1%. The robust standard errors are in parentheses: all inferences are based on a Huber-White sandwich estimate of variance.

In Table 3, the rankings and values of states' GDP-controlled and uncontrolled domestic and foreign export capacities are presented[20]. As discussed above in the empirical methods, we compute GDP-uncontrolled export capacities as the Naperian exponential of the exporter fixed effects in the gravity model (estimated by equation *2*) and GDP-controlled capacities as the GDP-uncontrolled values divided by the GDP impact estimated in equation *6* (exp $(0.566 * \ln GDP_i)$).

They are given for both periods and by Brazilian regions. The five regions of Brazil in the table are defined by the *Instituto Brasileiro de Geografia e Estatística* (IBGE) regional nomenclature. The IBGE endeavors to class the states with similar cultural, economic, historical and social characteristics in the same region as long as they are geographically clustered. Since there is a relative uniformity of characteristics across the states within the same region and they have easier access to each other's infrastructure and transport facilities due to geographic proximity, we can expect them to have similar product specializations and market orientations. Therefore, states acting dissimilarly in their region are of particular interest.

[20] The export capacity values are entered as multiplication in the bilateral trade equation where export from *i* to *j* (Xij) is measured in real dollar terms. More specifically,

$$\hat{X}ij = \widehat{XC}i^{GDP\ uncontrolled} . distance_{ij}{}^{\hat{\delta}_1} e^{\hat{\delta}_2 contiguity_{ij}} e^{\hat{\beta}_j}$$

or equally,

$$\hat{X}ij = \widehat{XC}i^{GDP\ controlled} . GDP_i{}^{0.566} . distance_{ij}{}^{\hat{\delta}_1} e^{\hat{\delta}_2 contiguity_{ij}} e^{\hat{\beta}_j}$$

Table 3: States' Domestic and Foreign Export Capacities by Brazilian Regions

	GDP Uncontrolled Export Capacities				**GDP Controlled Export Capacities**			
I. Domestic Export Capacities	$XC_i^{GDP\ uncontrolled^*}$				$XC_i^{GDP\ controlled^*}$			
	Period 1	*Rank*	*Period 2*	*Rank*	*Period 1*	*Rank*	*Period 2*	*Rank*
NORTH [a]	10 714 231 263	3	7 800 440 817	3	29 278	3	17 484	3
Acre (AC)	598 639 417	25	850 266 170	23	6 096	24	6 266	20
Amazonas (AM)	53 932 009 130	3	39 323 573 083	3	130 933	1	76 462	1
Amapá (AP)	324 270 953	26	149 249 506	26	2 979	26	1 055	26
Pará (PA)	6 396 264 596	16	3 844 733 013	16	13 944	17	7 324	18
Rondônia (RO)	2 254 783 959	22	2 106 050 017	19	12 000	19	8 038	16
Roraima (RR)	779 419 524	24	528 773 113	25	9 716	22	5 763	21
NORTH-EAST [a]	9 829 811 656	4	5 699 769 203	4	23 761	5	11 264	4
Alagoas (AL)	5 239 751 969	17	1 426 143 807	22	20 727	16	4 625	23
Bahia (BA)	21 498 521 451	9	14 189 952 774	8	30 295	13	16 059	11
Ceará (CE)	15 454 251 802	10	9 996 191 426	10	35 786	12	17 220	8
Maranhão (MA)	3 759 793 979	19	1 883 579 890	20	13 785	18	5 427	22
Paraíba (PB)	3 338 274 855	20	2 583 084 334	17	11 973	20	7 529	17
Pernambuco (PE)	25 926 462 443	8	11 529 214 013	9	46 358	7	16 918	9
Piauí (PI)	781 644 038	23	728 814 646	24	3 980	25	2 827	24
Rio Grande do Norte (RN)	3 170 071 564	21	2 402 558 384	18	11 860	21	7 199	19
Sergipe (SE)	9 299 532 807	14	6 558 383 553	13	39 088	10	23 572	5
CENTER-WEST [a]	9 087 301 352	5	4 681 193 719	5	25 772	4	9 398	5
Distrito Federal (DF)	3 989 413 242	18	1 472 606 799	21	8 087	23	2 277	25
Mato Grosso (MT)	13 239 756 552	12	4 107 457 250	14	45 460	8	10 015	14
Mato Grosso do Sul (MS)	7 314 905 846	15	3 909 400 991	15	24 014	15	9 572	15
Goiás (GO)	11 805 129 767	13	9 235 309 834	12	25 529	14	15 728	12
SOUTH-EAST [a]	97 466 134 198	1	68 153 005 444	1	60 257	1	30 909	1
Espírito Santo (ES)	14 635 559 696	11	9 601 642 360	11	35 868	11	17 220	7
Minas Gerais (MG)	52 204 785 298	4	31 914 937 585	4	47 507	6	22 493	6
Rio de Janeiro (RJ)	49 725 812 429	5	16 094 122 819	7	39 181	9	10 501	13
São Paulo (SP)	273 298 379 368	1	215 001 319 013	1	118 473	2	73 425	2
SOUTH [a]	46 929 904 158	2	27 922 018 766	2	57 966	2	26 285	2
Paraná (PR)	46 538 697 139	6	17 699 814 566	6	55 674	5	16 219	10
Santa Catarina (SC)	37 396 015 565	7	21 864 059 348	5	60 054	3	27 147	4
Rio Grande do Sul (RS)	56 854 999 771	2	44 202 182 383	2	58 172	4	35 491	3

II. Foreign Export Capacities	$XC_i^{GDP\ uncontrolled}$				$XC_i^{GDP\ controlled}$			
	Period 1	*Rank*	*Period 2*	*Rank*	*Period 1*	*Rank*	*Period 2*	*Rank*
NORTH [a]	102 152 947	4	90 677 231	4	251	4	188	4
Acre (AC)	867 282	25	175 517	26	9	24	1	26
Amazonas (AM)	39 955 624	17	65 391 968	15	97	20	127	16
Amapá (AP)	19 039 951	20	13 428 099	21	175	16	95	17
Pará (PA)	545 165 513	8	455 064 625	7	1 188	5	867	6
Rondônia (RO)	7 881 352	23	9 558 200	22	42	23	36	22
Roraima (RR)	7 962	26	444 978	25	0	25	5	24
NORTH-EAST [a]	121 440 608	3	90 622 244	5	282	3	163	5
Alagoas (AL)	106 489 825	12	45 346 339	17	421	11	147	15
Bahia (BA)	505 141 931	9	412 996 634	9	712	8	467	9
Ceará (CE)	105 590 609	13	87 852 515	13	245	13	151	14
Maranhão (MA)	169 854 034	10	141 922 260	11	623	9	409	10
Paraíba (PB)	22 058 311	19	15 924 829	19	79	21	46	21
Pernambuco (PE)	127 225 289	11	64 448 692	16	227	14	95	18
Piauí (PI)	15 010 492	21	13 446 777	20	76	21	52	20
Rio Grande do Norte (RN)	31 196 922	18	25 852 038	18	117	19	77	19
Sergipe (SE)	10 398 062	22	7 810 113	23	44	22	28	23
CENTER-WEST [a]	52 502 875	5	90 917 535	3	151	5	202	3
Distrito Federal (DF)	1 716 744	24	961 346	24	3	26	1	25
Goiás (GO)	83 476 023	14	103 561 894	12	181	15	176	12
Mato Grosso (MT)	82 396 210	15	192 760 684	10	283	12	470	8
Mato Grosso do Sul (MS)	42 422 524	16	66 386 216	14	139	17	163	13
SOUTH-EAST [a]	2 007 950 486	1	1 842 678 735	1	1 496	1	1 045	1
Espírito Santo (ES)	676 883 680	6	604 057 530	6	1 659	3	1 083	4
Minas Gerais (MG)	1 885 954 697	2	1 799 383 602	2	1 716	2	1 268	2
Rio de Janeiro (RJ)	681 004 860	5	427 831 507	8	537	10	279	11
São Paulo (SP)	4 787 958 705	1	4 539 442 300	1	2 076	1	1 550	1
SOUTH [a]	914 364 089	2	1 006 731 906	2	1 102	2	944	2
Paraná (PR)	706 108 877	4	995 046 472	4	845	7	912	5
Rio Grande do Sul (RS)	1 386 321 953	3	1 351 877 224	3	1 418	4	1 085	3
Santa Catarina (SC)	650 661 438	7	673 272 023	5	1 045	6	836	7

[a] The region average is calculated as the arithmetic mean of the export capacities of the states in that region.

After controlling for GDP impact, the export capacity values fall sharply as exporter GDP explains a large share of the exports. The rankings constructed from the values of GDP-

controlled export capacities, however, place the large states down a couple of ranks and upgrade the small states. The Rio de Janeiro (RJ)'s ranking changes considerably after controlling for size impact, suggesting that the high export capacities of Rio de Janeiro (RJ) on both markets are driven mostly by its large size. However, the change after controlling for GDP impact is not systematically the same (decreasing or increasing) for domestic and foreign export capacities; for example, Amazonas' ranking by domestic export capacity is higher after controlling for GDP, while its ranking by foreign export capacity becomes lower.

Table 3 shows that the states in the South and South-East regions have relatively higher export capacities on both markets even after controlling for their size. This is not surprising given that their better infrastructure and good transport facilities give them access to large domestic markets and the international markets. On closer inspection, the southern states are found to be individually better integrated into the domestic market compared to the south-eastern states. However, the overall rankings of the two regions as defined by their average domestic export capacities are close, since they are driven mostly by the high performance of São Paulo (SP).

The average domestic export capacity of the Northern region is higher than the North-East region over the period. Note, however, that this result is due mainly to the very high and surprising domestic export capacity of the state of Amazonas (AM). The high foreign export performance of the state of Pará (PA) in the Northern region is also considerable. Pará (PA) is a state specialized mostly in exports of primary products[21]. It also has an advantageous location at the mouth of the Amazon river (AM) with a large port (Port of Belém) giving direct access to international markets by sea. Yet the remarkable results for these two states of the Northern region may be partly due to the special tax regulations for the Free Trade Zone of Manaus (*FTZM*) implemented in the state of Amazonas (AM) to encourage exports to the

[21] The ALICEWEB statistics calculate the exports of Pará (PA) in *Iron ores and concentrates, not agglomerated* at approximately 34% of its total exports in 1998 and the percentage share of *Aluminum not alloyed, unwrought* in the state's exports at 20%.

domestic market[22]. It is possible that some goods produced in part in Amazonas may be re-exported to international markets after being transformed in part or finished in Pará (PA). However, further work is called for to trace the industrial linkages and production chains between these two states.

In Table 4, we analyze the growth in states' export capacities from *Period 1* to *Period 2* based on the percentage changes in the states' export capacities and real average GDPs. Export capacities on both markets fell in general from *Period 1* to *Period 2*, and the downturn was sharper for GDP-controlled export capacities. At first glance, this result appears to contradict the increase in the total domestic and foreign export performances of the states and the positive GDP growth over the period. However, these better performances appear to be driven, not by supply conditions, but mostly by increasing demand on the destination markets. Apparently, the positive GDP growth rates increased the states' market capacities and the same holds true for the international markets where world GDP also rose over the period.[23]

Table 4: Growth in States' GDP Controlled and Uncontrolled Domestic and Foreign Export Capacities (% change from *Period 1* to *Period 2*)

	ΔGDPi [a]	GDP Uncontrolled Export Capacities		GDP Controlled Export Capacities	
		ΔXC_i^*	ΔXC_i	ΔXC_i^*	ΔXC_i
NORTH [b]	42.26	-27.19	-11.23	-40.28	-25.13
Acre (AC)	76.97	42.03	-79.76	2.79	-85.35
Amazonas (AM)	47.97	-27.09	63.66	-41.60	31.08
Amapá (AP)	58.91	-53.97	-29.47	-64.60	-45.75
Pará (PA)	26.88	-39.89	-16.53	-47.48	-27.06
Rondônia (RO)	79.81	-6.60	21.28	-33.01	-13.02

[22] Free Trade Zone of Manaus (*FTZM*) provides tax incentives for exports to the domestic market. Producers in the zone are exempt from the Imposto sobre Productos Industrializados (*IPI*) – a federal excise tax applying to manufactured goods – provided they sell their products to the domestic market.

[23] Redding and Venables (2004a, 2004b) found in their work that overall supply (export) capacity of Brazil decreased of 6.65% from the period 1982/85 to 1994/97 without controlling for the positive impact of GDP growth. Our estimate for Brazil calculated as $\widehat{XC}_{BRZ,t} = \sum_{i \in states} \widehat{XC}_{i,t}$ shows from 1991 to 1997/99 Brazilian overall foreign export capacity decreased of 4,7% which is in coherence with their findings.

Roraima (RR)	26.77	-32.16	5488.92	-40.69	4786.15
NORTH-EAST[b]	48.66	-42.01	-25.38	-52.59	-42.08
Alagoas (AL)	42.01	-72.78	-57.42	-77.69	-65.09
Bahia (BA)	47.26	-34.00	-18.24	-46.99	-34.34
Ceará (CE)	68.57	-35.32	-16.80	-51.88	-38.11
Maranhão (MA)	53.03	-49.90	-16.44	-60.63	-34.34
Paraíba (PB)	44.23	-22.62	-27.81	-37.12	-41.33
Pernambuco (PE)	41.74	-55.53	-49.34	-63.50	-58.43
Piauí (PI)	61.58	-6.76	-10.42	-28.95	-31.74
Rio Grande do Norte (RN)	47.97	-24.21	-17.13	-39.30	-33.63
Sergipe (SE)	31.83	-29.48	-24.89	-39.70	-35.77
CENTER-WEST[b]	62.56	-48.49	73.17	-63.53	33.68
Distrito Federal (DF)	61.26	-63.09	-44.00	-71.84	-57.28
Goiás (GO)	52.46	-21.77	24.06	-38.39	-2.30
Mato Grosso (MT)	83.01	-68.98	133.94	-77.97	66.12
Mato Grosso do Sul (MS)	67.82	-46.56	56.49	-60.14	16.71
SOUTH-EAST[b]	51.02	-30.07	-8.23	-48.70	-30.17
Espírito Santo (ES)	73.53	-34.40	-10.76	-51.99	-34.69
Minas Gerais (MG)	57.01	-38.87	-4.59	-52.65	-26.11
Río de Janeiro (RJ)	39.52	-67.63	-37.18	-73.20	-47.98
São Paulo (SP)	52.35	-21.33	-5.19	-38.02	-25.31
SOUTH[b]	56.53	-40.50	10.10	-54.65	-14.35
Paraná (PR)	60.09	-61.97	40.92	-70.87	7.94
Rio Grande do Sul (RS)	53.40	-22.25	-2.48	-38.99	-23.47
Santa Catarina (SC)	57.48	-41.53	3.48	-54.80	-20.00

[a] The percentage differences are calculated on the basis of average real GDP for the entity in the two periods. For *Period 1*, the only available year is 1991. However, average GDP for *Period 2* is the arithmetic mean over the 1997-1999 period.

[b] The percentage GDP change of the regions are measured by the total average real GDP and their export capacity change by the total average export capacity of all the states in the region from *Period 1* to *Period 2*.

This evolution may be explained in part by Brazil's economic instability in the 1990s, which had a negative impact on the states' export capacities on both markets. Also of note are two main policy shocks in the Brazilian economy, which may imply different consequences

depending on the destination market. The first shock concerned the change in Brazil's monetary policy in the mid-1990s. In 1994, Brazil introduced the *Plano Real* (Real Plan) and pegged the Brazilian real to the U.S. dollar in order to curb inflation, which was a great concern in early 1990s. The transition phase provoked the over-appreciation of Brazilian real and a loss in the competitiveness of Brazilian goods on the international markets. In January 1999, the Brazilian real was devaluated by 66% against the US dollar. The second shock involved Brazil's trade policy change in the 1990s. In 1991, Brazil started gradually decreasing its international and regional tariffs following the creation of MERCOSUR between Brazil, Argentina, Uruguay and Paraguay in March 1991. The fiercer competition faced by the Brazilian states on the domestic market could have reduced their capacity to export to the domestic market. Trade policy liberalization could also have pushed some states more in the direction of the foreign markets, which is indeed the case for some Brazilian states during the period.

Yet exceptions exist, especially for the Center-West states whose foreign export capacities rose. During the period, the Center-West region specialized more in agricultural goods exported mainly to foreign markets (e.g. soya beans to China). Mato Grosso (MT) and Amazonas (AM) were the leading states, followed by Mato Grosso do Sul (MS) and Paraná (PR), which also posted a considerable increase in their foreign export capacities[24]. These results can also be checked from their relatively higher ranks in *Period 2* presented in Table 3.

We have seen from the gravity results that the states' domestic export capacities are considerably higher than their foreign export capacities. However, the extent of this relatively higher integration into the domestic market is not necessarily uniform across all the states. In the next section, we set out to identify the relative market orientations of the states and the linkages between their domestic and foreign export capacities in the 1990s. To this end, we

[24] However, the foreign export capacity of Roraima (RR) shot up in percentage terms over the period due to its initially very weak export performance. Roraima's total exports to the foreign market came to *$23,705* (0.00007% of the Brazilian states' total foreign exports) in 1991. Hence a small random increase in its export values prompts a large percentage change.

will concentrate on the states' GDP-controlled domestic and foreign export capacities as estimated by PPML.

V. Market Orientation of the States and Domestic-Foreign Export Capacity Linkages

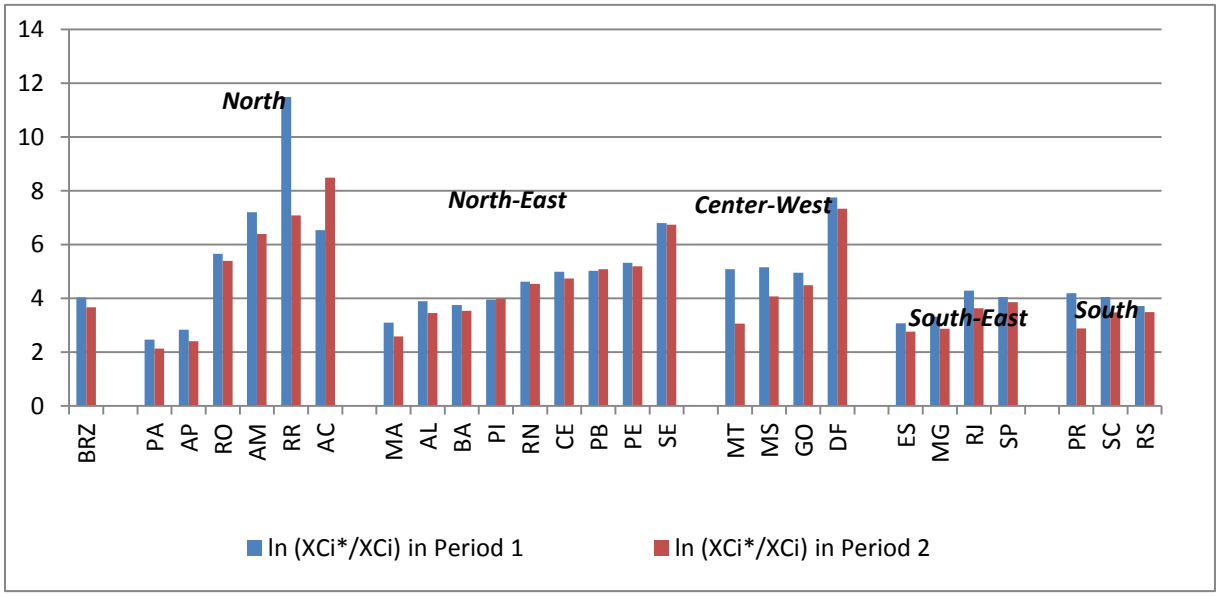
In the real world, exporters face the choice of exporting to different markets, domestic and/or foreign. Better exporters to the domestic market probably have a greater chance of also exporting to the foreign market due to their better supply side conditions. However, marginal differences can be found in the states' relative market orientations depending on the linkages between their domestic and foreign export capacities. In view of the production possibility frontier, a trade-off (substitution effect) may be made between resources allocated to production for the domestic and for the foreign markets. Yet positive externalities and vertical production channels between production industries targeting the domestic and foreign markets can also work as complementary forces and strengthen the positive relationship between domestic and foreign export capacities. These forces in play hence form the source of differences in the states' relative market orientations and define their trade patterns.

Graph 1 shows the Brazilian states' domestic-to-foreign market integration levels, measured in terms of their relative export capacities. These are also presented by region, since infrastructure advantages such as transport facilities make states of the same region more accessible and a relative uniformity of characteristics is found within Brazilian regions, as discussed above. The statistical indicator used is the ratio of domestic-to-foreign export capacities[25]. Our cross-state comparison points up the states' relative market orientations and how they change from *Period 1* to *Period 2*. However, our indicator is measured in natural logarithm form since the export capacity explanatory factors interact multiplicatively in the

[25] Note that the domestic-foreign ratio of GDP-controlled export capacities is similar to the GDP-uncontrolled figure. This is not surprising, since the denominator ($\exp(\widehat{\alpha}_1 * \ln GDP_i)$) is equal for both market destinations computed by the GDP of state *i*.

theoretical equation, which leads to more variation for the large values. The logarithmic scale reduces the differences between domestic and foreign export capacities for the states whose ratios are larger by squeezing them together and stretching them out in the inverse case.

Graph 1: States' market orientation by region and change from *Period 1* to *Period 2*



Source : Author's calculation by using the results in Table 3.

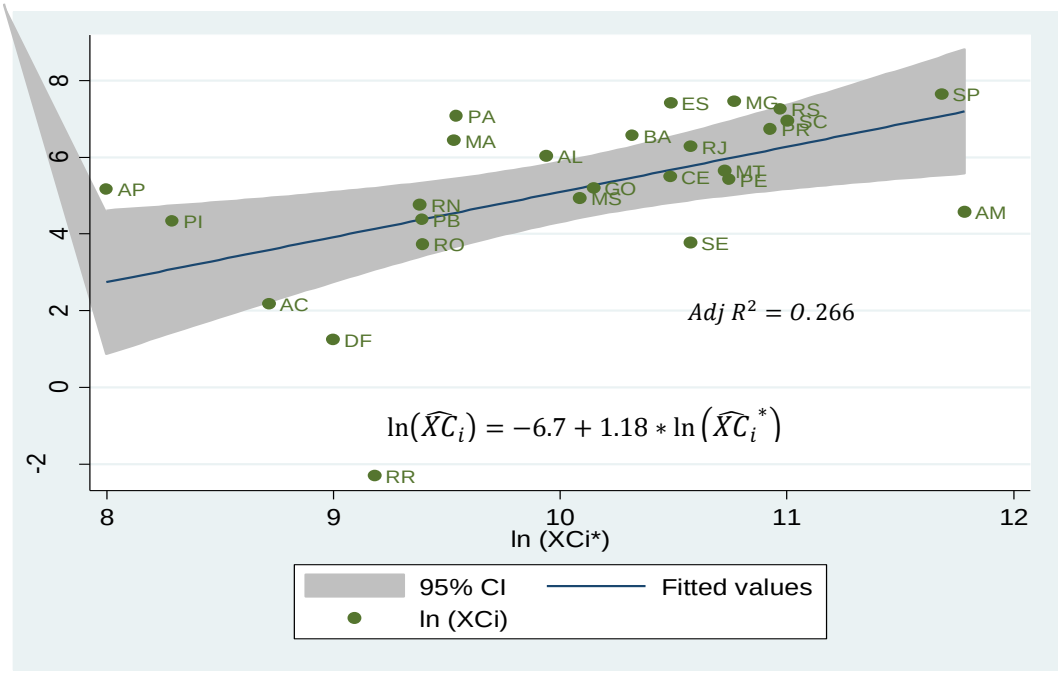
In *Graph 1*, the domestic-to-foreign integration levels for all the states are greater than 2 in log natural form. This means that the domestic export capacities of the states are at least 7 times higher than their foreign export capacities. Hence, as expected, the states are better integrated into the domestic market. More striking than the extent of ratios (approximately from 2 to 8 in log natural form, even after ignoring the high value for Roraima -RR) is that the market orientations differ considerably across the states. *Graph 1* also shows that the South and South-East regions' export capacities are more balanced between domestic and foreign markets than the other three regions. These two regions are where Brazil's large rich states are located. So they may well respond to different markets with a wider range of products and varieties supported by better infrastructures that help them to access even remote world markets.

The change in ratios from *Period 1* to *Period 2* is almost always towards the foreign markets, except in the case of Acre (AC), which is a very isolated state in the north of Brazil. This suggests that Brazil's liberalization policies in the 1990s succeeded in improving the states' integration into the world markets, even though their foreign export capacities generally decreased in absolute terms as discussed in the previous section. This swing towards the foreign markets is largest for the Center-West states of Mato Grosso (MT) and Mato Grosso do Sul (MS). These states are followed by Paraná (PR) in the South and the state of Amazonas (AM). Amazonas' swing towards the foreign markets is especially remarkable, coming as it does in a period of tax incentives for domestic market production.

In the next step, we trace the dominant pattern of domestic-to-foreign export capacities in Brazil by looking at their log-linear relation for 26 states. We use GDP-controlled export capacities, which we believe to provide a better measurement of integration into both markets.[26] This is expected to be positive, since the states' supply side conditions will generally define their capacity to export to both destinations. The possible outliers are states whose market orientations are significantly different to the average pattern. We proceed with the same analysis for both data periods (*Period 1* and *Period 2*) to see how the general pattern of these linkages and the outliers changes over time. Rapid liberalization during the period may have prompted the states to become more specialized due to economies of scale and the possibility of low-cost imports from world markets in the case of expensive local production. This would have stepped up the substitution between domestic and foreign market oriented production. However, export capacities could have grown on both markets due to increased market efficiency, positive externalities and better infrastructure.

[26] The results for GDP-uncontrolled export capacities are also available from the author. Aside from the greater explanatory power of the model for GDP-uncontrolled export capacities, the results are consistent with the GDP-controlled results presented in the paper.

Graph 2: Linear relation between GDP-controlled domestic and foreign export capacities in *Period 1*



Graph 2 shows the fitted regression line for the states' foreign export capacities over their domestic export capacities for *Period 1* with the relevant confidence intervals. The equation coefficient is significantly different from zero and positive. Thus, states with good domestic market export capacities also have good foreign market capacities and vice versa. Confidence intervals indicate outliers with relatively more of a domestic or foreign market orientation compared to the average pattern in Brazil. The foreign export capacities of Maranhão (MA), Pará (PA), Espírito Santo (ES), Minas Gerais (MG) and Amapá (AP) are significantly greater than expected for their given domestic export capacities and lower for Amazonas (AM), Sergipe (SE), Distrito Federal (DF) and Roraima (RR).

The existence of rich natural resources appears to determine those states with a foreign market orientation. Maranhão (MA) and Pará (PA) are Brazil's leading raw aluminum exporter states for the period. However, Espírito Santo (ES) has a more diversified specialization structure; iron and steel products, chemistry, coffee, etc. The Port of Vitória – the largest port in the

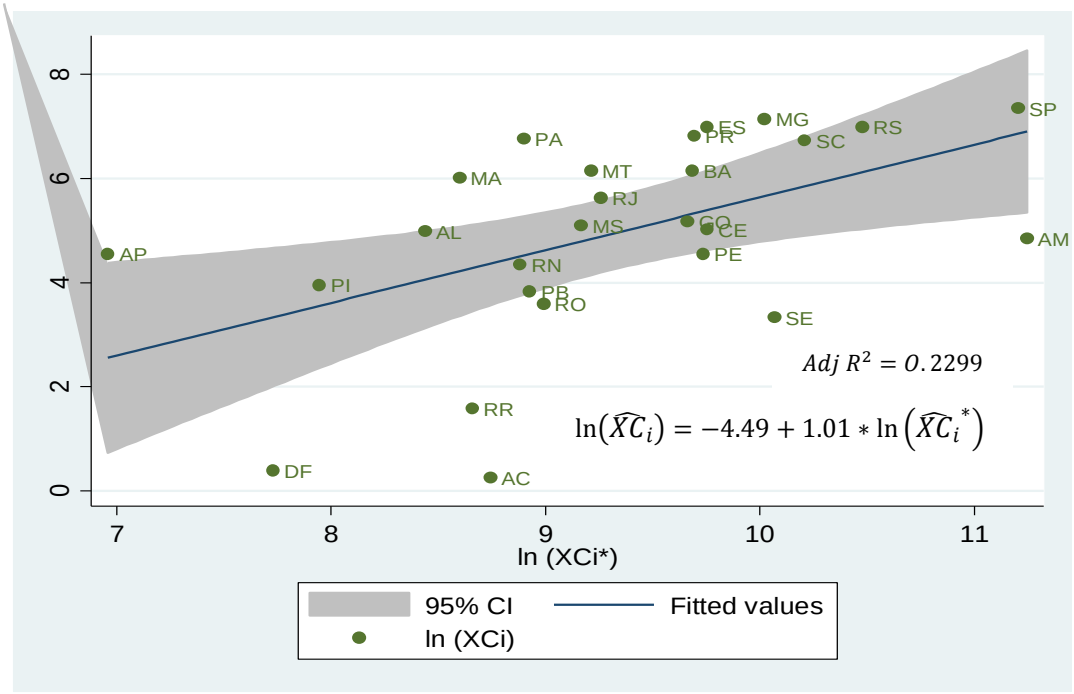
state – provides access to international markets, but is also well-connected with the rest of the country. Hence, there appears to be a trade-off between the foreign market-oriented and domestic market-oriented industries, possibly driven in part by rich natural resources. Amapá (AP) posts very poor domestic export capacities, whereas its 1991 exports were almost exclusively industrial with approximately 70% in manganese minerals.[27] The Port of Macapá in Amapá (AP) is also an important port for the state's access to international markets and the other Northern region states. Minas Gerais (MG) also has large iron reserves and produces a large amount of iron ore.

Conversely, Amazonas (AM), Distrito Federal (DF), Sergipe (SE) and Acre (AC) are more domestic market oriented. Distrito Federal (DF) is an artificially planned state built in 1960 as the country's capital. Its economy is driven mostly by the service sector meeting the demand of the local population employed in administrative and bureaucratic institutions. The domestic market orientation of Amazonas (AM) can be explained by the existence of the Manaus FTZ, as mentioned above. In Sergipe (SE), a trade-off between domestic and foreign market destination production seems to be at work. The large domestic-to-foreign export capacity ratios of Roraima (RR) and Acre (AC) may be due to the fact that their weak economies form a greater hindrance to their entering the international markets than the domestic market.

In *Graph 3*, we trace the log-linear relation of foreign-to-domestic export capacities for *Period 2*. The coefficient of the model is decreasing: states' foreign export capacities in *Period 2* increase by 1.01% as opposed to 1.18% in *Period 1*, with an increase of 1% in their domestic export capacities. The flattening in the slope of the line reveals that the growing foreign market orientation during the liberalization period, as discussed above in Figure 1, was not uniform across the states. States' foreign export capacities converged to each other. The more domestic market-oriented the states in *Period 1*, the more foreign market oriented they became in *Period 2*.

[27] The precise name of the product in NBM is "QQ.OUT.MINERIO DE MANGANES,N/AGLOMERADO,E CONCENTRADOS". Please care that for the year 1991, ALICEWEB trade statistics are categorized by the *Brazilian Merchandise Nomenclature* (NBM).

Graph 3: Linear relation between GDP-controlled domestic and foreign export capacities in *Period 2*



In *Period 2* , as opposed to *Period 1*, we observe that Mato Grosso (MT) and Paraná (PR) states are new outliers with significantly higher foreign export capacities to domestic export capacities than they should have compared to the Brazilian average. In other words, they are significantly more foreign market oriented than other states. This result points up that the higher foreign export capacity of Mato Grosso (MT) in *Period 2*, driven by the change in product specialization, also prompted a significant change in its market orientation with a re-specialization in foreign market-oriented products substituting for the domestic market products. Paraná (PR) is an important agricultural state, but it also boasts diversified industrial production ranging from computers to cosmetics and especially car manufacturing. Thus, the foreign export capacity of Paraná (PR) appears to have benefited from the new trade opportunities created by the Brazilian liberalization process, while its domestic market export capacity appears not to.

VI. Conclusion:

After controlling for demand side conditions in keeping with Redding and Venables (2004a, 2004b), we measured the integration of Brazilian states into the domestic and foreign markets. Our domestic foreign export capacity measurements were estimated by a gravity frame for the two periods concerned by the trade data available spanning four years (1991 for *Period 1*, and 1997-1998-1999 for *Period 2*). We also controlled for GDP impact using a second-stage regression, which otherwise dominates the states' trade pattern. All regressions, first and second stage, were estimated by the PPML estimator inspired by Santos Silva and Tenreyro (2006).

From *Period 2* to *Period 1*, the states' export capacities to domestic markets decreased as did, on the whole, their export capacities to foreign markets. However, the Brazilian states' trade performances actually rose in the 1990s. This happened because the decrease in the states' export capacities was offset by growth in the destinations' market capacities. Yet there were exceptional states whose foreign export capacities increased such as Mato Grosso (MT), Amazonas (AM), Mato Grosso do Sul (MS) and Paraná (PR).

First, we used export capacities to define the states and regions of Brazil with relatively better domestic and/or foreign market integration. The Southern and South-Eastern regions are relatively more integrated into both markets compared to other regions. However, the Southern states are individually more integrated into the domestic market compared to the South-Eastern states, with the exception of the high performance of São Paulo (SP). In the Northern region, Amazonas (AM) has strikingly high domestic export capacities while Pará (PA) performs better on the foreign market compared to other states in the region.

In the next step, we looked at the states' market orientation measured by the domestic-foreign export capacity ratios. These fell for almost all the states in *Period* 2, pointing up that Brazil's liberalization policy drove increased foreign market orientation. However, a comparison between the states found relative differences between state orientations. The log-linear

relation between the states' GDP-controlled domestic and foreign export capacities identified the states whose market orientation differs compared to the general pattern in Brazil. Namely, the states of Amapá (AP), Maranhão (MA), Pará (PA) and Espírito Santo (ES) are more foreign market oriented than the Brazilian state average, while Distrito Federal (DF), Amazonas (AM) and Sergipe (SE) are more domestic market oriented. We endeavored to identify plausible reasons for these different market orientations and found that states with rich natural resources are mostly foreign market oriented. In *Period 2*, Mato Grosso (MT) also became an outlier in terms of a shift in its specialization patterns towards products mostly exported to foreign markets.

Although the integration of countries into the world markets is largely discussed in the empirical and theoretical literature, there is relatively less work done on the internal integration of national markets. Brazil's high domestic market fragmentation and the period of available data, which coincide with the country's liberalization process, make for interesting insights on this issue. Our study takes a new approach by analyzing Brazil's domestic integration with a more detailed decomposition for each sub-national unit (states and regions) and in interaction with foreign market integration.

Future work could define which of the states' characteristics, in empirical terms, determine their relative domestic and foreign market performances. The strikingly high domestic market orientation of the state of Amazonas (AM) is also an ambitious focus for further work. The state's production is encouraged by the Free Trade Zone of Manaus (*FTZM*) tax incentives to export to the domestic market. Yet a look at the state's industrial linkages and production chains turns up that some goods produced in Amazonas may be re-exported to international markets after being transformed in part or finished in other states of the region or in the rest of Brazil.

ANNEX

Table 5: Country List

Algeria (DZA)	Guinea-Bissau (GNB)	Portugal (PRT)
Angola (AGO)	Guyana (GUY)	Qatar (QAT)
Argentina (ARG)	Haiti (HTI)	Rwanda (RWA)
Australia (AUS)	Honduras (HND)	Saudi Arabia (SAU)
Austria (AUT)	Hong Kong SAR, China (HKG)	Senegal (SEN)
Bahamas, The (BHS)	Hungary (HUN)	Sierra Leone (SLE)
Bahrain (BHR)	Iceland (ISL)	Singapore (SGP)
Bangladesh (BGD)	India (IND)	Spain (ESP)
Barbados (BRB)	Indonesia (IDN)	Sri Lanka (LKA)
Belize (BLZ)	Ireland (IRL)	Sudan (SDN)
Benin (BEN)	Israel (ISR)	Suriname (SUR)
Bermuda (BMU)	Italy (ITA)	Sweden (SWE)
Bolivia (BOL)	Jamaica (JAM)	Switzerland (CHE)
Bulgaria (BGR)	Japan (JPN)	Syrian Arab Republic (SYR)
Burkina Faso (BFA)	Jordan (JOR)	Tanzania (TZA)
Cameroon (CMR)	Korea, Rep. (KOR)	Thailand (THA)
Canada (CAN)	Kuwait (KWT)	Togo (TGO)
Cape Verde (CPV)	Lebanon (LBN)	Trinidad and Tobago (TTO)
Central African Republic (CAF)	Liberia (LBR)	Tunisia (TUN)
Chad (TCD)	Libya (LBY)	Turkey (TUR)
Chile (CHL)	Madagascar (MDG)	Uganda (UGA)
China (CHN)	Malawi (MWI)	United Arab Emirates (ARE)
Colombia (COL)	Malaysia (MYS)	United Kingdom (GBR)
Comoros (COM)	Mali (MLI)	United States
Congo, Rep. (COG)	Malta (MLT)	Uruguay (URY)
Costa Rica (CRI)	Mauritania (MRT)	Venezuela, RB (VEN)
Cyprus (CYP)	Mauritius (MUS)	Vietnam (VNM)
Denmark (DNK)	Mexico (MEX)	Yemen, Rep. (YEM)
Dominican Republic (DOM)	Morocco (MAR)	Zambia (ZMB)
Ecuador (ECU)	Mozambique (MOZ)	Zimbabwe (ZWE)
Egypt, Arab Rep. (EGY)	Nepal (NPL)	
El Salvador (SLV)	Netherlands (NLD)	
Ethiopia (ETH)	New Zealand (NZL)	
Fiji (FJI)	Nicaragua (NIC)	
Finland (FIN)	Niger (NER)	
France (FRA)	Nigeria (NGA)	
Gabon (GAB)	Norway (NOR)	
Gambia, The (GMB)	Pakistan (PAK)	
Germany (DEU)	Panama (PAN)	
Ghana (GHA)	Paraguay (PRY)	
Greece (GRC)	Peru (PER)	
Grenada (GRD)	Philippines (PHL)	
Guatemala (GTM)	Poland (POL)	
Guinea (GIN)	Romania (ROM)	

Table 6: List of Brazilian states by region and their abbreviations:

North		**Center-West**	
ACRE	AC	MATO GROSSO	MT
AMAZONAS	AM	MATO GROSSO DO SUL	MS
AMAPA	AP	GOIAS	GO
PARA	PA	DISTRITO FEDERAL	DF
RONDONIA	RO	**South-East**	
RORAIMA	RR	ESPIRITO SANTO	ES
North-East		MINAS GERAIS	MG
ALAGOAS	AL	RIO DE JANEIRO	RJ
BAHIA	BA	SAO PAULO	SP
CEARA	CE	**South**	
MARANHAO	MA	PARANA	PR
PARAIBA	PB	RIO GRANDE DO SUL	RS
PERNAMBUCO	PE	SANTA CATARINA	SC
PIAUI	PI		
RIO GRANDE DO NORTE	RN		
SERGIPE	SE		

CHAPTER 2: The Impact of MERCOSUR on Trade of Brazilian States[28]

Résumé

On décompose l'impact de MERCOSUR sur le commerce brésilien en distinguant les effets de l'accord sur les échanges entre les états brésiliens et de chaque état brésilien avec le MERCOSUR et le reste du monde. On utilise un modèle de gravité pour mettre en évidence les éventuels effets de création et de détournement de commerce et également un effet d' « érosion des préférences ». En utilisant les données sur le commerce interétatique sur une période de quatre ans, dont un an avant la période de MERCOSUR (1991), on aboutit à des résultats empiriques au niveau des 27 états brésiliens. Nous montrons que le MERCOSUR a permis d'augmenter le commerce des états avec les pays membres, sans effets importants sur le commerce interétatiques ou avec les pays tiers. Nous confirmons que l'impact du MERCOSUR varie selon les régions du Brésil.

Abstract

We consider the impact of MERCOSUR on trade among Brazilian states and on trade by Brazilian states with MERCOSUR and the rest of the world. We use a gravity model to shed light on MERCOSUR's possible creation and diversion effects as well as its "preference erosion" effect on trade among Brazilian states. Using data on interstate trade over a four-year period, including one year prior to the MERCOSUR period (1991), we deliver empirical evidence at state level with a focus on the impact of MERCOSUR which can vary across Brazilian regions. We show that MERCOSUR increased Brazilian states' trade with member countries, but had no effect on either interstate trade or Brazilian states' trade with third countries. The paper finds that MERCOSUR's impact varies across Brazilian regions.

[28] This chapter is issue of a published joint paper with Jean-Marc Siroën.

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I. Introduction

Much like other Latin American and many developing countries, Brazil long promoted an "import substitution" strategy and kept its doors relatively closed to international trade, endeavoring to take advantage of its sub continental status to promote domestic trade. Starting in the 1950s and throughout the military dictatorship (1964-1985), governments implemented protectionist and industrial policies to diversify the production structure seen as too highly concentrated in primary goods. This strategy was closely associated with regional development policies, managed at federal level, with infrastructure investment (e.g., the Trans-Amazonian Highway) and with policies to attract foreign capital in order to produce manufactured goods mainly for the Brazilian market (creation of the Manaus Free Trade Zone in 1967). However, the "Brazilian miracle" turned into an inflationary and over-indebted economy. The return to democracy strengthened the federal system by giving more rights to states and municipalities (Constitution of 1988) and, starting in the 1990s, the Real Plan opened the country up to international trade.

The previous Brazilian development strategy should have promoted specialization across Brazilian regions instead of a specialization at national level. However, the most recent trade openness strategy, albeit in complete, should lead Brazil as a whole to become more specialized. This implies a substitution of imported goods for previously uncompetitive homemade products, which means that, in relative terms, each state should trade less with one another and more with foreign countries. We would then expect international trade openness to reduce interstate trade compared with foreign trade.

Although openness had a significant multilateral component with the reduction of applied MFN (Most Favored Nation) tariffs, Brazilian trade openness went ahead within the regional MERCOSUR (*Mercado Común del Sur*) framework (Treaty of Asunción, 1991). However, unlike other Latin American countries (e.g., Chile, Mexico and Peru), Brazil has few preferential trade agreements. MERCOSUR is virtually the only regional or bilateral

agreement Brazil has signed, which makes it easier to isolate its repercussions on Brazilian domestic and foreign trade.

The Vinerian empirical literature frequently uses gravity models in order to compare creation and diversion trade effects. Intra-Regional Trade Agreements are expected to increase trade between members to the detriment of it with the rest of the world with an indeterminate net effect. Literature usually confirms that MERCOSUR had a significant trade creation effect whatever the specification of the model and the estimation method (Soloaga and Winters, 2001; Dee and Gali, 2003; Ghosh and Yamarik, 2004; Carrère, 2006; Coulibaly, 2007; Magee, 2008). As expected by theory, the import trade diversion effect is also frequently observed by the same authors meaning that MERCOSUR's imports from the rest of the world decrease consecutively to the agreement. However, an export trade diversion effect -i.e., less exports to rest of the world- is not so clearly observed: it is insignificant (Coulibaly, 2007), varying with time (Soloaga and Winters, 2001) or trade creating (Carrère, 2006).The difference between trade creation and trade diversion frequently give off a net trade diversion effect for Mercosur (Dee and Gali, 2003; Carrère, 2006; Coulibaly, 2007).

Literature on the impact of customs unions on trade usually considers member countries to be a single, fully integrated entity and therefore ignores the effects of such agreements on domestic trade. The trade creation/diversion effect is supposed to be found only between member and third countries, not within countries. This is highly debatable for a country as fragmented as Brazil. We can consider pre-MERCOSUR Brazil to be a customs union between the 27 Brazilian states, diverting trade from other countries including the current MERCOSUR. We can then consider the Treaty of Asunción to be an enlargement to three neighboring countries (Argentina, Paraguay and Uruguay),expected to produce three different effects: first, a trade creation effect for Brazilian states, e.g., increasing trade between each Brazilian state and its new partners; second a diversion effect vis-à-vis third countries –the rest of the world –and, third, a "preference erosion"[29] effect due to the fact that "duty free"

[29]Preference erosion refers to erosion in the value of preferential access, where trade liberalization leads a decrease in prices on the market to which a country (Brazilian states) has been given preferential trading access.

trade among Brazilian states is extended to MERCOSUR countries, leaving some uncompetitive Brazilian producers exposed to new foreign competition. Theoretically, the eviction of uncompetitive outputs is part of the trade creation effect, e.g., a welfare gain for Brazil due to a net consumer gain derived from a lower price for goods imported from other MERCOSUR countries. However the trade effects of MERCOSUR could be unevenly distributed across Brazilian states. The most competitive states might maintain their market share on Brazilian markets and increase their exports to MERCOSUR, while others may be faced with dwindling exports to other Brazilian states as they fail to increase their exports to MERCOSUR. For a country like Brazil, which suffers from strong regional inequalities and whose domestic market is highly fragmented, the impact of MERCOSUR will vary a great deal across the 27 states (26+Federal District).

The Treaty of Asunción should then generate relative growth in Brazilian states' trade with other MERCOSUR countries and a decrease with other Brazilian states (preference erosion effect) and the rest of the world (diversion effect). However, this outcome based on basic static theory could well overlook unexpected adaptation to globalization. Actually, one of the most challenging consequences of trade globalization is the acceleration of the vertical specialization process and the international fragmentation of the "value chain".[30] Once we consider Brazil as an aggregation of 27 states, which all have their specific comparative advantages, trade openness might have led to greater vertical specialization between Brazilian states, e.g., São Paulo processing of primary products exported from Minas Gerais or relocation of labor-intensive activities from "rich" states to poor states paying lower wages. Moreover, the small number of "ports" (air or sea) might also foster vertical specialization, for example, with the location of assembly work close to a port.

This context of relatively rapid Brazilian openness in 1990s and the availability of even just a few years of interstate trade data mean that we can look at the Brazilian states as trade entities arbitrating between domestic and foreign markets, the former comprising trade among Brazilian states and the latter with MERCOSUR and other countries.

[30]See. for example, Hummels *et al.*(2001), Yi (2003; 2009) and Freund (2009).

The aim of this paper is to consider the effects of MERCOSUR on the direction of Brazilian trade. In Section 1, we present the issue and the possible regionally different effects of MERCOSUR on Brazilian trade. In Section 3, we present our empirical methodology, the basic specification for the gravity model we use and our data sources. Section 4 delivers empirical evidence for trade creation, trade diversion and preference erosion at state level. Section 5 focuses on the impact of MERCOSUR which can vary across Brazilian regions. We conclude in Section 6.

II. Previous Studies and a New Focus on the Issue

Studies on interstate trade are nothing new, but the literature on the "border effect" gives new reasons to reconsider it. One of the most famous papers on the topic is McCallum's "home bias" (McCallum, 1995). In it, he estimates trade between Canadian provinces at 22 times expected trade between Canadian provinces and the United States. The inclusion of control variables in the gravity model used, including the distance between regions and their size, enabled the author to attribute this huge "home bias" to a "border effect" as a large impediment to trade. Since this seminal work, the border effect has been confirmed, albeit less intense, by refined econometric methods that do a better job of dealing with the omitted variables bias and size heterogeneity, obviously important in the case of US-Canadian trade (Helliwell, 1998; Wolf, 2000; Anderson and van Wincoop, 2003; Balistreri and Hillberry, 2007). Other empirical studies concern other countries like China (Poncet, 2003; 2005), Japan (Okubo, 2004) and the EU (Chen, 2004). However, there is a lack of domestic inter-regional trade data available to be able to estimate border effects for other countries and regions.

On the basis of available interstate trade data, some authors have quantified this domestic fragmentation compared with the level of Brazilian state integration into the world market. Hidalgo and Vergolino (1998) find that Brazilian interstate exports are 11.5 times higher than exports from Brazilian states to foreign countries (cross-section for 1991). However, the model is highly biased by the absence of country/state fixed effects to control for a heterogeneity bias and by the elimination of zero observations. Pooling the data for the four

available years (1991, 1997, 1998 and 1999), Paz *et al.* (2003) obtain border effect measurements that are sometimes implausible. Results are actually sensitive to different methods (inclusion of country/state fixed effects and treatment of zero observations). Using the same data for intra-state, interstate and international trade, Daumal and Zignago (2010) focus on both the "home bias" and on Brazilian interstate integration compared with intra-state trade. After controlling for size, distance and heterogeneity (country/state fixed effects), they show that Brazilian states trade 38 times more with each other than with foreign countries. Leusin *et al.* (2009) and Silva and Oliveira (2007) find very similar results for the same time period.

Brazil's relative fragmentation originates mainly in historically uneven and disjointed development across different Brazilian regions, hardly corrected by regional integration policies. It is seen in high domestic transport costs due to the lack of infrastructures and large inter-regional inequalities accompanied by differences in consumption preferences. Even though it swings cyclically between "recentralization" and "decentralization" periods, Brazil is a federal country with considerable state autonomy in terms of regulation and fiscal policy. For example, the Brazilian equivalent of VAT (ICMS) is collected at state level, which introduces distortions in interstate trade and probably contributes to the interstate border effect (see Brami-Celentano and Siroën, 2007). At the beginning of the 1990s, Brazil was not only an economy relatively closed to trade with foreign countries, but each state was more (Northern states) or less (Southern states) closed to trade with other states. Daumal and Zignago (2010) point out that, despite significant progress with integration policies, the Brazilian market is still fragmented, although less so than China (Poncet, 2005). Actually, the internal border effect relative to intrastate trade stood at a ratio of 23 in 1991 and even fell to 13 in 1999. Note that, in 1999, a Brazilian state traded 460 times more with itself on average than with a foreign country.

In this paper, we use a similar approach to address a different issue. We take the gravity model methodology inspired by the "border effect" literature, not to quantify it using intra-state trade as a reference, but to shed light on the impacts of MERCOSUR on the direction of Brazilian state trade, comparing intra-Brazilian, intra-MERCOSUR and international trade.

We suggest that Brazil's openness to international trade in the 1990s, especially within MERCOSUR, triggered a shock that affected the trade-off between the different possible trade directions for Brazilian states. We could expect this openness to be detrimental to domestic trade, because some states might prefer to trade with relatively more accessible foreign countries instead of other states, especially in the MERCOSUR area. After the "shock", it might have been cheaper for Paulistan firms to export to opening Argentina than to Amazonian states. If this hypothesis were to hold, it would mean that Brazil's integration into regional (MERCOSUR) and world markets could undermine the traditional Brazilian objective to promote a more integrated Brazilian market. However, this assumption might be contradicted by the fact that greater international trade could induce more labor division and specialization within Brazil and then drive up interstate trade in an overall trend towards vertical specialization.

III. Methodology and Data

Recent empirical studies on the impact of regional trade agreements (RTAs) on countries' trade and post-McCallum "border effects" studies to measure intra-country trade volumes usually use gravity models, which estimate the expected bilateral trade using a number of control variables including size and different distance measurements (geographical, cultural, institutional, etc.). The challenge here is to link both separately measured issues. For this purpose, we need to consider Brazil not as a single integrated country, but as a huge customs union covering 27 different "countries" (the Brazilian States).

The gravity model used in this paper takes up the theoretical rationale put forward by Anderson and van Wincoop (2003), which states that trade between two units, depends on their bilateral trade costs and their trade costs with the rest of world. They call the latter multilateral resistance (MR) as it measures the country's trade costs with all its trade partners, which have to be included to prevent an omitted variable bias in the regression.

The gravity model[31] generated by the theory is:

$$\ln \frac{X_{ij}}{Y_i Y_j} = k + (1 - \sigma)\left[\ln t_{ij} - \ln P_i - \ln P_j\right]$$

where t_{ij} is the bilateral trade cost between i and j, while $\ln P_i$and $\ln P_j$ are the logarithmic measurements of prices as an indicator of MR (e.g., high tariffs and non-tariff barriers imply higher domestic prices). This equation can be augmented with many structural and policy variables expected to have an impact on trade volumes as components of trade costs, e.g., contiguity, common language, common colonizer RTAs.

The usual way of addressing MR is to introduce country fixed effects, which are dummy variables attached to each exporter or importer trade unit. Our empirical model uses this methodology and controls for MR by introducing time invariant exporter and importer fixed effects for sample countries and Brazilian states. In addition to the basic variables in the traditional gravity model (exporter and importer GDPs, bilateral distance), we also control for contiguity (common border). In keeping with the trade creation-diversion literature, we augment the model introduced by Anderson and van Wincoop (2003) with the variables measuring MERCOSUR's trade impact.

The creation of MERCOSUR constituted a shock for Brazil's domestic and foreign trade costs and changed the country's domestic and international trade structure. In fact, although MERCOSUR directly reduced trade costs between local units and member countries (e.g., Minas Gerais-Argentina), it also changed the relative level of Brazil's trade costs with third countries (e.g., Minas Gerais-Germany) as well as relative costs among Brazilian States (e.g., Minas Gerais-Pará).Following Magee (2008) and by considering each Brazilian state as a country, the impact of MERCOSUR on the exports and imports of states and member countries will be assumed as symmetric. Thus, we will measure MERCOSUR's trade creation between members (state or country), its diversion effect on Brazilian states trade with the rest

[31]See Deardorff (1998), Anderson and van Wincoop (2003), Feenstra (2004).

of the world and the preference erosion impact (trade shift from Brazilian domestic market to MERCOSUR countries).

Gravity models, long estimated using ordinary least squares, were challenged by Santos Silva and Tenreyro (2006). In addition, many economists prefer the PPML (*Poisson Pseudo Maximum of Likelihood*) estimator over conventional log-normal methods in gravity equation estimations mainly due to the limits of log-normal specification in gravity models. First, the estimation methods calling for a logarithmic transformation give rise to inefficient estimated parameters and increase inconsistency since the error terms are heteroscedastic and their expected values depend on the model regressors (*Jensen's Inequality)*. Second, the PPML estimator is a useful tool for dealing with zero trade values, which conceal a large amount of information explaining why some countries trade very little. Log-linearization, which returns zero trade values to missing data points, can cause a bias in the estimation, especially when the zero trade outcomes are not randomly distributed.

However, the PPML estimator's assumption of equidispersion $V[T_{ij}|x] \propto E[T_{ij}|x]$ considers the conditional variance of the dependent variable (T_{ij}) to be equal to its conditional mean. Since this assumption is unlikely to hold, Santos Silva and Tenreyro (2006) recommend estimating statistical inferences based on an Eicker—White robust covariance matrix estimator.

Burger *et al.* (2009) posit that other Poisson family estimators (*Negative Binomial* and *Zero Inflated Poisson*) can be used depending on the reason why the conditional variance is higher than the conditional mean, due to overdispersion or excess zero trade values or both. From an economic point of view, negative binomial specification accounts for unobserved heterogeneity, which is generated by an omitted variable bias. The distribution equation of this specification is adjusted for the overdispersion. Yet its variance is a function of the conditional mean (μ) and the dispersion parameter (α). Another possible cause for the violation of the equidispersion assumption can be found in excess zeros in the trade volumes: the Zero-Inflated Poisson (ZIP) model (Lambert, 1992; Greene, 1994; Long, 1997) accounts for two latent groups. One is strictly zero for the entire sample period and the other presents

positive trade potential, irrespective of whether they trade or not. The first part of the model is a logit regression estimating the probability of belonging to "never-trading group", while the second part is a Poisson regression.

Negative binomial specification introducing the overdispersion parameter in the distribution is an understandable statistical choice. However, unlike the ZIP specification, it does not provide an economic rationale for excess zeros. Furthermore, the negative binomial model is based upon a gamma mixture of Poisson distributions whose conditional variance is a quadratic function of its conditional mean. As Santos Silva and Tenreyro (2006) put it, within the power-proportional variance functions, the estimators assuming conditional variance as being equal to higher powers of the conditional mean give more weight to observations from smaller countries whose data quality is questionable.

From this perspective, we consider that the ZIP model is a stronger methodological tool than the negative binomial model for solving the overdispersion problem in a gravity model of trade, since it has a theoretical rationale in addition to its statistical value[32]. Thus, in this paper, we use two estimators: a PPML in line with Santos Silva and Tenreyro (2006) and a zero-inflated Poisson pseudo-maximum likelihood model (ZIPPML) from the modified Poisson estimator family to deal with the overdispersion problem encountered in Poisson estimations of trade models.

Our basic gravity model explains bilateral exports based on the usual variables: GDP of the exporter *i* and importer *j*, their bilateral distance and contiguity. However, since we work with cross-section time series data, the traditional model needs to be adjusted for distortions originating from price changes and shocks in world trade. Thus we introduce a time dummy for each year, which controls for fluctuations in dollar prices. Baldwin and Taglioni (2006) also advocate time dummies in gravity equations instead of deflating the nominal trade values by the US aggregate price index, which they call a "*bronze medal mistake*" since the common global trends in inflation rates raise spurious correlations. We include country fixed effects as previously justified. Then, our basic model is written as follows;

[32]Negative binomial models have been tested, but are not presented in this paper.

$$\ln X_{ijt} = \beta_1 + \beta_2 \ln GDP_{it} + \beta_3 \ln GDP_{jt} + \beta_4 \ln Dist_{ij} + \beta_5 Contiguity_{ij} + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt}$$

(Eq. 1)

X_{ij} is the export flow between the country (or Brazilian State) pair *i* and *j* in year *t* and $Dist_{ij}$is the bilateral distance. GDP_{it} and GDP_{jt} are the nominal gross domestic products of exporter country/state *i* and importer country/state *j* in year *t.* $Contiguity_{ij}$ takes value 1 if the trade pair *ij* (state or country) shares a common border, which makes them neighbors. The variables $\alpha_i$and α_j are the country fixed effects respectively for the exporter and the importer, α_t is the time fixed effect. We inflate the model with the $\ln Dist_{ij}$ and $Contiguity_{ij}$ variables in ZIP estimations.[33]

The purpose of this paper is to consider the effect of MERCOSUR on trade among member countries, on interstate Brazilian trade and on Brazilian states' trade with third countries. The methodological choice is to introduce dummy variables for these three sets of bilateral relations, with a distinction made between the pre-MERCOSUR (1991) and post-MERCOSUR (1997 to 1999) period. Even constrained by the time lag between 1991 and 1997, we can consider that our data is relevant to capture the impact of MERCOSUR on Brazilian trade. While measuring MERCOSUR's bilateral trade impact, we also control for world RTAs.

In Equation 2, the star exponent indicates that the variables refer to the MERCOSUR period (1997 to 1999), while the pre-MERCOSUR period concerns 1991 only (*t*=1991). The variables $IST_{ijt}{}^{91}$ and IST^{*}_{ijt} refer to interstate trade during the considered period taking value 1 when *i* and *j* are both Brazilian states (e.g., Minas Gerais-Para). $MERCOSUR_{ijt}{}^{91}$ and $\text{MERCOSUR}^{*}_{\text{ijt}}$ indicate trade between members of the MERCOSUR agreement, including trade between Brazilian states and member countries (e.g., Minas Gerais-Argentina and

[33]Frankel (1997) states that zero trade outcomes come mostly from a lack of trade between small and distant countries. Rauch (1999) adds a lack of historical and cultural links as a possible reason for zero trade between country pairs.

Uruguay-Argentina). By introducing the variable $MERCOSUR_{ijt}{}^{91}$, we expect to estimate the preliminary impact and unobserved bilateral characteristics leading trade between MERCOSUR members even before the implementation of the agreement. The change in the coefficients between two periods shows if there has been a relative increase in trade for the countries concerned after the establishment of MERCOSUR. The variables $BRZ_{ijt}{}^{91}$ and BRZ^{*}_{ijt} are dummy variables, which are equal to 1 for export flows from Brazilian states to non-MERCOSUR countries. A comparison of these two variables' coefficients will show the extent of Brazil's integration into the international market compared to international trade in the rest of the world. All these dummies in *Equation 2* need to be interpreted relative to the reference group, which is equal to the bilateral trade structure of non-MERCOSUR countries, (e.g., China-Germany). The change in trade structure triggered by MERCOSUR can only be pointed up by comparing pre- and post-MERCOSUR years.

$$\begin{aligned}\ln X_{ijt} = \beta_1 + \beta_2 \ln GDP_{it} + \beta_3 \ln GDP_{jt} + \beta_4 \ln Dist_{ij} + \beta_5 Contiguity_{ij} + \beta_6 IST_{ijt}{}^{91} + \beta_7 IST^{*}_{ijt} \\ + \beta_8 MERCOSUR_{ijt}{}^{91} + \beta_9 MERCOSUR^{*}_{ijt} + \beta_{10} BRZ_{ijt}{}^{91} + \beta_{11} BRZ^{*}_{ijt} \\ + \beta_{12} RTA_{ijt} + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt}\end{aligned}$$

(Eq. 2)

Since the impact of an RTA can vary over time, our analysis goes further by conducting a yearly decomposition of the variables of interest in Equation 2. As mentioned by Frankel (1997), the period before and after the agreement enters into force has an impact on the annual extent of trade creation and trade diversion considered.[34] The time fixed effect introduced in the equation cannot specifically take into account this timely evolution in the impact of MERCOSUR on trade. We therefore isolate the three years (1997, 1998 and 1999) by decomposing our variable of interest (interstate, intra-MERCOSUR and trade with third countries).

[34] Magee (2008) posits that the agreement has no cumulative impact after its 11th year of being in effect.

However, caution is called for when interpreting evolution of the RTA's impact, because country-specific shocks can have a huge impact on members' trade volumes and bias the annual estimates. Thus we introduce time-varying country-fixed effects into our robustness test, which controls for specific economic shocks such as policy changes and recession as these shocks can have an impact on trade specifically within MERCOSUR (e.g., the 1999 Brazilian crisis with the depreciation of the Brazilian real against other currencies, including the Argentinean peso).

We use balanced panel data covering the export values of the 27 Brazilian states and 118 countries (see Table 5 in the Annex) for 1991, 1997, 1998 and 1999. So the data consist of subgroups of trade pairs, with a different data source used for each. We draw on the export values of the 27 states trading with one another ($27^{*}26$), their trade with other countries ($27^{*}118^{*}2$) and the trade of the 118 countries with one another ($118^{*}117$), all for four years and balanced for the pairs with missing values while keeping zero values.

The Brazilian states' international trade flows are taken from AliceWeb[35], and containing the export and import values for Brazilian states to and from each country. The export values of the 118 countries trading with one another are taken from the *Directory of Trade Statistics* (DOTs) published by the International Monetary Fund. Both sources concur and can be combined since they present similar total export volumes for all Brazilian trade with sample countries.

We also use Brazilian interstate export flows for our empirical study. Domestic tax regulation introduced by the federal system gives us bilateral export data on the Brazilian states for 1991, 1997, 1998 and 1999. The Brazilian authorities use the information from the ICMS tax accounts to measure interstate trade flows. The ICMS tax (*Imposto sobre Circulação de Mercadorias e Serviços*) is a type of value added tax (VAT) collected by the exporting

[35]Secretaria de Comércio Exterior (Secex) do Ministério do Desenvolvimento, Indústria e Comércio Exterior (MDIC).

State[36]. From this information delivered by the Brazilian Ministry of Finance, it has been constructed a database for 1997 (Ministério de Fazenda, 2000), 1998 and 1999 (Vasconcelos, 2001a, 2001b). The 1991 data come from SEFAZ-PE (1993)[37] and are measured and extrapolated by the Pernambuco Finance Ministry from the 1987 interstate database. Unfortunately, lack of data for a longer period and gaps between 1991 and 1997 place limitations on the study. However, we believe we can cover a large part of the shock triggered by the launch of MERCOSUR, since it came into effect in late November 1991 and was scaled up in 1994 by the Treaty of Ouro Preto.

GDP values for the countries are given in current dollars and drawn from the World Bank's *World Development Indicators* database. GDP values for the Brazilian states are provided by the IBGE (*Instituto Brasileiro de Geografia e Estatística)* in local currency units, in cruzeiro for 1991 and in real for the following years. Given that the exchange rate from cruzeiro to current dollars is not provided by the *WDI*, we calculate the ratio of state GDP to total Brazilian GDP based on the IBGE database presented in local currency units and multiply it by the total GDP of Brazil in current dollars provided by the *WDI*. For 1997, 1998 and 1999, the ratios turn up similar results to those calculated by the *WDI* exchange rates, which confirms the 1991 values of state GDP.

The distance and contiguity variables are taken from CEPII's *Distances* database. For the most part, the capital cities are the main unit of the distance measurements. However, the data occasionally also use the economic capital as the geographic center of the country. The *World Gazetteer* website furnishes the geographical coordinates of the state's capital from which we have calculated the states' bilateral distances from one another and the other countries. The information on state contiguity is conducted directly from Brazilian map. RTA dummy is also taken from CEPII; *Gravity Dataset* (Head *et al*. 2010).[38]

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[36] We also use the terms "export" and "import" for trade between two Brazilian states (e.g. São Paulo-Minas Gerais).

[37]See Daumal and Zignago (2010).

[38] See for further information, http://www.cepii.fr/anglaisgraph/bdd/gravity.htm

IV. Results and Robustness Check

In Table 1, the basic gravity model (Model 1) presents coefficients similar to those usually found in the literature. We find very close β values with both estimators, PPML (Poisson Pseudo Maximum of Likelihood) and ZIPPML (Zero Inflated Poisson). Income elasticity is generally less than 1 for both estimators, which means that large countries trade relatively less than small countries. We hence relax the Anderson van Wincoop (2003) hypothesis of unitary elasticity. The logit regression finds that distance between countries increases the probability of zero trade, while sharing a common border decreases it. Since the coefficients are significantly different from zero and concur in sign and value with the theory, our choice of using ZIPPML over PPML is strengthened even though the results are quite similar. The significantly positive Vuong (1989) statistic also favors ZIPPML over PPML. The same holds true for the Akaike Information Criterion and the Bayesian Information Criterion, which are smaller in the ZIPPML model.

Starting with Model 2, we measure the impact of MERCOSUR based on Equation 2 augmented with dummy variables controlling for different groups of trade pairs over time and among subgroups. Their coefficients are to be interpreted compared to the reference group, which is bilateral trade between non-MERCOSUR countries after controlling for RTAs. All coefficients are significant. The interstate trade coefficients are higher than the intra-MERCOSUR trade coefficients for the entire period, which provides evidence of a home bias. The coefficients for Brazilian foreign trade with third countries are significantly negative for the entire period. The first conclusion is that Brazilian states trade more with one another than with other countries, even within MERCOSUR, and that their integration into world trade is relatively weak on average. The second conclusion concerns the comparison between the pre- and post-MERCOSUR period (*MERCOSUR* and *MERCOSUR**). The coefficients for interstate trade (*IST* and *IST**) and international trade (*BRZ* and *BRZ**) are not significantly affected, although they are slightly lower for the post-MERCOSUR period, while intra-MERCOSUR trade is significantly higher after the establishment of MERCOSUR. These first

results are consistent with the hypothesis that MERCOSUR had a trade creation effect within the area, without triggering either a decrease in trade among Brazilian states or a decrease in Brazilian trade with third countries.

In Model 3, we decompose the impact of MERCOSUR for each year using the pooled cross-section time series data. It has long been argued that the impact of an RTA is not uniform over time. However, the decomposition is particularly important in the Brazilian case. In this way, we can observe if the deterioration in the economic situation of Brazil and Argentina at the end of 1990s (devaluation of the Brazilian real in 1999) had an impact on MERCOSUR's trade performance as well as on Brazilian interstate trade. Descriptive statistics show that the value of Brazilian exports to MERCOSUR fell 24% between 1998 and 1999.[39] This drop is expected to have benefited Brazilian interstate trade, but it has to be balanced out by the consequences of the economic recession. In order to take a closer look at this development, we replace $\beta_7 IST^*_{ijt}$ with $\sum_{s=97}^{99} \beta_{ist,s} {IST^*_{ijt}}^s$; $\beta_9 MERCOSUR^*_{ijt}$ with $\sum_{s=97}^{99} \beta_{MERCOSUR,s} {MERCOSUR^*_{ijt}}^s$; and $\beta_{11} BRZ^*_{ijt}$ with $\sum_{s=97}^{99} \beta_{BRZ,s} {BRZ^*_{ijt}}^s$. We believe this method is better than a strict cross-section analysis conducted separately for each year, where the gravity benchmark is different for each year and hence vulnerable to yearly fluctuations and shocks in world trade. In the pooled panel data, given that we use a single control group for all years, the coefficients are comparable with one another and over time.[40]

Annual decomposition of the IST variable to identify differences over the four available years (Model 3) finds a small change in the key variables' general trends. We observe a small down turn in the impact of MERCOSUR's creation on trade followed by an increase in interstate trade and Brazilian trade with non-member countries in 1999. However, the change is not statistically significant and is negligible in value. Thus, Model 3 confirms our previous

[39] From WTO (2000), Table III-24.

[40] For the reader's information, we did after all attempt to present the estimation results taken from the cross-section analysis. Unfortunately, PPML and ZIPPML do not converge for all the years (STATA), especially for 1991, which is vital to an evaluation of the impact of MERCOSUR since it is the only year in the sample before its creation.

TABLE 1: Annual Decomposition of MERCOSUR impact

Table 1	Model 1			Model 2			Model 3		
Dependent Variable:X_{ijt} [1]	PPML	ZIPPML		PPML	ZIPPML		PPML	ZIPPML	
X_{ijt} [a]		Logit	Poisson		Logit	Poisson		Logit	Poisson
ln_*gdpnominali*	0.454***		0.451***	0.374***		0.372***	0.384***		0.381***
	(0.127)		(0.127)	(0.116)		(0.116)	(0.133)		(0.133)
ln_*gdpnominalj*	0.697***		0.683***	0.615***		0.603***	0.627***		0.614***
	(0.123)		(0.123)	(0.113)		(0.114)	(0.131)		(0.131)
ln_*distance*	-0.822***	0.560***	-0.818***	-0.472***	0.798***	-0.469***	-0.472***	0.798***	-0.470***
	(0.016)	(0.021)	(0.016)	(0.018)	(0.029)	(0.018)	(0.018)	(0.029)	(0.018)
Contiguity	0.684***	-1.116***	0.686***	0.658***	-0.648***	0.659***	0.658***	-0.648***	0.659***
	(0.060)	(0.216)	(0.059)	(0.056)	(0.239)	(0.055)	(0.056)	(0.239)	(0.055)
RTA				0.962***		0.967***	0.962***		0.966***
				(0.050)		(0.050)	(0.051)		(0.050)
*IST**91				3.434***		3.400***	3.445***		3.410***
				(0.276)		(0.273)	(0.278)		(0.274)
*IST**				3.346***		3.314***			
				(0.267)		(0.263)			
*IST**97							3.358***		3.329***
							(0.273)		(0.269)
*IST**98							3.320***		3.290***
							(0.271)		(0.267)
*IST**99							3.380***		3.343***
							(0.274)		(0.270)
*MERCOSUR**91				1.002***		0.970***	1.008***		0.977***
				(0.184)		(0.183)	(0.186)		(0.185)
*MERCOSUR**				1.675***		1.643***			
				(0.159)		(0.159)			
*MERCOSUR**97							1.689***		1.659***
							(0.184)		(0.183)
*MERCOSUR**98							1.714***		1.682***
							(0.177)		(0.177)
*MERCOSUR**99							1.614***		1.580***
							(0.178)		(0.178)
*BRZ**91				-0.651***		-0.638***	-0.646***		-0.633***
				(0.139)		(0.137)	(0.140)		(0.138)
*BRZ**				-0.567***		-0.565***			
				(0.129)		(0.127)			
*BRZ**97							-0.576***		-0.573***
							(0.144)		(0.143)
*BRZ**98							-0.597***		-0.594***
							(0.144)		(0.143)
*BRZ**99							-0.515***		-0.513***
							(0.143)		(0.141)
Constant	-21.018***	-6.490***	-19.634***	-21.845***	-9.043***	-21.381***	-22.309***	-9.043***	-21.773***
	(3.791)	(0.196)	(3.808)	(3.375)	(0.273)	(3.371)	(4.303)	(0.273)	(4.299)
Observations	78,580	78,580	78,580	78,580	78,580	78,580	78,580	78,580	78,580
-2 log pseudo-likelihood	7,542,282		7,383,215	5,568,066		5,441,724	5,567,418		5,441,115
Vuong *(z)*			28.40***			24.87***			24.88***
AIC	7,542,874		7,383,813	5,568,672		5,442,336	5,568,035		5,441,739
BIC	7,545,619		6,500,841	5,571,481		4,559,430	5,570,900		4,558,888

[1]Dependent variable is scaled by 10^{-6}. Robust standard errors are in parentheses: All inferences are based on a Huber—White sandwich estimate of variance. *** Significant at 1%. Importer, exporter and time fixed effects for all estimations.

conclusion: MERCOSUR created trade without generating any significant loss in trade among states or in Brazilian trade with third countries.

Being focused on trade of Brazilian states makes irrelevant the comparisons with previous studies which consider effects on trade at the level of each RTA. However in our model, the positive trade creation of MERCOSUR is measured for a region with 27 states and 3 countries (Argentina, Paraguay, Uruguay). Our results are in line with the current literature measuring the impact for the 4 member countries (Soloaga, and Winters, 2001; Dee and Gali, 2003; Ghosh and Yamarik, 2004; Carrère, 2006; Coulibaly, 2007; Magee, 2008).

Another source of divergence with literature is that we have introduced states/countries fixed effects in order to control the heterogeneity of states/countries and their MR (Anderson and van Wincoop, 2003). The alternative is to introduce country-pair fixed effects dealing with unobservable variables specific to the bilateral relations and constant in time, as historical or political relationship between the partners (Haveman and Hummels, 1998; Magee, 2008). Because the heterogeneity inside MERCOSUR, including the heterogeneity between Brazilian states, is a major matter of concern, we consider that states/countries fixed effects are more suitable.

Because all unobservable bilateral variables are not included in the model, we base the analysis on changes in the value of coefficients. In this way, Soloaga and Winters (2001) estimate the value of coefficients during 17 consecutive years by cross-country regressions. Alternatively, we follow Magee (2008) by periodizing the interest variable in a single pseudo-panel regression. However, the effects might be under-estimated because they frequently precede the implementation of the agreement (Magee, 2008). The adjustment in MERCOSUR appears to have begun between 3 years (Freund and McLaren, 1999) and 5 years (Coulibaly, 2007), before the entry in force of the agreement (1991). Unfortunately the year of the first available data for inter-state trade exactly corresponds to the launching of MERCOSUR and we cannot estimate pre-MERCOSUR effects.

In the next step, we present the results for the different versions of Model 3, considered as a benchmark and modified in order to check its robustness.

In the first column *(version 1*) of Table 2, we introduce into the model two new measurements of cultural and/or historical distance taken from *CEPII's Distances* database. The $colony_{ij}$ dummy indicates whether two countries have ever had a colonial relationship and $comlang_ethno_{ij}$ is equal to one if a language is spoken by at least 9% of the population in both countries. Both variables are significantly different from zero and decrease the probability of being in the zero trading country pair group. These two dummies partially capturing trade between states by means of trade cost measurements decrease the value of the *IST* coefficient. However, it is always greater than intra-MERCOSUR trade. The values and change over time of MERCOSUR's trade creation and trade diversion impact are similar to previous results and evidence of the robustness of the model.

In the *2nd* and *3rd versions*, the results are found in order, after dropping Brasília (Distrito Federal) and Amazonas, which are two potential outliers. Brasília is a state planned and built as of 1956 with the objective of transferring the country's capital from Rio de Janeiro. Its economic activity is hence driven mostly by demand from the local population, who are basically occupied in bureaucratic jobs, and satisfied mainly by imports from other states while exports are abnormally low compared to the other states. The state of Amazonas can also be considered to be an exceptional case like Brasília. It potentially presents different trade patterns to other Brazilian states since it benefits from preferential tax regulations (e.g., lower interstate ICMS rates) for its business within the country and special trade incentives (exemptions from export and import taxes) within the Manaus Free Trade Zone, which accounts for the largest proportion of state production. This area is the number two high-tech district (after São Paolo) despite its location deep in the Amazonian forest without road access. This makes the state of Amazonas a highly specific case.

However, after controlling for specific trade patterns in Brasília (D.F.) and Amazonas by dropping them, the results remain unchanged. Thus, our fixed effects are correctly capturing the particular characteristics of trade units and the model is robust to the heterogeneity.

Another issue that makes an empirical analysis of MERCOSUR's impact vulnerable is the volatility of Brazil's and Argentina's economies, the two foremost members of MERCOSUR

in terms of their economic size, in the 1990s.[41] The economic volatility of the MERCOSUR region over the period of analysis prompted us to introduce time-varying country fixed effects into the model represented in the second column of Table 2 (*version 4*).

Time-varying country fixed effects – in addition to accounting for the domestic level of prices, which is an indicator of the MR term in the theory – also account for time-varying characteristics specific to the trade unit (country/state) that have an impact on trade values such as recessions, economic or structural policy changes, and exchange rates. Replacing time-constant country-fixed effects with time-varying country-fixed effects adds a control for events specifically affecting one country. However, the huge number of dummies and the cumbersome iteration procedure make it extremely hard to obtain results due to convergence problems in the PPML and ZIPPML estimation procedures. Hopefully, the results we have provide some useful insights.

In Model 3-*Version 4*, after controlling for Brazil's economic deterioration in late 1990s and other time-varying characteristics in the sample, we observe a drop in interstate trade with MERCOSUR and then an upturn through to 1999. However, a clear conclusion cannot easily be drawn since the Fisher statistics show that we cannot significantly reject the hypothesis of the equality of coefficients. As regards the trade creation variable ($MERCOSUR_{ijt}^{*}{}^{s}$), the introduction of time-varying fixed effects shows that trade between MERCOSUR members increases steadily and continuously even in 1999, which indicates that the collapse of trade within MERCOSUR was caused by recession in member countries rather than by a slowdown in regional integration.

[41]The first period of the 1990s was marked by high inflation rates for both countries (inflationary pressure continued in Brazil until Plano Real in 1994 and in Argentina until 1993). Exchange rates were also highly volatile. The Brazilian Real was sharply devaluated in 1999. A recession started in Argentina in 1999 and continued with the crisis of 2001-2002 and the devaluation of peso.

TABLE 2: Robustness Analysis

Table 2	Model 3_Augmented		Model 3_Without state of Brasilia		Model 3_Without state of Amazonas		Model 3_Time varying fixed effects	
Dependent Variable:X_{ijt}[1]	ZIPPML		ZIPPML		ZIPPML		ZIPPML	
	Logit	Poisson	Logit	Poisson	Logit	Poisson	Logit	Poisson
ln_*gdpnominali*		0.374***		0.381***		0.381***		
		(0.129)		(0.133)		(0.133)		
ln_*gdpnominalj*		0.607***		0.614***		0.613***		
		(0.128)		(0.131)		(0.131)		
ln_*distance*	0.696***	-0.460***	0.788***	-0.469***	0.792***	-0.471***	0.815***	-0.462***
	(0.030)	(0.018)	(0.030)	(0.018)	(0.030)	(0.018)	(0.030)	(0.017)
Contiguity	-0.587**	0.501***	-0.639***	0.661***	-0.600***	0.661***	-0.830***	0.658***
	(0.260)	(0.051)	(0.238)	(0.056)	(0.237)	(0.056)	(0.269)	(0.055)
RTA		0.984***		0.967***		0.963***		1.006***
		(0.051)		(0.050)		(0.050)		(0.046)
Colony	-1.883***	0.133***						
	(0.213)	(0.046)						
comlang_ethno	-0.217***	0.425***						
	(0.059)	(0.039)						
*IST**91		2.555***		3.387***		3.371***		3.753***
		(0.290)		(0.274)		(0.275)		(0.367)
*IST**97		2.481***		3.308***		3.283***		2.958***
		(0.286)		(0.269)		(0.270)		(0.420)
*IST**98		2.442***		3.271***		3.250***		3.305***
		(0.284)		(0.267)		(0.268)		(0.408)
*IST**99		2.490***		3.327***		3.300***		3.787***
		(0.286)		(0.270)		(0.272)		(0.454)
*MERCOSUR**91		0.953***		0.974***		0.970***		1.369***
		(0.186)		(0.585)		(0.187)		(0.219)
*MERCOSUR**97		1.641***		1.659***		1.653***		1.436***
		(0.184)		(0.184)		(0.185)		(0.255)
*MERCOSUR**98		1.664***		1.683***		1.675***		1.592***
		(0.179)		(0.177)		(0.178)		(0.262)
*MERCOSUR**99		1.559***		1.580***		1.568***		1.835***
		(0.179)		(0.178)		(0.179)		(0.274)
*BRZ**91		-0.771***		-0.633**		-0.634***		-0.465**
		(0.141)		(0.138)		(0.139)		(0.185)
*BRZ**97		-0.702***		-0.573***		-0.598***		-0.783***
		(0.145)		(0.142)		(0.146)		(0.213)
*BRZ**98		-0.723***		-0.594***		-0.607***		-0.605***
		(0.145)		(0.142)		(0.146)		(0.207)
*BRZ**99		-0.645***		-0.519***		-0.530***		-0.300
		(0.144)		(0.141)		(0.144)		(0.229)
Constant	-8.093***	-21.330***	-8.959***	-21.765***	-8.993***	-21.709***	-9.218***	3.771***
	(0.279)	(4.079)	(0.274)	(4.300)	(0.275)	(4.298)	(0.280)	(0.422)
Observations	78,580	78,580	77,516	77,516	77,516	77,516	78,580	78,580
Importer fixed effects		Yes		Yes		Yes		
Exporter fixed effects		Yes		Yes		Yes		
Time varying exporter fixed effects								Yes
Time varying importer fixed effects								Yes
Time fixed effects		Yes		Yes		Yes		Yes
-2 log pseudo-likelihood		5,195,885		5,426,626		5,383,084		5,245,693
Vuong *(z)*		24.14***		24.79***		24.78***		23.48***
AIC		5,196,517		5,427,250		5,383,708		5,248,057
BIC		4,313,703		4,557,445		4,513,903		4,373,272

[1] Dependent variable is scaled by 10^{-6}. Robust standard errors are in parentheses: All inferences are based on a Huber—White sandwich estimate of variance. ** significant at 5%; *** significant at 1%. Results are given only for interest variables.

However, compared with our reference model, the trade creation effect of MERCOSUR appears lower when we consider country-fixed effects to be time varying. Thus, the trade creation impact of MERCOSUR is questionable because the assumption of coefficient equality is not rejected by the Fisher statistics – unless the higher coefficient in 1991 is attributed to the preliminary impact of the agreement. Brazilian trade with non-member countries (BRZ_{ijt}^{*S}) follows the same trend as interstate trade, with an initial drop in trade volumes followed by a steady increase. However, the Fisher statistics are always non-significant. Yet we do believe that Brazil's specialization patterns changed slightly by creating new trade opportunities over the period, although only an analysis conducted at sector level could give clearer results on this issue.

V. Measures of Trade Effects on Brazilian States

According to our estimations in Model 3 (Table 2) trade between states (*ceteris paribus)* in 1991 is approximately 29 times higher than the trade between countries other than MERCOSUR members after controlling for an eventual RTA impact. This number is ~26 times in 1998. Once we compare these two coefficients, we find the difference not to be statistically significant. On the other hand, trade between MERCOSUR members is 2,65 times higher than control group in 1991 and ~5,4 times higher in 1998; while the difference being statistically significant.

However, it can be misleading to conclude up uniquely on the basis of statistical significance of the average impact since the total impact depends on the number of observations under consideration. Especially, in our data structure we have 570[42] interstate observations of bilateral trade for each year while the number of observations for intra-MERCOSUR trade is only 168[43]. Thus, a small decrease in the average interstate trade once aggregated for 570

[42]Unfortunately due to lack of data, we have only 570 observations instead of 702 (27*26).

[43] Exports of states to member countries (27*3), exports of members to states (3*27) and exports between members (3*2) which is totally equal to 168.

observations can be of an important size once compared to the aggregated impact of intra-MERCOSUR trade over 168 observations. Trade diversion variable measuring the average impact over 3,105 observations (27*115 nonmembers) can be reconsidered similarly.

In order to calculate the impact in dollar terms, we will first predict what would be the level of trade if there were no MERCOSUR in post-MERCOSUR period. For this, we will always use our benchmark model, the ZIPPML estimates of MERCOSUR impact in Model 3 which also decomposes the impact for each available year. In line with our methodology, we measure the impact of each interest variable by introducing a dummy for pre- and post-MERCOSUR period and we consider the evolution of trade instead of the value of the coefficient itself, we will assume counterfactually that for the post-MERCOSUR years, trade would show a similar structure pre-MERCOSUR period. For example in 1997, we will predict the level of trade under *no MERCOSUR hypothesis* by giving "0" to interest variables concerning the year 1997 (*IST**97, *MERCOSUR**97, *BRZ**97) and giving "1" to the interest variables concerning the year 1991 (*IST**91*), MERCOSUR**91, *BRZ**91). Thus, the export volume predictions for post-MERCOSUR period will be calculated from the coefficient values of the MERCOSUR dummies in 1991. Second, we will calculate the difference between the trade level fitted by the benchmark model ($\hat{X}_{ij,t}$) and the predicted trade under the hypothesis that there were no MERCOSUR ($\hat{x}_{ij,t}^{*}$) for each year. This difference is equal to the impact of MERCOSUR on bilateral trade in dollar terms for the year under consideration (1997, 1998 and 1999).

At last, we decompose the trade impact of MERCOSUR in dollars for preference erosion, trade creation, and trade diversion for each state. These three impacts will be separately calculated on the exports of each Brazilian states with relevant trade partners (States, MERCOSUR members, rest of the world), namely the sum of the difference between the export values fitted by the benchmark model and the counterfactual values.

The impact on export values in year *t* for state *i*, then is as follows

$$Preference\ Erosion^{X}_{state\ i,t} = \sum_{j \in Brazilian\ states}^{26} (\hat{X}_{ij,t} - \hat{X}^{*}_{ij,t})$$

$$Trade\ Creation^{X}_{state\ i,t} = \sum_{j \in MERCOSUR\ members}^{3} (\hat{X}_{ij,t} - \hat{X}^{*}_{ij,t})$$

$$Trade\ Diversion^{X}_{state\ i,t} = \sum_{j \in Nonmember\ countries}^{115} (\hat{X}_{ij,t} - \hat{X}^{*}_{ij,t})$$

Symmetrically, the impact on import values in year *t* for state *j*is the sum of export values from partner country/state *i* to state *j*:

$$Preference\ Erosion^{M}_{state\ j,t} = \sum_{i \in Brazilian\ states}^{26} (\hat{X}_{ij,t} - \hat{X}^{*}_{ij,t})$$

$$Trade\ Creation^{M}_{state\ j,t} = \sum_{i \in MERCOSUR\ members}^{3} (\hat{X}_{ij,t} - \hat{X}^{*}_{ij,t})$$

$$Trade\ Diversion^{M}_{state\ j,t} = \sum_{i \in Nonmember\ countries}^{115} (\hat{X}_{ij,t} - \hat{X}^{*}_{ij,t})$$

In Table 3, we show the results on exports and on imports separately for each state of Brazil. All numbers are calculated over three years, so are equal to the total impact of MERCOSUR in dollars for the whole post-MERCOSUR period available in data. Because these are measured regarding to export values fitted and predicted (*no MERCOSUR hypothesis)* by the benchmark model (Model 3), they should be interpreted as the gain/loss in the trade potential of the state rather than the real gain/loss accounted by the inauguration of MERCOSUR.

TABLE 3: Predicted Values of MERCOSUR's Total Trade Impact (Summed over 1997-1999; millions US $)

Exporting/ Importing State	Impact of MERCOSUR on Export			Impact of MERCOSUR on Imports		
	Preference Erosion	Trade Creation	Trade Diversion	Preference Erosion	Trade Creation	Trade Diversion
Center-West	-2,337.812	383.400	259.691	-4,483.815	633.623	543.940
Distrito Federal (DF) [a]	-182.361	28.858	21.686	-1,216.634	174.214	156.382
Goiás (GO)	-1,109.548	142.455	104.109	-1,745.721	186.309	163.833
Mato Grosso do Sul (MS)	-529.010	103.251	52.887	-697.542	110.079	75.361
Mato Grosso (MT)	-492.350	101.558	74.374	-754.645	144.702	128.600
Acre (AC) [a]	-24.543	7.279	6.635	-69.273	18.319	19.765
North	-2,101.739	480.080	509.474	-1,902.731	392.705	496.491
Amazonas (AM) [a]	-1,345.395	332.523	352.767	-732.921	165.954	208.228
Amapá (AP)	-18.093	4.053	4.518	-46.758	9.714	12.816
Pará (PA)	-599.715	110.172	120.304	-718.793	127.855	165.795
Rondônia (RO) [a]	-76.188	20.838	19.058	-210.710	51.980	56.411
Roraima (RR) [a]	-4.730	1.307	2.886	-30.395	7.679	21.795
Tocantins (TO) [a]	-57.618	11.187	9.942	-163.154	29.523	31.445
North-East	-4,361.834	670.700	694.969	-7,403.411	1,204.384	1,522.388
Alagoas (AL) [a]	-194.913	29.978	29.842	-403.587	64.440	76.916
Bahia (BA)	-1,595.928	231.154	210.238	-2,223.963	324.301	354.493
Ceará (CE)	-693.676	112.804	122.729	-1,093.550	187.974	244.206
Maranhão (MA) [a]	-227.563	44.000	47.619	-516.184	95.824	123.522
Paraíba (PB)	-282.889	36.788	38.912	-511.353	75.755	96.075
Pernambuco (PE)	-1,025.317	151.798	157.193	-1,667.913	265.957	329.623
Piauí (PI) [a]	-55.524	9.629	9.958	-280.184	48.720	60.127
Rio Grande do Norte (RN) [a]	-169.493	29.017	31.427	-461.406	81.051	105.299
Sergipe (SE) [a]	-116.532	25.535	47.051	-245.272	60.361	132.127
South	-12,453.186	4,729.838	1,254.800	-11,804.762	3,956.879	1,216.952
Paraná (PA)	-4,879.291	1,173.775	347.419	-4,974.053	978.637	346.404
Rio Grande do Sul (RS)	-4,176.804	2,437.390	572.761	-3,955.360	2,107.777	572.570
Santa Catarina (SC)	-3,397.091	1,118.673	334.620	-2,875.349	870.466	297.978
South-East	-36,827.541	6,085.777	3,914.900	-32,487.394	4,856.079	3,791.366
Espírito Santo (ES)	-1,707.642	228.326	173.556	-1,890.234	239.132	218.506
Minas Gerais (MG)	-7,913.272	811.761	585.369	-6,907.651	645.520	559.091
Río de Janeiro (RJ)	-4,255.867	442.507	302.232	-7,603.289	641.619	528.413
São Paulo (SP)	-22,950.760	4,603.183	2,853.743	-16,086.220	3,329.809	2,485.356
BRAZIL (BRZ)	-58,082.112	12,349.795	6,633.834	-58,082.113	11,043.670	7,571.137

Source: Impacts of MERCOSUR on exports and imports are calculated in dollar terms by authors and based on the predictions of the estimation Model 3.

[a] Unfortunately, due to the lack of data, preference erosion numbers for indexed states are measured by summing bilateral impacts only over 15 partner states instead of 26.

In Table 3 the preference erosion impacts are inevitably equal on exports and imports of states because the exports of states to states are *per se* equal to the imports of states from states. The table also reveals that predicted trade creation impact and trade diversion impact of MERCOSUR in dollar terms are of similar size. The diversion impact on Brazil's potential trade to nonmember countries seems to increase the export and import of states nearly as half of the increase in its potential with MERCOSUR during the period, for some states this potential increases even higher than MERCOSUR trade creation impact. This gain in trade potential of Brazil with other countries strengthens our position on the emergence of new specialization patterns in Brazil. On the other hand, the interpretation of the results for preference erosion impact is not straightforward. We observe a remarkable decrease in interstate trade potential in dollar terms relatively to *no MERCOSUR* hypothesis nevertheless, the econometric model reveals that this change can be arising by chance since Fisher statistic is not significant.

VI. Regional Decomposition of the Impact of MERCOSUR

In Table 1, we have previously seen that MERCOSUR creates trade without significantly reducing trade with non-member countries and among Brazilian states. This means that there is no evidence of a "preference erosion" effect in Brazil. Yet this result is not necessarily clear-cut for all regions and states of Brazil. Indeed, MERCOSUR's impact can vary depending on regional differences in production structure. In the Brazilian case, it is particularly important to decompose the aggregate impact in regional terms, since there are substantial regional disparities among states' economic development levels and huge differences in specialization patterns. Where the MERCOSUR's "preference erosion" effect might undermine uncompetitive activities in some regions and reduce interstate trade, this effect could be offset by a domestic specialization process. So in order to find the size and direction of the international trade impact by region, we decompose MERCOSUR's Trade Creation ($MERCOSUR_{ijt}$) in regional terms. Unfortunately, we will not be able to keep in equation the Trade Diversion impact (BRZ_{ijt}) due to colinearity problems. It is impossible to measure the states' fixed effects as exporter and importer while decomposing the regional

effects on both; trade of states with members and nonmembers for whole sample period since these are just two different ways of decomposing the same variation. The reference will then be slightly different since it includes also the trade of Brazilian states with the rest of world and the results are not comparable with the estimates of previous models.

We use the Instituto Brasileiro de Geografia e Estatística (IBGE)'s regional nomenclature for our regional decomposition. The IBGE divides Brazil into five macro-regions. We use this macro-level division: namely South, South-East, North-East, Center-West and North (see Map 1 in the Annex). The IBGE endeavors to group together states with similar cultural, economic, historical and social characteristics in the same region provided they are geographically clustered. Thus there is minimum uniformity within each regional division and the study at regional level provides enough information to capture the differences in trade impact.

We decompose MERCOSUR's trade creation for each region by introducing a bilateral dummy for the period before and after MERCOSUR. Thus we have *k*=5 dummies of the trade creation variable for the pre-MERCOSUR period ($\sum_{k=1}^{5}\beta_{MERCOSUR,k}MERCOSUR_{ijt}{}^{91^{k}}$), 5 dummies of the trade creation variable for the post-MERCOSUR period ($\sum_{k=1}^{5}\beta_{MERCOSUR,k}MERCOSUR^{*}_{ijt}{}^{\mathrm{k}}$).For example, $MERCOSUR_{ijt}{}^{91^{north}}$ is equal to 1 for Northern states' exports to MERCOSUR members as well for their imports from member countries in 1991. We also introduce a dummy for the pair of MERCOSUR countries other than Brazilian states (*mercosur_memb*). For ease of reading, the results in Table 3 are presented horizontally for post- and pre-MERCOSUR dummies. The results for the basic control variables (GDP, distance, contiguity, RTA, etc.) in Equation 2 are not given in this table since they concur with previous results. We also conduct a Fisher test to control for whether the difference in the value of the coefficients is statistically significant. Both methods of estimation produce very similar results.

TABLE 4: Regional Decomposition of the impact of MERCOSUR

	PPML			ZIPPML		
Dépendent Variable *Xijt*[1]:	Pre—MERCOSUR period	Post—MERCOSUR period	Fisher Test of equality	Pre—MERCOSUR period	Post—MERCOSUR period	Fisher Test of equality
	β	B	$\chi^2(1)$	B	β	$\chi^2(1)$
IST	4.595***	4.504***	1.06	4.551***	4.463***	1.00
	(0.116)	(0.093)		(0.116)	(0.093)	
MERCOSUR_north	0.366	1.013***	3.88***	0.345	0.965***	3.34**
	(0.325)	(0.176)		(0.337)	(0.178)	
MERCOSUR_south	1.290***	1.996***	6.40***	1.247***	1.959***	6.64***
	(0.276)	(0.143)		(0.274)	(0.143)	
MERCOSUR_northeast	1.394***	2.100***	10.72***	1.338***	2.050***	10.58***
	(0.204)	(0.134)		(0.207)	(0.137)	
MERCOSUR_southeast	1.832***	2.538***	28.11***	1.793***	2.505***	29.08***
	(0.141)	(0.102)		(0.140)	(0.103)	
MERCOSUR_centerwest	0.578*	1.145***	2.64	0.613**	1.091***	1.96
	(0.305)	(0.209)		(0.297)	(0.210)	
MERCOSUR_memb	1.201***	1.655***	9.84***	1.162***	1.624***	10.79***
	(0.163)	(0.162)		(0.161)	(0.161)	
Observations	78,580	78,580		78,580	78,580	
Importer fixed effects	Yes	Yes		Yes	Yes	
Exporter fixed effects	Yes	Yes		Yes	Yes	
Time fixed effects	Yes	Yes		Yes	Yes	
-2 log pseudo-likelihood	5,561,942	5,561,942		5,435,436	5,435,436	
Vuong *(z)*				24.92***	24.92***	
AIC	5,562,565	5,562,565		5,436,064	5,436,064	
BIC	5,565,448	5,565,448		4,553,232	4,553,232	

[1]Dependent variable is scaled by 10^{-6}. Robust standard errors are in parentheses: All inferences are based on a Huber—White sandwich estimate of variance. * Significant at 10%; ** significant at 5%; *** significant at 1%. Results are given only for interest variables.

In Table 4, different than previous results *IST* and *IST** variables are of bigger size. This is a consequence of the change in the reference with the inclusion of Brazilian states' trade with nonmembers as we found above to be very little integrated to world trade relatively to average. However, in line with previous estimations, we do not find any significant preference erosion impact. Results for regions show that even before MERCOSUR, the trade of Brazilian states was significantly (except for North) higher with members relatively to the average integration level of world exports. Furthermore, Fisher test showed MERCOSUR has significantly created trade in all regions except the Center-West. The South-Eastern states, which are the most economically developed part of Brazil, already strongly integrated, have

posted an important increase. The Southern and, more surprisingly, North-Eastern states have also benefited from the creation of MERCOSUR. The North-East has probably benefited from a relative relocation of businesses prompted by incentives and lower labor costs. Northern region disadvantaged before MERCOSUR has also increased, albeit less so, its trade with MERCOSUR countries Center-West economic activity has not benefited from the creation of MERCOSUR. The region Center-West became more specialized in exportable agricultural goods over the period, which could be a plausible explanation why it trades very little with MERCOSUR members whose agricultural specialization is in similar products (soya, beef, etc.).

VII. Conclusion

The purpose of this paper was to consider the effects of MERCOSUR on the trade of Brazilian states by highlighting three contradictory effects: a trade creation effect with MERCOSUR countries and an expected diversion effect with other countries, but also a preference erosion effect on interstate trade. We confirm that Brazil "prefers" to trade with itself and with MERCOSUR countries rather than trading with the rest of the world. In spite of its trade openness, Brazil remains poorly integrated compared with the other countries in the world. However, MERCOSUR has had a significant trade creation effect without affecting either interstate trade or trade with the rest of the world. Although trade with MERCOSUR decreased in the late 1990s, this was mainly due to the economic crisis and monetary adjustments rather than a lack of integration. Nevertheless, MERCOSUR's positive effects are unevenly spread across the different Brazilian regions.

A lack of updated statistics on interstate trade means that the number of years considered in this article is unfortunately too short to see how MERCOSUR's impact on trade develops over a longer period.

The updating of data would mean that we could analyze the effects of MERCOSUR over a longer period. We would then expect the effects to dwindle over time. The analysis also needs extending in a number of directions. We need to improve the identification of trade barriers between states caused mainly by poor infrastructures and the particularity of the Brazilian tax system. And an analysis should be conducted of changes in states' specialization patterns in order to point up the paradoxical development of high-tech industries in Manaus, the recent industrialization of the east coast and the displacement of agriculture from the south to the center.

ANNEX

Map 1: Brazilian Regional Map and States



Source: IBGE (http://www.ibge.gov.br/ibgeteen/mapas/brasil_regioes.htm)

Region North: Acre, Rondônia, Amazonas, Roraima, Pará, Amapá, Tocantins
Region North-East: Maranhão, Pauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, Bahia
Region Center-West: Mato Grosso, Mato Grosso do Sul, Goiás
Region South-East: Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo
Region South: Paraná, Santa Catarina, Rio Grande do Sul

Table 5: List of Countries

Algeria (DZA)	Guinea-Bissau (GNB)	Portugal (PRT)
Angola (AGO)	Guyana (GUY)	Qatar (QAT)
Argentina (ARG)	Haiti (HTI)	Rwanda (RWA)
Australia (AUS)	Honduras (HND)	Saudi Arabia (SAU)
Austria (AUT)	Hong Kong SAR, China (HKG)	Senegal (SEN)
Bahamas, The (BHS)	Hungary (HUN)	Sierra Leone (SLE)
Bahrain (BHR)	Iceland (ISL)	Singapore (SGP)
Bangladesh (BGD)	India (IND)	Spain (ESP)
Barbados (BRB)	Indonesia (IDN)	Sri Lanka (LKA)
Belize (BLZ)	Ireland (IRL)	Sudan (SDN)
Benin (BEN)	Israel (ISR)	Suriname (SUR)
Bermuda (BMU)	Italy (ITA)	Sweden (SWE)
Bolivia (BOL)	Jamaica (JAM)	Switzerland (CHE)
Bulgaria (BGR)	Japan (JPN)	Syrian Arab Republic (SYR)
Burkina Faso (BFA)	Jordan (JOR)	Tanzania (TZA)
Cameroon (CMR)	Korea, Rep. (KOR)	Thailand (THA)
Canada (CAN)	Kuwait (KWT)	Togo (TGO)
Cape Verde (CPV)	Lebanon (LBN)	Trinidad and Tobago (TTO)
Central African Republic (CAF)	Liberia (LBR)	Tunisia (TUN)
Chad (TCD)	Libya (LBY)	Turkey (TUR)
Chile (CHL)	Madagascar (MDG)	Uganda (UGA)
China (CHN)	Malawi (MWI)	United Arab Emirates (ARE)
Colombia (COL)	Malaysia (MYS)	United Kingdom (GBR)
Comoros (COM)	Mali (MLI)	United States
Congo, Rep. (COG)	Malta (MLT)	Uruguay (URY)
Costa Rica (CRI)	Mauritania (MRT)	Venezuela, RB (VEN)
Cyprus (CYP)	Mauritius (MUS)	Vietnam (VNM)
Denmark (DNK)	Mexico (MEX)	Yemen, Rep. (YEM)
Dominican Republic (DOM)	Morocco (MAR)	Zambia (ZMB)
Ecuador (ECU)	Mozambique (MOZ)	Zimbabwe (ZWE)
Egypt, Arab Rep. (EGY)	Nepal (NPL)	
El Salvador (SLV)	Netherlands (NLD)	
Ethiopia (ETH)	New Zealand (NZL)	
Fiji (FJI)	Nicaragua (NIC)	
Finland (FIN)	Niger (NER)	
France (FRA)	Nigeria (NGA)	
Gabon (GAB)	Norway (NOR)	
Gambia, The (GMB)	Pakistan (PAK)	
Germany (DEU)	Panama (PAN)	
Ghana (GHA)	Paraguay (PRY)	
Greece (GRC)	Peru (PER)	
Grenada (GRD)	Philippines (PHL)	
Guatemala (GTM)	Poland (POL)	
Guinea (GIN)	Romania (ROM)	

CHAPTER 3: Vertical Specialization in the Domestic Market and the Foreign Trade Structure of Brazilian States – A New Approach to Gravity Models

Resumé:

L'OMC, l'OCDE, parmi d'autres, suggèrent que le commerce en valeur ajoutée est une meilleure mesure pour analyser l'impact du commerce sur l'emploi, la croissance ou la production, etc. quand le contenu en importation est importante. On utilise un tableau Input-Output pour l'année 2008 à partir duquel on calcule les valeurs ajoutées exportées des états brésiliens en distinguant la valeur ajoutée exportée « directement » par l'état et « indirectement » via des autres états. Ensuite, on estime dans un modèle de gravité l'impact des déterminants de commerce à partir des valeurs ajoutées exportées. On introduit enfin un modèle de gravité trilatéral qui estime les déterminants du commerce en distinguant trois étapes : l'état d'origine, l'état ré-exportateur et le pays importateur.

Abstract:

WTO, OECD with many others, suggest the trade in value-added would be a "better" measure to understand the impact of trade on employment, growth, production etc. when import content in exports is important. We use in this work an Input-Output table for 2008, to calculate the value-added exported by Brazilian states. We distinguish the value-added exported directly by the state itself or indirectly via other states. First, by using value-added we define the extent of vertical specialization among Brazilian states. Exported value-added are then used in a gravity model to determine the structure of trade in value-added terms. We also define a trilateral gravity structure which permits to control for the vertical specialization between states and to estimate the trade determinants at three steps: origin state, re-exporter state and importer country.

I. Introduction

In the previous chapters, we analyze trade using the "traditional" export measurement in gross value. However, the goods exported by a country are rarely produced entirely within the country. The value of exports may then be decomposed into imported and domestic value-added. The contribution of exports to the exporting country's growth, employment and balance of trade depends solely on its own value-added or, in other words, on the domestic value-added. The more fragmented the "international supply chain", the more countries will be specialized in "tasks" (design, assembly, transport, distribution, etc.) instead of goods (cars, computers, etc.). For example, China is not specialized in exports of laptops, but after importing the technology and the components, it is specialized in the assembly of the final good, which is situated at the final stage of the industrial process. A few years ago, the WTO proposed the concept of "Made in the World" to highlight the fact that final goods are not produced by one country alone, but by many firms located in different countries (WTO-IDE-JETRO, 2011).

However, trade statistics are still presented in terms of gross value and the import content of exports is not available. We have just a few indications for certain specific goods. For example, the 1998 WTO Annual Report estimated that a mere 37% of the production value of a typical American car is generated in the US. More recent case studies are available for the iPod, iPhone and iPad, the Nokia N95 (Yrkkö *et al.*, 2011), and even … Barbie dolls (WTO-IDE-JETRO, 2011; Maurer and Degain, 2010; World Economic Forum, 2012). However, this measurement of import content in a specific exported good cannot be used to aggregate the total import content of exports either across the whole industry or in the entire country or region.

International input-output tables are commonly used as indirect measure of the import or domestic value content of exports (for example, Hummels *et al.*, 2001), and some international organizations are currently supporting the construction of international input-output matrices based on the method introduced by Leontief (1986) (see OECD-WTO, 2012).

At the same time, the gravity model frequently used in empirical analyses of international trade becomes debatable in the light of the "international supply chain". First, the model estimates trade in terms of gross value and hence ignores the share of import content in exports, which is not at all the same for all countries. Second, demand concerns not only final consumption, but also intermediate consumption. This raises questions about the use of the importer's GDP as a demand indicator in the model. Lastly, the gravity model estimates bilateral trade whereas the fragmentation of the supply chain should be addressed at a multilateral level. Japanese exports of hard disks to China for iPads assembled in a Chinese export processing zone (EPZ) are not determined by Chinese final demand, but by US, European and so on final demand (see Baldwin and Taglioni, 2011).

Brazil's rate of openness is low compared to other large emerging countries such as China. However, the domestic value-added content of Brazilian exports is probably higher (or the import content lower) since Brazilian specialization is in tasks located at the early stages of the supply chain, such as raw materials, while China is specialized in the final stage of the production process (Koopman *et al*., 2008).

Brazil's poor performance in terms of openness does not imply a low level of division of labor along the domestic supply chain. Considering the high heterogeneity of Brazilian regions in terms of climate, location and factor endowment, there is room for large specialization differences within Brazil. Yet although inter-state trade statistics are available (see the previous chapters), they are given in gross value and we have no information on the shares of own domestic value-added and import content from other states in states' exports. For example, we saw in the previous chapter that the foreign export capacity of Amazonas is low, but that São Paulo's exports may include substantial import content from Amazonas.

The purpose of this chapter is precisely to explore the contribution of each Brazilian state to Brazilian exports and to propose gravity models more in keeping with the "new trade paradigm" set-up. Section II shows how the geographic fragmentation of the production process has generated a "new trade paradigm" and what its implications are for traditional trade analysis. Section III looks into Input-Output analysis as a new way of measuring trade in value-added terms and tracking interregional linkages from a value-added point of view.

Section IV explains the method used for the Brazilian Inter-State IO Table built by Guilhoto (2005, 2010) for 2008, which is the basic source of data for this paper's analysis and estimations. Section V provides a descriptive preliminary analysis of the results on the structure of inter-state vertical specialization for export products. Section VI revises the gravity model by reworking the theory based on the implications of vertical specialization for trade. Section VII estimates Brazilian states' gross exports to the rest of the world, first using a bilateral gravity model inspired by the traditional approach and then the new measurements of exports in value-added terms. In section VIII, we take a trilateral gravity model further in keeping with our theoretical insight in order to measure and control for the impact of inter-state vertical specialization in states' exports. Lastly, we present a conclusion on our results.

II. Domestic trade in the light of the "new trade paradigm"

The Made in the World Initiative (MiWi) launched by the WTO is subtitled A Paradigm Shift to Analyzing Trade. Indeed, the increasing dominance of task specialization over product specialization has many implications that could be interpreted as a "paradigm shift" (Kuhn, 1962). Theory, statistics, analyses and textbooks currently view the entire gross value of exports as if it were made up solely of domestic value-added, disregarding the import content (or foreign value-added) of exports.

The traditional theory of international trade functions in terms of "horizontal" specialization where countries or firms "*become adept at producing particular goods and services from scratch and then export them,*" (Hummels *et al.*, 1998). However, we are seeing a growing geographic fragmentation of the production process in international trade, even though the phenomenon is not exactly new. The prolific research on the "effective rate of protection" already refers to this as found, for example, in France, in research on the "Division Internationale des Processus Productifs" (DIPP).[44] We probably owe the term of "vertical

[44] Lassudrie-Duchêne (1982)

specialization", in contrast to the traditional concept of "horizontal specialization", to Balassa (1967, p. 97).

However, it is only in recent years that international institutions have turned their attention to the practical repercussions of this trend on international trade statistics and their interpretation.[45] Two events explain this new interest:

1) The collapse of international trade from mid-2008 to mid-2009 threw the world suddenly and unexpectedly into deeper world recession. For example, exports fell 38% for the World and a massive 53% for China in just nine months[46]. Many explanations have been advanced for this, such as a trade transaction "credit crunch". Nevertheless, the fact is that vertical specialization implies that the value-added of a component may be recorded several times in the trade statistics, i.e. each time it crosses the border for use in a new stage of the production process. In this case, a $100 drop in national exports of a final good could cause a drop of $200, $300 or more in world exports[47].
2) Case studies that decompose the origin of the value-added of a specific final good exported outward also reveal very surprising results. These case studies find a spectacularly weak share of domestic value-added in the value of national exports. The most striking case is probably the iPod 30 gigabit valued at US$300 in the United States, previously exported by China for US$150, but with a Chinese value-added focused on assembly tasks of just US$4 (Dedrik *et al.*, 2009a, 2009 b).

This phenomenon concerns the division of production processes into stages and among countries until the product arrives on the consumer market as a final good. So countries become increasingly interconnected with production chains. They are specialized not only in goods (cars, shoes, etc.), but also in tasks (design, components, assembly procedures, etc.).

[45] For example, WTO & IDE-JETRO published a report on the issue in 2011. The Organization of Economic Cooperation and Development (OECD, 2012) supports the position of the World Trade Organization (WTO) in this area. OECD Secretary-General Angel Gurría highlighted the importance of the subject at the G20 meeting in Mexico in 2012. And in September 2012, the WTO, OECD and UNCTAD, held a joint seminar with the Chinese Ministry of Trade on Global Value Chains in Beijing.

[46] WTO statistics.

[47] See, for example, Escaith *et al*. (2010)

The phenomenon is defined more precisely by Hummels *et al.* (1998) as, "*Vertical specialization occurs when a country uses imported intermediate parts to produce goods it later exports".* Then, the three conditions need to hold:

(1) A good must be produced in multiple sequential stages,

(2) Two or more countries have to specialize in producing some, but not all stages,

(3) At least one stage must cross an international border more than once.

Incidentally, recognition of vertical specialization prompts a series of questions on the consistency of the conventional statistical tools and/or on the general concepts of trade literature. Previously used cross trade measures, which are fairly suitable in a context of "horizontal" specialization, are becoming more and more unreliable in a world where a final good is produced in more than one country or, in general terms, more than one geographic location. Therefore, the notion of "home" or "origin" of the good is dissociated from the notion of "exporter". In particular, the bilateral trade balances measured in gross trade terms provide very little information on the supply side, because the export values do not reflect the competitiveness of the exporter entity, but the entire product chain, especially when the exporter is situated at the final step of the production process. When there is a large volume of trade in intermediate goods, the use of bilateral gross trade is not appropriate either for the demand side analysis, since trade flows to the importer country would depend mostly on the demand of third countries.

The geographic fragmentation of the production process is driven by decreasing trade costs, policy related or not, such as tariffs, transport and/or communications, etc. The revolutionary developments in information technologies in the 1990s are an important factor since they have reduced the cost of communications, enabled remote management and allowed companies to coordinate long production chains. All of this drives the unbundling of the global economy (Baldwin, 2006). The emergence of free trade zones, with their advantageous regulations to attract foreign direct investment (FDI), is also helping to drive this process. The WTO is

making a particular effort to bring down tariffs on the circulation of intermediate products such as computers, semi-conductors, etc. (e.g. Information Technology Agreement (ITA)).[48] Grossman and Rossi-Hansberg (2006) accentuate the impact of this structural change on trade and call it "trade in tasks". Hence, under this new structure of trade costs, the countries not capable of covering the entire production chain for a good get the chance to produce at least some of the tasks, provided their production technologies and factor endowments give them a comparative advantage in a specific task.

On the other hand, these recent dynamics in the structure of trade costs and hence in the trade structure are also at work in domestic markets. New business management practices have moreover reduced the cost of coordination within a country. Furthermore, the relatively good trade integration of domestic markets should make for reduced costs in components trade, which should facilitate the geographic fragmentation of production stages. Yet, these two factors are not enough to explain why trade in tasks occurs in domestic markets.

Trade in tasks (or vertical specialization) occurs when differences in countries' factor endowments and/or production technology give them the comparative advantage in a specific task. Nevertheless, under the classical assumptions of traditional trade theories, with factors of production being perfectly mobile in national markets, endowments are uniform in space. If that were true, all the regions in a country would have similar comparative advantages and the company would gain nothing, but face only extra costs from splitting up the production chain across the country.

However, in reality, neither factor nor good markets are really "perfectly" integrated. Factors of production are not completely mobile, even within one country. A country's regions may differ from in terms of their specializations and production costs. So there could be a gain in producing tasks in different regions of a country. This is especially true for developing and emerging markets, such as Latin American countries, India and China, where regional

[48]"The Ministerial Declaration on Trade in Information Technology Products (ITA) was concluded at the WTO Singapore Ministerial Conference in December 1996. The ITA eliminates duties on IT products covered by the Agreement." See WTO & IDE-JETRO (2011).

differences are considerable. On the other hand, transaction costs and the trade integration of goods markets can also differ across the regions of a country. Wolf (1997) calls this the spatial non-linearities[49] of transaction costs and states that, under these non-linearities, the production of tasks will be spatially concentrated, instead of being spread out geographically, and trade in intermediate goods will take place among close entities.

Lastly, trade in tasks is expected to occur in the exporting sectors, since the gain from economies of scale is another important factor behind specialization in tasks even though intra-country vertical specialization can occur in a closed economy where internal demand is large enough to benefit from economies of scale. In that case, trade openness may be a further incentive to deepen this type of specialization and create a dual dynamic of vertical specialization. Yet, this internal dimension of specialization driven by trade openness has not been studied, since many international organizations prioritize inter-country vertical specialization.

The use of gross trade measures in intra-country trade specialization can trigger a paradigm change in statistical analysis on two levels: in trade by local entities with world markets and among themselves. First, the regions specialized in the last stage of the production in the country seem to export more and so are more integrated into world markets. Second, where interregional statistics are available to track trade, a good may be counted many times in the production chain in the internal market. However, the export of the good generally happens only once and so is counted only once; usually at the last stage of the production chain in the country. This statistical bias produces extremely high intra national gross trade values for local entities compared to their actual trade with the rest of the world.

Therefore, a better statistical tool focused on the "origin" and "final destination" of the good is required to analyze bilateral trade relations at national level as they are at international level. Measuring trade using the "value-added" approach enables us to approximate the true

[49] Wolf (1997) believes these non-linearities may be due to "spatial spillovers on the demand or supply side, spatial clustering of (immobile) factors or an uneven spatial distribution of demand, again coupled with high transportation costs".

origin of exports. This may also be used to determine the value-added contribution at each stage and hence track the value chain through to the end of the production process. In this manner, we capture the supply and demand side determinants of trade, such as the "revealed" competitiveness and comparative advantages of geographic entities that participate at the different stages of production. The bilateral trade flows, estimated on net value, are incidentally corrected for the statistical bias created by the multiple accounting of imported intermediate goods and components embodied in exports.

III. Trade in value-added and interregional input-output tables

Pascal Lamy, the WTO's Director General, recently said, "In order to understand the true nature of trade relationships, we need to know what each country along a global value chain contributes to the value of a final product. We also need to know how that contribution is linked to those of other suppliers in other countries coming before and after along the chain. In order to ensure that trade openness creates jobs overall, as we believe it does, we need to know how much employment is generated by this value-added factor. The only way to do this is to measure trade in terms of value-added. This is more easily said than done. But we must do it."[50]

Conceptually, the gross value of each exported good includes the exporter's value-added and the value-added of the imported inputs incorporated into the good by the foreign and domestic firms at earlier stages of the production chain. Then, for a traded good, the domestic content in exports or the value-added by an exporting entity is measured at first glance as the direct difference between the gross value of the exported good and the imported inputs used to produce it.[51] However, part of the imported inputs may be produced by the exporting country

[50]Lamy Pascal (2012). *Global value chains are "binding us together"* speech at the WTO-MOFCOM-OECD-UNCTAD Seminar on Global Value Chains in Beijing on 19 September 2012.

[51] In regional input-output work, the flows from one region in a given country to another region of the same country are referred to as *interregional trade* (or *trade)* flows and the terms *export* and *import* are used only

at earlier stages. Some primary goods and components might be exported and re-imported after transformation, which complicates the measurement of domestic content in exports. If we use this logic to find the origin of the inputs used and, by extension, the origin of the inputs used to produce these inputs and so on, we can decompose the value of a good (P^a) in the value-added (V_i^a) generated across countries or, more broadly, across different geographic entities (*i*) participating in the production chain.

$$P^a = \sum_i V_i^a$$

Where P^a is the gross value of product *a* and *i* is the origin of value-added. However, given the complexity of re-exporting and re-importing along the production chains and the multitude of product production processes, it is tricky to measure the origins of value-added using national accounts. One way of estimating value-added is then to use input-output (IO) tables. More specifically, interregional input-output (IRIO) tables can be used to estimate the value-added in traded goods since, unlike standard IO tables, they can track the geographic path of the production chain and the inter-linkages among regions.

Basically, IO tables were introduced in the 18th century by François Quesnay's *Tableau Économique.* They were subsequently developed by Wassily Leontief (1986) in the 20th century. Originally, they were used to represent interrelations between industries within an economy in terms of supply and use of products in order to analyze the industrial impact of economic policy, which was a foremost concern post-World War II due to bottlenecks being created in the economy by full employment, shortage of raw materials, the "dollar gap", etc. One of the most famous applications of the IO tables in international trade is the revelation of "Leontief's paradox" showing that, in contradiction to HOS theory, the United States was not specialized in capital-intensive goods. Today, IO tables are used across a broader spectrum such as international and national trade analysis, CO_2 emissions, employment issues, etc.

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when dealing with foreign trade (Miller and Blair, 2009). However, we use the terms *export*, *import* and *trade* for flows between all types of geographic entities, countries and sub-regions of a country.

The input-output tables draw on the flows of products taken from the national accounts to determine the pattern of inter-industry dependencies and their linkages with the final demand elements in an economy for a reference year. Hence, the production technology is assumed to be the same for the period of analysis as for the reference table and the input-output coefficients are assumed to be fixed in the analysis. In the static input-output table, there is a strict dichotomy between quantities and prices, meaning that production has no effect on prices and vice versa. Therefore, there is no substitution across inputs and no gain from economies of scale. Lastly, the supply of labor and capital are unlimited.

Under the above assumptions, input-output tables use the mathematical equality between sales and purchases to analyze the impact of an increase in sales on purchases. To be more precise, the input-output table consists of a closed, endogenous part, which basically concerns the flows of inputs among the industrial sectors of the economy, and the final demand in the economy, which is "exogenous", since it is independent of the industrial production linkages. Further, the analysis can be extended with interdependencies among industrial sectors in different geographic entities, which will then appear in the endogenous part of the interregional input-output (IRIO) table.

On the sales side (IO table row), the output of sector *i* (x_i) is equal to its supply (sales of inputs) of intermediate goods to other industries *j* ($a_{ij}x_j$ where $j = 1, \dots n$) for production (output x_j) and to domestic purchasers for consumption, e.g. households (*final consumption expenditure*), government (*government expenditure*) and purchasers abroad (*exports)*. The total demand of the consumer agents is called total final demand (f_i).

$$x_i = \sum_{j=1}^{n} a_{ij}x_j + f_i \qquad (1)$$

Where a_{ij} is a technical coefficient calculated as the ratio of inputs from industry *i* used in the total output of industry *j*. Final demand is exogenous and cannot be predicted by the model.

On the purchase side (IO table column), the output of sector *j* (x_j) is equal to its purchases of inputs from other industries *i* ($a_{ij}x_j$) and its purchases from payment sectors (p_i) e.g. *value-added* (labor, remuneration of capital), *imports*, etc.

$$x_j = \sum_{i=1}^{n} a_{ij} x_j + p_j \quad (2)$$

Since each industrial sector (*j*) needs purchases from payment sectors in addition to inputs from industries (*i*), technical coefficients (a_{ij}) have the following features:

$$\sum_{i=1}^{n} a_{ij}\, x_j < x_j \qquad \text{and} \qquad \sum_{i=1}^{n} a_{ij} < 1 \quad (3)$$

By writing the equation (***1***) for all industrial sectors *i* ($i = 1, \dots n$), we get a system of n linear equations, which can be represented in matrix form:

$$x = Ax + f \quad \text{and} \quad x = (I - A)^{-1} f = Lf \quad (4)$$

where

- x is a n*1 vector of the n industries' output
- A is an n*n matrix of technical coefficients representing interdependencies between industries
- f is an n*1 vector of final demand
- $(I - A)^{-1}$ is the Leontief inverse (L)

Equation ***4*** is the touchstone of the input-output analysis since it represents the pattern of inter-industry linkages. It can be used to evaluate the impact of a change in final demand on total output and further measure, based on the equality from the purchase side, its impact on the payment sectors, which includes in part the value-added (using Equation ***2***).

To be more precise, the volume of gross output required to produce final demand $f = \bar{f}$ is calculated as follows,

$$\bar{x} = (I - A)^{-1} \bar{f} = L\bar{f} \quad (6)$$

Or equally, we can approximate it as follows[52]:

$$\bar{x} = \bar{f} + A\bar{f} + A^2\bar{f} + \cdots \quad (7)$$

Then the gross output required to produce $\bar{f}$ will be more than $\bar{f}$ ($\bar{x} > \bar{f}$). This can be explained by round-by-round effects in the input-output analysis. Final demand $\bar{f}$ will be responded to by the productive sectors that the demand initially addresses. These productive sectors will produce $\bar{f}$, with the inputs coming from other sectors ($A\bar{f}$). This first round effect is called the direct effect of the final demand on the economy. However, the sectors producing inputs ($A\bar{f}$) also need inputs, calculated in the second round as $A^2\bar{f}$, etc. These secondary, tertiary and so on round effects are called the indirect effect of demand $\bar{f}$ on the economy[53]. The strength of Leontief's inverse ($(I - A)^{-1}$) is that it captures all these initial, direct and indirect effects in a single measure.

The next step is to calculate the purchases from the payments sector or, more specifically, the value-added contribution of the change in final demand. On this point, we need the vector of value-added coefficients representing the share of value-added in the gross output of each industrial sector to measure the impact of output on value-added.

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[52] An approximation of $(I - A)^{-1}$ can be made by generalizing the Neumann series. Consider the identity:

$$(I - A)(I + A + A^2 + \cdots A^k) = I - A^{k+1}$$

which is equal to:

$$(I + A + A^2 + \cdots A^k) - (I - A)^{-1} = -(I - A)^{-1}A^{k+1}$$

If $\sum_{i=1}^{n} a_{ij} < 1$ and $a_{ij} > 0$, then $\lim_{k\to\infty} A^k = 0$

Hence,

$(I - A)^{-1} = (I + A + A^2 + \cdots A^k)$ when $k \to \infty$

[53] The definitions of *initial*, *direct* and *indirect* effects can be found in *Foundations of IO Analysis* by Miller and Blair (2009). However, in the literature, it is also common to refer to the initial effect as part of the direct effects.

Let's represent the direct value-added contribution for each industrial sector $(1, \dots n)$ in the reference IO table (purchases from payment sectors (p_j) from equation ***2)*** with a row vector v';[54]

$$v' = [v_1 v_2 \dots v_n] \tag{8}$$

The value-added coefficients $(v_c{}')$ are then equal to the initial value-added contribution of each industrial sector divided by that sector's gross output:

$$v_c{}' = v'\hat{x}^{-1} = [v_1/x_1 v_2/x_2 \dots v_n/x_n] \tag{9}$$

Where $\hat{x}$ is a diagonal matrix[55] and $\hat{x}^{-1} = \begin{bmatrix} 1/x_1 & \dots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \dots & 1/x_n \end{bmatrix}$

From the matrix algebra, ε is a column vector whose elements measure the value-added generated in each sector in order to produce final demand *f*. Returning to our example with final demand $\bar{f}$, $\bar{\varepsilon}$ is equal to

$$\bar{\varepsilon} = v_c{}'\bar{x} = v_c{}'L\bar{f} \tag{10}$$

and

$$m(v) = v_c{}'L$$

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[54]Please see Miller and Blair (2009), pp. 243-271, for further details.

[55] The "hat" over vector *x* denotes the diagonal matrix whose elements are situated along the diagonal.

Since $(\hat{x})(\hat{x})^{-1} = I$

Then $\hat{x} = \begin{bmatrix} x_1 & \dots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \dots & x_n \end{bmatrix}$

$m(v)$ is called a sector-demand-to-sector-value-added multiplier. It measures the initial, direct and indirect value-added contributions of each sector in the total output required to produce $\bar{f}$.

Interregional input-output (IRIO) tables introduce another aspect of information into the analysis by extending into interdependencies in space. In IRIO tables, the industrial sectors in a region also need inputs from other regions in order to produce. Then the basic difference between standard IO tables and IRIO tables is that the IO tables consider sales to other regions as exports and account for them in the final demand, while IRIO tables see the production of the regions as interdependent and therefore endogenous. In IRIO models, *exports*, as an element of total final demand, refer to those goods sold to the regions outside the model's geographic scope (one region, two regions, etc.) and hence to the purchasers exogenous to the production sectors. However, as an element of final demand, we have equally the sales for the final consumption in each region.

Let's take, for example, an IRIO table for two regions (*r* and *s*), with each having two industrial sectors (*i* and *j*). In this case, the Leontief inverse is calculated by a two-region input-output table. The output of industry *i* in region *r* is equal to:

$$x_i^r = a_{ii}^{rr} x_i^r + a_{ij}^{rr} x_j^r + a_{ii}^{rs} x_i^s + a_{ij}^{rs} x_j^s + f_i^r \quad (11)$$

Equation 11 can be generalized in matrix form where A is the interregional input-output coefficient matrix:

$$x = (I - A)^{-1} f = Lf \quad (12)$$

Where,

$$\text{A}= \begin{bmatrix} a_{ii}^{rr} & a_{ij}^{rr} & a_{ii}^{rs} & a_{ij}^{rs} \\ a_{ji}^{rr} & a_{jj}^{rr} & a_{ji}^{rs} & a_{jj}^{rs} \\ a_{ii}^{sr} & a_{ij}^{sr} & a_{ii}^{ss} & a_{ij}^{ss} \\ a_{ji}^{sr} & a_{jj}^{sr} & a_{ji}^{ss} & a_{jj}^{ss} \end{bmatrix}$$

and the output vector *x* is equal to:

$$x = \begin{bmatrix} x_i^r \\ x_j^r \\ x_i^s \\ x_j^s \end{bmatrix}$$

Therefore, the output required to produce the final demand in one region can be decomposed by region of origin and industry. The impact of an increase in the output of one region over the output of other regions is called a "spillover effect" in the literature. To be more precise, in our example, the output required from sector *i* in region *r* ($\bar{x}_i^r$) to respond to the final demand in region *s* from sector *j* ($\bar{f}_j^s$) is equal to:

$$\bar{x}_i^r = l_{ij}^{rs} \bar{f}_j^s \tag{13}$$

l_{ij}^{rs} is the element of the interregional Leontief inverse matrix (L) concerning trade from sector *i* in region *r* to sector *j* in region *s*.

$$L = (I - A)^{-1} = \begin{bmatrix} l_{ii}^{rr} & l_{ij}^{rr} & l_{ii}^{rs} & l_{ij}^{rs} \\ l_{ji}^{rr} & l_{jj}^{rr} & l_{ji}^{rs} & l_{jj}^{rs} \\ l_{ii}^{sr} & l_{ij}^{sr} & l_{ii}^{ss} & l_{ij}^{ss} \\ l_{ji}^{sr} & l_{jj}^{sr} & l_{ji}^{ss} & l_{jj}^{ss} \end{bmatrix}$$

Then, the value-added coefficient $(v_c)_i^r$ for industry *i* in region *r* is calculated as the ratio of the industry's direct value-added to its total output from the reference IRIO table. The indirect value-added contribution of sector *i* in region *r* for the final demand from industrial sector *j* in region *s* ($\bar{f}_j^s$) is:

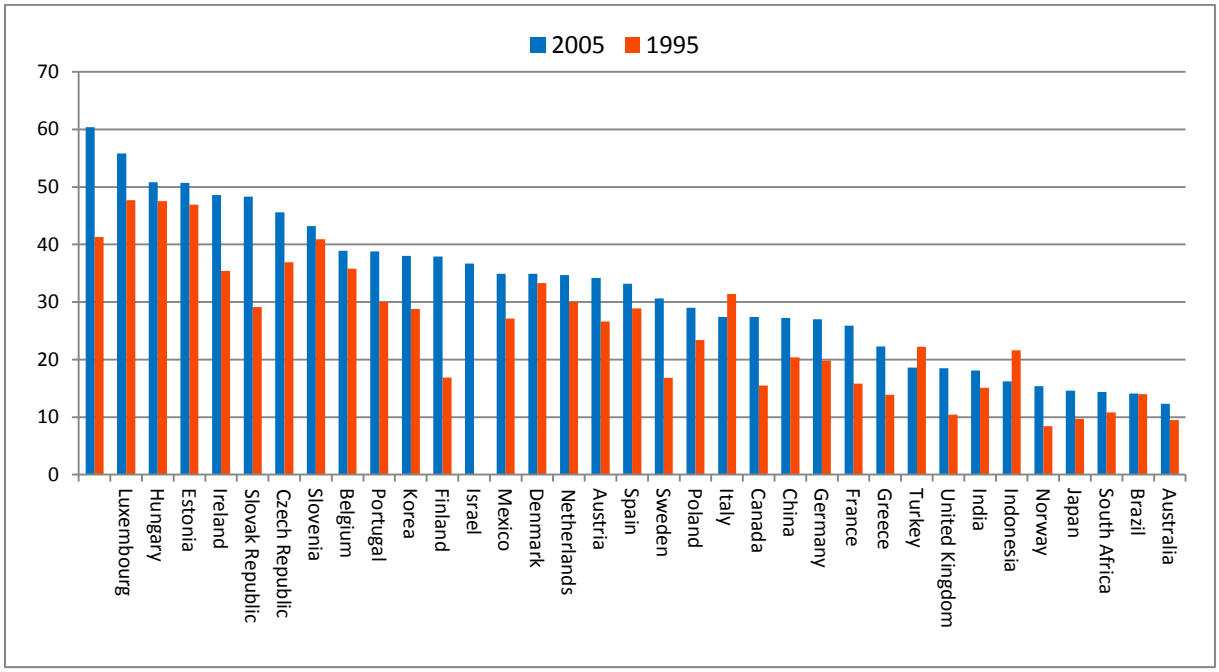
$$\bar{\varepsilon}_i^r = (v_c)_i^r * l_{ij}^{rs} \bar{f}_j^s \tag{14}$$

$(v_c)_i^r * l_{ij}^{rs}$ is the row element of the sector-demand-to-sector-value-added multiplier for interregional trade from sector *i* in region *r* to sector *j* in region *s*. In matrix form, sector-demand-to-sector-value-added multiplier $m(v)$ is equal to the following row vector:

$$m(v) = v_c{}'L \tag{15}$$

At international level, a form of IRIO table, an international input-output table has been constructed by the World Input-Output Tables project funded by the European Commission of Research[56]. The OECD also has national IO tables for some countries showing the import volume for each export sector (Graph 1). However, the distinction between imported input allocated to domestic final demand and to exports is not always obvious. For example, for China, the share of import content is significantly higher when input imports by EPZs are distinguished (Yang *et al.*, 2009).

Graph 1: Import content of exports, 1995 and 2005 (% of Total Gross Exports)



Source : OECD, STAN Input-Output Database, May 2011. *http://dx.doi.org/10.1787/888932487875*

[56]Data are available on **www.wiod.org.**

In our work, we will concentrate on the interregional input-output table for Brazilian states, which traces the geographic fragmentation of production across the states and hence shows the "origin" state of Brazilian foreign exports.

IV. Inter-state input-output table (2008)[57]

The Brazilian inter-state input-output system for 27 regions (26 states and the Federal District) was estimated based on a combination of different sources of data and methodologies. We first detail the data available to estimate the Brazilian input-output table and then address the construction of the inter-state input-output system.

The most recent input-output system released by the Brazilian Statistical Office (IBGE) refers to 2005 (IBGE, 2008). However, using the information available in the Brazilian System of National Accounts (IBGE, 2010) and the methodology presented by Guilhoto and Sesso Filho (2005; 2010), we can estimate an input-output system for Brazil for the most recent years based closely on the Brazilian input-output systems released by the IBGE. From the above, a national input-output system was estimated for 2008, consisting of national supply and use tables, giving basic prices, at the level of 56 industries and 110 commodities. The estimated national input-output system was then used as the basis to estimate the inter-state system for Brazil based on the methodology presented in Guilhoto *et al.* (2010).

The steps followed for the estimation of the inter-state system for Brazil can be summarized as follow[58]:

[57]Thanks to Prof. Joaquim Guilhoto from USP (Universidade de São Paulo) who calculated the value-added data I needed and used in the rest of this paper during my two stays at USP. He kindly agreed to share the Inter-state Input-Output Table for 2008 constructed by himself and his NEREUS team and also the construction methodology presented in this section.

58 See Figure 1 in Annex, which summarizes the work needed to estimate the inter-state input-output system for Brazil.

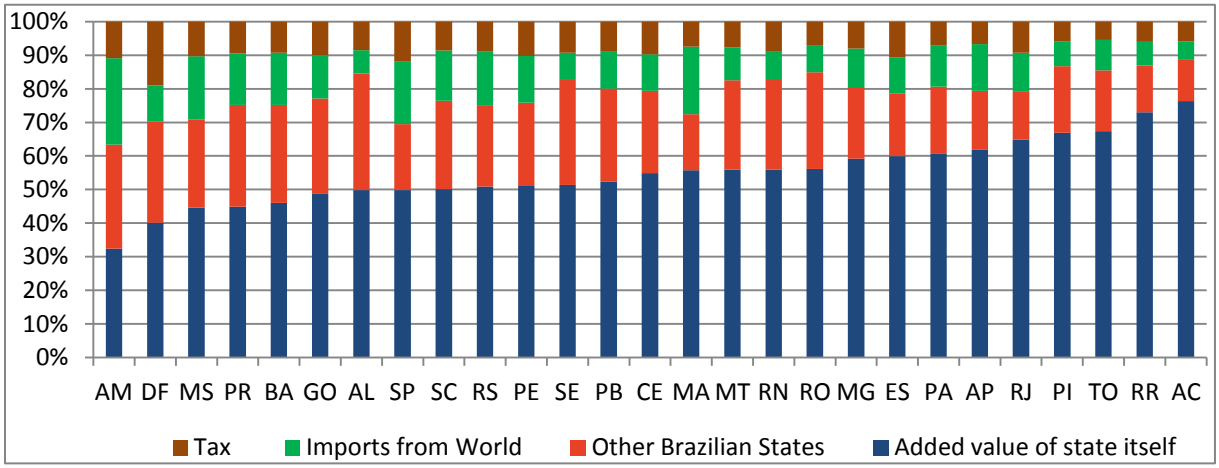
- Using information from the IBGE surveys of Agriculture, Industry, Trade, Transport, Services, and Civil Construction, a first estimate is made of total output by 56 industries and 110 commodities for each of the Brazilian states;
- These initial estimates are then balanced to match the total output at the level of 17 industries presented in the Brazilian Regional Accounts (IBGE);
- These output estimates are also used to estimate the supply tables for each of the Brazilian states. The states' supply tables are estimated in such a way as to be consistent with the national supply table;
- Using information: a) on imports by state, from the Ministry of Development, Industry and External Trade; b) on tax collection in each state, from the Ministry of Finance and the State Secretaries of Finance; c) on payments to workers by industry and state, from the Ministry of Labor and the IBGE Household Survey; d) on value-added generated at the level of 17 industries, by state, presented in the Brazilian Regional Accounts (IBGE), the tax, imports, and value-added components are estimated for the 56 industries for each of the Brazilian states, which are also consistent with the value-added components in the national input-output table;
- Using information: a) on exports by each state, from the Ministry of Development, Industry and External Trade; b) on government spending estimated by the Ministry of Finance, the States Secretaries of Finance and the IBGE; c) on household spending estimated by the Household and Household Consumption Patterns surveys; d) on investment based on the level of the Civil Construction in each state (IBGE), the input-output system's final demand components are estimated for each state, which are consistent with the national input-output table;
- Using cross-industry location quotients for intermediate consumption and simple location quotients for final demand, a first estimation is made of flows of goods and services among the Brazilian states;
- Using the work done by Vasconcelos and Oliveira (2006), which estimates the flow of goods among Brazilian states for 1999, and taking into consideration the growth of the states from 1999 to 2008, a second estimation is made of flows of goods and services among the Brazilian states;

- The third and final estimation of flows of goods and services among the Brazilian states is made taking into consideration the following: a) the inter-state input-output system should be consistent with the national table; b) the change in inventories should be zero when they are zero in the national table; c) the change in inventories in each state, when related to the total output of the corresponding sector should be in a range no greater than 30% of this relation found in the national table;
- The third estimation produces a commodity by industry inter-state input-output system for Brazil. The supply tables for each of the states are then used to obtain the industry-by-industry inter-state system used in this work.

V. Vertical specialization in Brazil

Under the "new trade paradigm", the diversified nature of Brazilian states' characteristics, such as factor endowments, economic sizes, infrastructures, etc., may drive vertical specialization at national level. Foreign demand will also drive state specialization in tasks in order to take advantage of economies of scale. The exported goods are then produced by a sequence of tasks in which one or more Brazilian states are involved. Hence, the value of gross exports from one state may partly include the value-added from other states, which inter-link the foreign trade with inter-state trade.

Graph 2: Breakdown of states' gross exports (2008)



Source: 2008 Inter-State Input-Output Table calculated in association with J. Guilhoto (USP) based on the NEREUS database. Some elements are available on http://guilhotojjmg.wordpress.com/banco-de-dados/matrizes-nacionais-2/

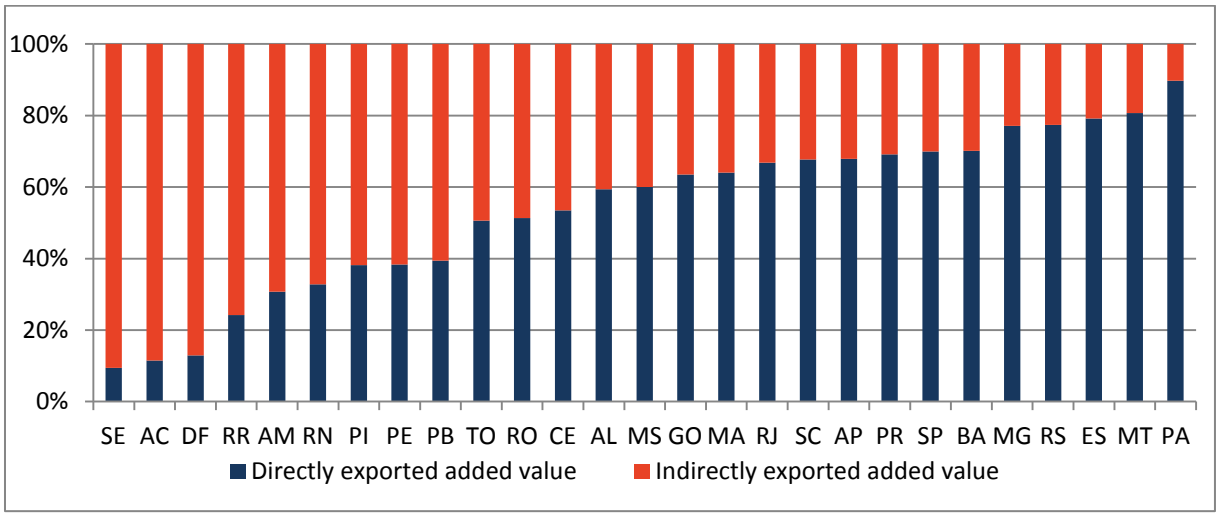
In Graph 2, we show the percentage share of the gross export values of each state broken down by the value-added of the state itself, the value-added originating in other states and re-exported, the gross imports from other countries – without identifying the origin of the imported value-added – and the tax collected by Brazil, at different administrative levels, by federal and state governments or by municipalities. To be more precise, for the example of São Paulo (SP), the value-added produced by the state itself represents approximately 50% of SP's gross exports, while the value-added of 26 other states embodied in SP's gross exports is 20%. The content imported from the world is also approximately 20% (see Table 5 in Annex for the states' two-letter codes).

Graph 2 shows that an average of 54% of states' exports are produced by themselves while 24% is the domestic import content re-exported. The foreign import content in states' exports is around 12% on average, which is in line with the OECD's calculation for 2005 (see Graph 1). However, percentages vary across states. Three small states (Roraima (RR), Acre (AC) and Tocantins (TO)) in the Northern region, which are relatively isolated from the rest of the country, have more than 70% of their own value-added in their exports. The states of Minas Gerais (MG), Pará (PA), Amapá (AP), Espírito Santo (ES), Piauí (PI) and Rio de Janeiro (RJ) also post a higher than average (more than 54%) domestic value-added share in their gross exports. This result may be explained by the states' large exports of natural resources, such as minerals for MG and iron ore for PA, which is the leading iron mining area in the country[59]. In the case of the state of Amazonas (AM), where the Manaus Free Trade Zone (MFTZ) is situated, the domestic value-added share is the lowest of all the Brazilian states at 32%. However, the value-added originating in other states (domestic import content) is around 31%, which is higher than the foreign import content (26%). This is surprising for a Free Trade Zone, even though it is much higher than the Brazilian states' average foreign import content (12%).

[59] Lopes Neto (2001); "Lessons from Brazil's regional development programs" from the OECD China Conference.

Graph 3 presents the value-added exported *directly* by the state itself and by other states *indirectly*, which means re-exported embodied in the exports of other states. On average, 54% of states' exported value-added is realized directly by themselves while 46% is exported indirectly, via other states. Graph 3 shows that states are very different from each other in terms of the share of their direct-indirect exported value-added shares. This result highlights, as does Graph 2, that state inclusion in the national production chain of Brazilian exports is highly diverse and virtually non-existent in some states, e.g. Pará (PA) (approximately 90% of exported value-added is direct). Other states with high mineral resources also export their output relatively directly (Minas Gerais (MG) and Pará (PA)). Also the rich states of the South and South-East, with their advantageous access to international markets, appear to export their own value-added by themselves (Espírito Santo (ES), Rio Grande do Sul (RS), São Paulo (SP), Rio de Janeiro (RJ) and Santa Catarina (SC)). These features are relatively more complicated to interpret for poor states, e.g. while Sergipe (SE) exports very little of its value-added itself, Tocantins (TO) posts the Brazilian average. Amazonas (AM) exports its value-added in large part indirectly, which can be explained by the MFTZ special tax scheme to integrate the zone into the Brazilian domestic market.

Graph 3: Indirectly and directly exported value-added of states (%)

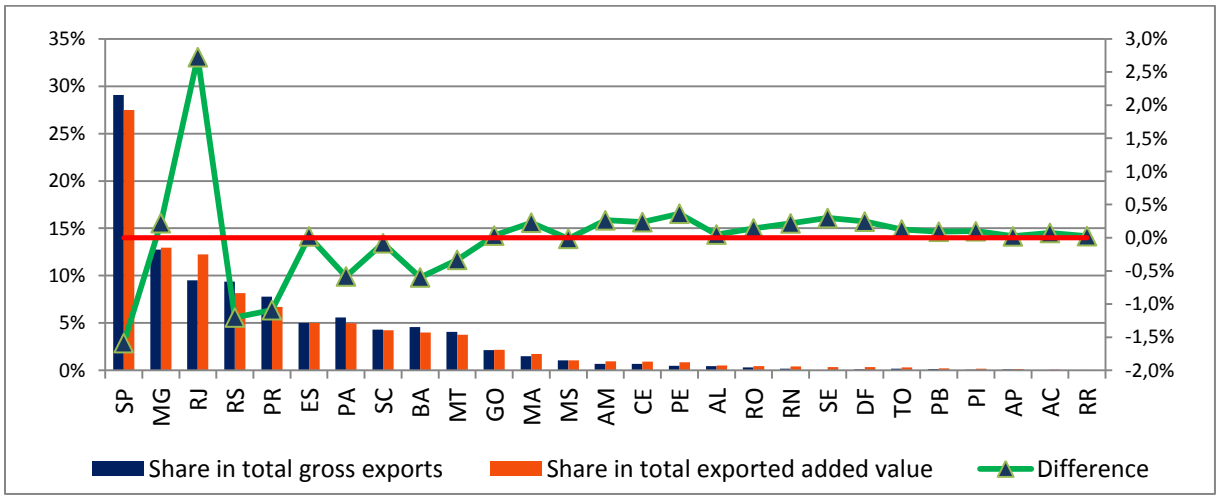


Source: 2008 Inter-State Input Output Table calculated by J. Guilhoto at USP.

The above two graphs present the structure of vertical specialization in the Brazilian internal market for export products. Aside from states that directly export primary products, industrial

production in large states is dependent on other states. States' exports (São Paulo (SP), Santa Catarina (SC), Rio Grande do Sul (RS), and Amazonas (AM) in Graph 2) create a demand for other states. Graph 3 shows the states that serve as suppliers (Amazonas (AM), Rio Grande do Norte (RN), Piauí (PI), Pernambuco (PE), etc.). Amazonas (AM) appears to be both supplier and consumer; a supplier for the exports of other states and a consumer of the products from other states to re-export. This can be explained by the existence of the Manaus Free Trade Zone and its special tax structure.

Graph 4: States' gross exports and value-added share in Brazilian total (%)



Source: 2008 Inter-State Input Output Table calculated by J. Guilhoto at USP.

However, another interesting issue is the comparison between the structures of states' gross exports and the structure of their exports in value-added terms. Hence, in Graph 4 we present the share of states' exports in Brazilian total gross exports and their value-added share – exported directly or indirectly – in Brazilian total exported value-added.

Graph 4 shows that the states' exports shares (%) in value-added terms and in gross terms are very similar, with the difference between two indicators generally being zero or close to zero. Rio de Janeiro (RJ)'s share in exported value-added seems to be relatively larger than it is in gross terms. São Paulo (SP), however, has a higher percentage of its exports in Brazilian total gross exports. However, these differences are very marginal: 3% for Rio de Janeiro (RJ) and 1.6% for São Paulo (SP).

VI. Restructuring gravity model: bilateral or trilateral trade?

First introduced by Tinbergen (1969) with empirical intuitions, the gravity model has since been enriched with robust theoretical underpinnings by different approaches and is used today as the workhorse in the empirical trade analysis. In its standard form, it is derived from a consumer expenditure system in which the price term is eliminated using the general equilibrium structure of the theoretical model (Anderson and van Wincoop 1979, 2003). In Anderson and van Wincoop (2003), the demand for the products of *i* by entity *j*, derived by maximizing the CES utility function of consumer *j*, is as follows:

$$x_{ij} = \left(\frac{\beta_i p_i t_{ij}}{P_j}\right)^{1-\sigma} Y_j \tag{16}$$

where p_i is the supply price of *i*, t_{ij} the iceberg trade costs and P_j the consumer price index in *j*. The aggregate exports of *i* to all partners *j* are equal to the total output of *i:*

$$Y_i = \sum_j x_{ij} \tag{17}$$

The above market clearance condition is then used to eliminate the relative price term (p_i) in expenditure equation (16). The equilibrium prices are then:

$$(\beta_i p_i)^{1-\sigma} = \frac{Y_i}{\sum_j (t_{ij}/P_j)^{1-\sigma} Y_j} \tag{18}$$

Hence, the trade from *i* to *j* in equilibrium is:

$$x_{ij} = \frac{Y_i}{\Omega_i}\left(\frac{t_{ij}}{P_j}\right)^{1-\sigma} Y_j \tag{19}$$

where,

$$\Omega_i = \sum_j (t_{ij}/P_j)^{1-\sigma} Y_j \tag{20}$$

The above model relies on the assumption that the products exported from *i* to *j* are produced solely in *i*. In empirical gravity literature, x_{ij} is measured as the gross exports of *i* to *j*, while Y_i is measured on a value-added basis by the GDP of entity *i*. However, under vertical specialization, the origin of the value-added and the exporter of the good are no longer the same and the volume of aggregate gross exports is much higher than the amount of domestic value-added due to the high or increasing import content of exports or, in other words, intermediate goods imported and re-exported. However, as discussed by Baldwin and Taglioni (2011), GDP can be used to measure gross output provided the import content of exports is similar across entities and over time. This is understandable since the ratio of imported intermediate goods in exports may be considered a constant in the econometric estimations as long as it is fixed for the whole sample. Nevertheless, trade relation dependencies are not uniform across countries and world trade today is characterized by a varying extent of trade in tasks across trade partners. Furthermore, trade in intermediate goods has grown sharply in recent years.

Another problem in the theoretical model concerns the measurement of *j*'s expenditure (Baldwin and Taglioni, 2011). The model assumes that the demand of *j* is for the final consumption. Therefore, *j's* expenditure is its total income, which is again measured by the GDP of entity *j*. However, if *j* is not the final demand market, but is solely the point where the good is transformed before being re-exported, then *j's* GDP does not reflect its expenditure on imported goods.

We set out to overcome these two problems in the theoretical model by extending the value chain from the bilateral frame in the standard gravity model to a trilateral trade relation. With a trilateral model, we can structure and estimate the trade relation between producer *i* and importer *j*, but we can also control for importer *j*'s export relations with its partners. So the exports of *i* to *j* can be in final goods, which will be consumed in *j* or in intermediate goods, which will be re-exported by *j* to *k* (as trade partners of *j*). For the sake of simplification, we assume that exports from *j* to *k* are solely for final consumption in the destination markets. This trilateral construction takes us one step closer to the real world and it can even be extended further to a multilateral relation.

j's demand for products imported from *i* can then be written as follows:

$$v_{ij} = \left(\frac{\beta_i p_i t_{ij}}{P_j}\right)^{1-\sigma} \left(E_j + \sum_{k \neq j} x_{jk}\right) \quad (21)$$

In Equation 21, unlike the traditional gravity literature, we concentrate on the demand for outputs produced entirely by exporter *i*. Hence, instead of the notation x_{ij} – as used in Equation 16 – we use the total value-added exported from *i* to *j* (v_{ij}). This is a better measure when there is a high level of vertical specialization. Exports in value-added also appears to be more in line with the theory, which implicitly assumes that the exported products originate entirely in the exporter's country (e.g. Anderson and van Wincoop, 2003), contrary to the empirical literature, which uses gross exports. Another difference in the equation is that *j*'s demand depends not only its own final consumption, but also on its exports to the rest of the world (*k).* So the demand addressed to *i* also covers the intermediate goods imported by *j* for re-exportation. Therefore, *i* exports part of its output directly to its partner *j* in response to *j*'s final demand as measured by its consumer expenditure (E_j). Another part is exported from *i* indirectly to *k* via *j*. The demand of *j* for this re-exportation is measured by *j*'s bilateral gross exports to *k* (x_{jk}), since a partner can be either direct or indirect at once ($k \neq j$).

The market clearance condition can then be written as follows:

$$\sum_j v_{ij} = Y_i \quad (22)$$

where $i \epsilon j$.

The sum of v_{ij} over *j* should cover the total output of country *i* either consumed within the country itself ($i \epsilon j$) or exported to *j* (for final consumption in *j* or re-export to *k*). By taking the sum of Equation 21 on *j* and using the equality in Equation 22:

$$Y_i = (\beta_i p_i)^{1-\sigma} \sum_{\mathrm{j}} \left(\left(\frac{t_{ij}}{P_j}\right)^{1-\sigma} \left(E_j + \sum_{k \neq j} x_{jk}\right) \right) \quad (23)$$

From Equation 23, the price in equilibrium is then equal to:

$$\beta_i p_i = \left(\frac{Y_i}{\Omega_i}\right)^{1/(1-\sigma)} \quad (24)$$

where, Ω_i is the distance weighted sum of *j*'s expenditure normalized by *j*'s price indices:

$$\Omega_i = \left(\sum_j \left(\frac{t_{ij}}{P_j}\right)^{1-\sigma} \left(E_j + \sum_{k \neq j} x_{jk}\right)\right)^{1/(1-\sigma)}$$

By substituting the general equilibrium price – calculated by Equation 24 – in Equation 21 demand, we get trade in equilibrium:

$$v_{ij} = \frac{Y_i}{\Omega_i}\left(\frac{\beta_i p_i t_{ij}}{P_j}\right)^{1-\sigma} \left(E_j + \sum_{k \neq j} x_{jk}\right) \quad (25)$$

where $i \epsilon j$.

Ω_i is commonly referred to in the literature as exporter *i*'s *multilateral resistance term*[60]. Baldwin and Taglioni (2011) also call it *i*'s market potential index. It measures entity *i*'s trade barriers with all trade partners. However, Ω_i in Equation 25, unlike the gravity literature (see Equation 20), assesses *i*'s trade barriers by assuming that its partners *j* have access to demand in third markets ($\sum_{k \neq j} x_{jk}$). So, if *i* can access a market (*j*), which in turn has good access to third markets (k), *i*'s multilateral resistance will fall.

From Equation 25, the exported value-added can be re-written for exports of *i* to *j* as follows:

$$v_{ij} = \frac{Y_i}{\Omega_i}\left(\frac{t_{ij}}{P_j}\right)^{1-\sigma} E_{j=1} + \frac{Y_i}{\Omega_i}\left(\frac{t_{ij}}{P_j}\right)^{1-\sigma} x_{j,k=1} + \frac{Y_i}{\Omega_i}\left(\frac{t_{ij}}{P_j}\right)^{1-\sigma} x_{j,k=2} + \cdots \quad (26)$$

[60] Anderson and van Wincoop (2003) go further and show, under symmetrical trade barriers, that the multilateral resistance term for *i* is equal to its price index (P_i). However, these calculations are beyond the scope of our paper and are hence not included here.

We can write Equation 26 as follows:

$$v_{ij} = d_{ij} + \sum_{k \neq j} z_{ijk} \quad (27)$$

The first additive term (d_{ij}) in Equation 27 is equal to the directly exported value-added from *i* to *j* for final consumption in (*j*) and it can be calculated taking Equation 26*:*

$$d_{ij} = \frac{Y_i}{\Omega_i}\left(\frac{t_{ij}}{P_j}\right)^{1-\sigma} E_j$$

d_{ij} depends, as does the traditional gravity equation, solely on the characteristics of exporter *i* and importer *j*. However, the following additive terms ($\sum_{k \neq j} z_{ijk}$) taken from Equation 27 also depend on the characteristics of the final destination *k*.

So, from Equation 26 and 27:

$$z_{ijk} = \frac{Y_i}{\Omega_i}\left(\frac{t_{ij}}{P_j}\right)^{1-\sigma} x_{jk}$$

where $k \neq j$.

z_{ijk} is the indirectly exported value-added of *i* to *k*. It is indirect since this value-added is re-exported via *j* to *k*. Hence, it measures the extent of intermediate trade to *j* from *i* for final demand in *k*.

As highlighted by the above theoretical model, the structure of trade in final goods displays a different pattern to trade in intermediate goods when these are re-exported. The first is shaped by the bilateral relation between *i* and *j* while the latter is trilateral, if not multilateral. In the next section, we discuss the repercussions of this different trade structure on the empirical analysis

.

VII. Bilateral estimation model and results

The traditional empirical trade analysis approach takes the bilateral gravity model, ignoring the multilateral nature of trade in components. It estimates bilateral gross exports by exporter and importer sizes and/or by augmenting the model with their other observable characteristics along with bilateral distance. In this section, we will take this approach to understand the limits of the model and then introduce a new trade measure based on value-added instead of gross exports.

We first estimate the structure of Brazilian states' exports with the rest of the world. To this end, we take the exports of 27 states with 81 countries in 2008 (see Table 4 and 5 in Annex). In order to analyze Brazilian states' exports with the rest of the world and the impact of states' characteristics, we can estimate the following bilateral model in its simplest traditional form:

$$\ln(X_{ij}) = \beta_0 + \beta_1 \ln(GDP_i) + \beta_2 \ln(R_i) + \beta_3 \ln(dist_{ij}) + \alpha_j + \varepsilon_{ij} \qquad \text{(I)}$$

where X_{ij} denotes gross exports from Brazilian exporter state *i* to destination country *j*, $\ln(dist_{ij})$ is the natural logarithm of the distance between state *i* and partner country *j* and GDP_i is the gross domestic product of state *i*. Given that our main aim is to estimate the impact of exporter characteristics, we simply take fixed effects (α_j) to control for the impact of importer characteristics. R_i is the remoteness of state *i* from the rest of the world ($m \neq j$, aside from its partner country *j*. This is measured in keeping with Head (2003) by[61]:

$$R_i = 1/\sum_{m \neq j}[GDP_m/Dist_{im}]$$

[61] We have also tested the model with a remoteness index calculated in line with McCallum (1995). However, the results do not differ a lot.

The higher is R_i, the more distant state *i* from countries *m* ($m \neq j$) and/or the closer to countries whose *GDP*s are relatively small. The more remote the state, the higher trade can be expected to be between *i* and its partner *j* since exporter state *i*'s access to other markets *m* is limited.

According to Baldwin and Taglioni (2011) the traditional bilateral model, as introduced in Model I, returns biased estimates when trade in intermediate goods dominates. So we need to focus more closely on vertical specialization in the Brazilian market while working with the empirical gravity model. The exported product does not necessarily originate in Brazilian exporter state *i*. Generally, at least part of it is produced in other states. Trade between exporter state *i* and its partner *j* depends not only on their characteristics but also on *i*'s trade with other supplier states and *j's* exports with the rest of the world. If this is ignored, the model will generate structure-biased estimates depending on the nature of the correlation between exporter and/or importer characteristics and the rest of the production chain. Empirically, this bias may occur, for example, if vertical specialization is more probable between close trade partners. We then expect to get higher export values for countries with their close partners since they are not trading solely for final consumption, but also for re-export. In this case, if vertical specialization is not controlled for, the impact of the bilateral distance variable will be overestimated since the real destination of the gross exports is in part a more distant country.

Aiming to solve this problem in Model II, we take up the proposal put forward by Baldwin and Taglioni (2011) and replace the exporter variables (GDP and remoteness) with exporter fixed effects. We already have importer fixed effects for the importer. Consequently, the model controls for the multilateral nature of the components trade, namely the dependencies of the final exporter and its bilateral partner with third, fourth or more partners. We then estimate the following bilateral trade equation with exporter and importer fixed effects, which should provide a better measurement of the Brazilian states' trade structure:

$$\ln(X_{ij}) = \beta_0 + \beta_1 \ln(dist_{ij}) + \alpha_i + \alpha_j + \varepsilon_{ij} \qquad \text{(II)}$$

where X_{ij} is again gross exports from exporter state *i* to destination country *j* and $\ln(dist_j)$ is the natural logarithm of the distance between state *i* and partner country *j*. α_i and α_j are, respectively, the exporter fixed effects of *i* and importer fixed effects of *j*. Model II then assumes that the characteristics of the production chain as far as exporter *i* are specific to *i* and that the characteristics of the production chain from importer *j* onwards are specific to *j*. This structure should provide a better measurement of the impact of bilateral distance on bilateral gross exports.

Another way of solving the disassociation between the origin of the exported goods and the exporter is to find another measurement of trade focusing on the origin of exports. This means dropping off the value-added originating in other states, otherwise included in the gross exports from state *i* to country *j*. These values are calculated using the Inter-State Input-Output Table for 2008. In Model III below, we analyze the characteristics of exporter state *i* in terms of their impact on the value-added produced and exported by state *i*:

$$\ln(V_{ij}) = \beta_0 + \beta_1 \ln(GDP_i) + \beta_2 \ln(R_i) + \beta_3 \ln(dist_{ij}) + \alpha_j + \varepsilon_{ij} \quad \text{(III)}$$

This is similar to Model I with the difference that the dependent variable is not gross exports, but the value-added produced by state *i* and exported by state *i* to destination country *j* (V_{ij}). Model IV, including exporter and importer fixed effects, is also estimated for the purpose of comparison with Model II:

$$\ln(V_{ij}) = \beta_0 + \beta_1 \ln(dist_{ij}) + \alpha_i + \alpha_j + \varepsilon_{ij} \quad \text{(IV)}$$

We estimate the above four models in cross-section for 2008. For the purpose of comparison, we use two types of estimator: Ordinary Least Square (OLS) and Pseudo Poisson Maximum Likelihood (PPML), which has been widely used in the literature since Santos Silva and Tenreyro (2006). The PPML model is a better tool for estimating gravity models in the way it deals with the model's existing estimation bias due to heteroskedasticity in the trade data. Another advantage of PPML is that the model estimates the gravity equation in its multiplicative form and hence deals with zero trade values better. The log-linearization

procedure in OLS returns zero trade values for missing data points, which can cause a bias when they are not random.

National GDP values are given in current dollars and are drawn from the World Bank's *World Development Indicators* database. GDP values for the Brazilian states are provided by the IBGE (*Instituto Brasileiro de Geografia e Estatística)* in local currency units. They are converted into current dollars by applying the exchange rate taken from WDI. The distance variable is calculated by the author using the geographical coordinates of the capitals of the states and the countries as furnished by the *World Gazetteer* website.

Table 1 shows the results for the bilateral gravity model with dependent variables: states' bilateral gross exports (Model I and II) and bilateral exported value-added (Model III and IV). For ease of reading, we present the models that are similar in terms of their explanatory variables side by side. Estimates for Model I – with GDP and Remoteness – are shown in the first and third column of the table, the former in OLS and the latter in PPML. In keeping with the literature, both estimators show that GDP has a positive impact and that bilateral distance drives down states' gross exports to countries. Remoteness is significantly positive as expected, although at 1% under OLS and at 10% under PPML.

In Model I, the distance variable is larger in absolute terms when estimated by PPML and is significant at 1%. It is smaller and significant only at 10% when estimated by OLS. This can appear surprising at first sight since the PPML estimator, compared to OLS, generally estimates a smaller impact of bilateral distance on exports. In our sample, however, since the Brazilian states are very close to each other and so are similar distances from the rest of the world, the bilateral trade barriers vary more by importer country than by exporter state and are hence captured in part by the importer fixed effects. Apparently, PPML manages better to isolate the impact of bilateral distance from the importer fixed effects while OLS estimates a smaller impact of distance on exports. This may also be explained by the PPML estimator's ability to solve the bias due to the heteroskedasticity in the data.

Table 1: Bilateral gravity model estimates

Estimator :	OLS		PPML		OLS		PPML	
	I	III	I	III	II	IV	II	IV
	ln (X_{ij})	ln (V_{ij})	X_{ij}	V_{ij}	ln (X_{ij})	ln (V_{ij})	X_{ij}	V_{ij}
ln (GDP_i)	1.340	1.327	0.922	0.927				
	(0.065)**	(0.065)**	(0.054)**	(0.060)**				
ln (R_i)	6.869	6.635	1.992	1.633				
	(0.940)**	(0.944)**	(1.092) +	(1.223) +				
ln ($Dist_{ij}$)	-0.356	-0.305	-0.602	-0.513	-0.519	-0.472	-0.613	-0.555
	(0.304)+	(0.292) +	(0.206)**	(0.204)*	(0.286) +	(0.280) +	(0.220)**	(0.232)*
Constant	150.909	144.687	51.812	42.090	15.774	15.040	17.421	16.548
	(22.693)**	(22.752)**	(24.856)*	(27.699)**	(2.547)**	(2.490)**	(2.001)**	(2.101)**
Exporter fe	No	No	No	No	Yes	Yes	Yes	Yes
Importer fe	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 or *Pseudo* R^2	0.51	0.52	0.77	0.77	0.64	0.64	0.84	0.84
N	1,692	1,670	2,187	2,187	1,692	1,670	2,187	2,187

Robust standard errors are in parentheses: All inferences are based on a Huber-White sandwich estimate of variance. *Pseudo* R^2 in the table is calculated for PPML estimates by McFadden's Pseudo R^2 and are not comparable with OLS R^2. $^+p<0.1$; $^*p<0.05$; ** $p<0.01$

Model II gives better results in that the exporter fixed effects also control for unobservable characteristics and that the goodness-of-fit, measured in terms of R^2 for OLS and Pseudo R^2 for PPML, is increasing from Model I to Model II for both. The gravity results for the distance variable seem more sensitive to the control of unobservable characteristics by exporter fixed effects when it is estimated in OLS. In Table 1, the size of the OLS-estimated distance variable decreases from -0.356 in Model I to -0.519 in Model II. The PPML-estimated coefficients, however, are relatively similar for both models: -0.602 in Model I and -0.613 in Model II.

Another point of note is that the OLS-estimated distance coefficient approaches the PPML estimate when exporter fixed effects are introduced into Model II. The impact of distance estimated by OLS is -0.519 and -0.613 by PPML in Model II, while the difference is greater in Model I: -0.356 estimated by OLS and -0.602 estimated by PPML. In line with Baldwin and Taglioni (2011), Model II with exporter fixed effects should be a better empirical model

since it also controls for the structure of components trade. By accepting their assumption and following our comparison between Model I and Model II, we can conclude that the trade structure of Brazilian states is estimated quite well by PPML even when the exporter fixed effects are replaced by observable exporter characteristics.

Last but not least, our estimation with the new measurement of trade, based on exported value-added, slightly reduces the impact of distance and remoteness in absolute terms. The impact of GDP changes very slightly without any clear conclusion. This result can be explained by the across-the-board uniformity of states' vertical specialization. The smaller impact of distance and remoteness on exported value-added, compared to their impact on gross exports, may be due to Brazil's production structure in which the states exporting primary goods, high in the states' own value-added, are located in the same region (South-East: Minas Gerais (MG), Espírito Santo (ES) and Rio de Janeiro (RJ)) where the natural conditions required for rich natural resources are found.

VIII. Trilateral estimation model and results

Trade in final goods depends on trade partners' bilateral relations while the analysis of trade flows in intermediate goods calls for a multilateral approach to trace the trade relation throughout the entire value chain. As discussed in the theoretical section, trade in intermediate goods in a trilateral set-up depends on both the exporter-importer couple's characteristics and the origin and demand characteristics in third countries. Hence, the exporter may serve as a go-between between origin and final demand in third countries and the bilateral trade volume between the exporter and the importer becomes partly, since it also partly concerns trade in final consumer goods, the result of this trilateral relation that is typical of components trade.

The traditional bilateral gravity model, even regressed for exports in value-added terms as conducted in the previous section, does not distinguish the structure of components exports from the structure of exports in final goods. We therefore focus our analysis on the pattern of trade in intermediate goods and use an empirical model inspired by Equation 27 above, as discussed in detail in theoretical section VI. In Equation 27, demand for intermediate goods

from *j* to *i* also depends on importer *j*'s gross exports to the rest of the world (*k*). Then, from Equation 27, trade in intermediate goods between *i* and *j* for final consumption in *k* is equal to;

$$z_{ijk} = \frac{Y_i}{\Omega_i}\left(\frac{t_{ij}}{P_j}\right)^{1-\sigma} x_{jk}$$

where $k \neq j$

z_{ijk} is the value-added of *i* indirectly exported to *k* after transformation in *j*. In other words, it is equal to the value of components goods – originating in *i* – which are embodied in the exports of *j*. x_{jk} represents gross exports from *j* to the rest of the world ($k \neq j$).

Therefore, in the light of the above equation, we can reinterpret the Brazilian states' trade structure. In this perspective, Brazilian states' foreign exports depend on their trade relations with the Brazilian domestic market, namely with other states. To be more precise, bilateral exports from a Brazilian state *j* to a given country *k* (e.g. São Paulo to France) also create demand for components produced in other states *i* (e.g. Amazonas). Let's consider that importer *j* in the above equation is equally an exporter to *k*, or to be more precise, a re-exporter. In the empirical analysis, for easy reading, we denote "*i*" for the original Brazilian state, "*j*" for the re-exporter Brazilian state, and "*k*", as before, for the foreign country of final destination or the importer in the model. For example, we consider the Amazonas (*i*)-São Paulo (*j*)-France (*k*) relation.

The above theoretical model explains only part of the picture. Total trade from state *i* to state *j* is more than the trade of re-exported intermediate goods. However, some intermediate or final goods can be produced and exported by a given state (state *j*) independently of other Brazilian states' production. Yet our objective is to show the structure of trade across vertically specialized entities and what the implications of disregarding it could be for empirical studies conducted using the usual approach in the literature, in bilateral terms and gross exports terms.

First, then, we estimate the following empirical gravity model inspired by the above theoretical Equation 27;

$$\ln(V_{ijk}) = \beta_0 + \beta_1 \ln(dist_{ij}) + \beta_2 \ln(X_{jk}) + \alpha_i + \alpha_j + \varepsilon_{ijk} \quad \text{(V)}$$

V_{ijk} – equivalent to z_{ijk} in Equation 27 – is measured by the Inter-State IO Table for 2008. It is equal to the value-added produced in state *i* and re-exported – as embodied in the exported goods – by state *j* to destination country *k*. An important point of Model V is that the value-added re-exported from *j* to *k*, hence part of the gross exports from *j* to *k*, also depends on the distance of the state of origin *i* to re-exporter *j* ($dist_{ij}$) and on the characteristics of the state of origin *i*. They are controlled with the origin fixed effects (α_i). α_j denotes the re-exporter fixed effects, or the multilateral resistance term for re-exporter *j*, which refers to importer *j*'s price index P_j in the theoretical equation.

Model V, however, suffers from an endogeneity problem due to simultaneous causality between exported value-added V_{ijk} and gross exports from *j* to *k*. The gross exports from *j* to *k* should drive up *i*'s value-added re-exported by *j*. However, the opposite is also true. V_{ijk} obviously represents some share of X_{jk}. In the case of simultaneous causality, the error term is correlated with the independent variables. So the model is estimated with a simultaneity bias. In our model, X_{jk} and the error term, which counts for the part of V_{ijk} unexplained by the model, are correlated. So we identify Model V with the exogenous variables explaining X_{jk} and estimate a reduced form with these exogenous variables. To this end, we use the traditional gravity model with importer fixed effects, estimating the impact of observable characteristics for re-exporter state *j*,

$$\ln(X_{jk}) = \delta_0 + \delta_1 \ln(GDP_j) + \delta_2 \ln(R_j) + \delta_3 \ln(dist_{jk}) + \alpha_k + \varepsilon_{jk} \quad \text{(V')}$$

Where R_j is the remoteness of state *j* from countries *m*,

$$R_j = 1/\sum_{m \neq k} [GDP_m / Dist_{jm}]$$

Model VI is equal to the reduced form of Model V with exogenous variables explaining X_{jk}, as exposed in the traditional gravity Equation V'.[62] We then identify Model VI as follows:

$$\ln(V_{ijk}) = \theta_0 + \theta_1 \ln(dist_{ij}) + \theta_2 \ln(GDP_j) + \theta_3 \ln(R_j) + \theta_4 \ln(dist_{jk}) + \alpha_i + \alpha_k + \varepsilon_{ijk} \quad \text{(VI)}$$

Model VI traces the structure of vertically specialized trade in a trilateral set-up. However, importer fixed effect α_k will also control for the continuation of the value chain, if it exists, after importer *k.* In this case, indirect importer *k* would "re-re-export" the value-added originating from state *i* to its trade partners, so consumption would take place in the fourth, fifth or more destination.

In Model VII, we estimate the model using a more general approach based on Baldwin and Taglioni (2011), where they assume fixed effects to be the best estimation method for the bilateral gravity model. However, for the trilateral model, we extend their fixed-effects approach to all three entities in the value chain. In Model VII, then, we introduce the fixed effects for re-exporter state *j* along with state of origin *i* and importer country *k* fixed effects.

$$\ln(V_{ijk}) = \theta_0 + \theta_1 \ln(dist_{ij}) + \theta_2 \ln(dist_{jk}) + \alpha_i + \alpha_j + \alpha_k + \varepsilon_{ijk} \quad \text{(VII)}$$

Model VII serves as a good reference. Next, we concentrate on the characteristics of the state of origin *i*. To this end, we estimate the above three models by introducing – instead of origin fixed effects – the observable characteristics of state *i.*

[62]In the simultaneous equation estimation, the unbiased impact of the endogenous independent variable (X_{jk} in our model) can be calculated by using the algebra on the coefficients estimated separately by the reduced form equations. However, our objective is not to calculate the impact of X_{jk} on V_{ijk} but to structure a gravity model that correctly estimates the multilateral structure of vertically specialized trade. Hence, the traditional model (V') is not estimated, as parameters δ are not of interest to the scope of our study.

Hence, the fourth model is equal to:

$$\ln(V_{ijk}) = \beta_0 + \beta_1 \ln(GDP_i) + \beta_2 \ln(R_i) + \beta_3 \ln(dist_{ij}) + \beta_4 \ln(X_{jk}) + \alpha_j + \varepsilon_{ijk} \qquad \text{(VIII)}$$

where R_i is the remoteness of state of origin *i* from other states *j*. It is measured again in keeping with Head (2003):

$$R_i = 1/\sum_{m \neq j} [GDP_m / Dist_{im}]$$

Models IX and X are inspired by the reduced form equation used in Model VI:

$$\ln(V_{ijk}) = \theta_0 + \theta_1 \ln(GDP_i) + \theta_2 \ln(R_i) + \theta_3 \ln(dist_{ij}) + \theta_4 \ln(dist_{jk}) + \alpha_j + \alpha_k + \varepsilon_{ijk} \qquad \text{(IX)}$$

In Model X, we describe the trade structure by means of the impact of observable characteristics in states of origin *i* and re-exporter states *j*:

$$\ln(V_{ijk}) = \theta_1 \ln(GDP_i) + \theta_2 \ln(R_i) + \theta_3 \ln(dist_{ij}) + \theta_4 \ln(GDP_j) + \theta_5 \ln(R_j) + \theta_6 \ln(dist_{jk}) + \alpha_k + \varepsilon_{ijk} \qquad \text{(X)}$$

In Table 2, we present the results for the above six equations estimated in cross-section for 2008. Table 2 shows solely the PPML estimates. As discussed above, for the bilateral gravity model, the impact of observable characteristics is better measured by PPML even when the multilateral structure of the trade is not directly controlled for. However, readers can find the results of the OLS estimates in Annex (Table 3).

Table 2: PPML estimates for the trilateral model

	V V_{ijk}	VI V_{ijk}	VII V_{ijk}	VIII V_{ijk}	IX V_{ijk}	X V_{ijk}
ln (GDP_i)				1.169	1.187	1.130
				(0.028)**	(0.035)**	(0.037)**
ln (R_i)				0.354	0.431	0.252
				(0.051)**	(0.062)**	(0.069)**
ln $(Dist_{ij})$	-0.336	-0.201	-0.336	-0.239	-0.339	-0.224
	(0.020)**	(0.038)**	(0.033)**	(0.017)**	(0.031)**	(0.034)**
ln (GDP_j)		0.949				0.913
		(0.023)**				(0.023)**
ln (R_j)		1.670				1.777
		(0.431)**				(0.443)**
ln $(Dist_{jk})$		-0.684	-0.606		-0.606	-0.688
		(0.115)**	(0.107)**		(0.107)**	(0.119)**
ln (GDP_k)						
ln (X_{jk})	0. .973			0.953		
	(0.007)**			(0.008)**		
Constant	-4.823	38.961	12.291	-17.745	-0.071	28.306
	(0. 212)**	(10.155)**	(1.004)**	(0.421)**	(1.190)	(10.610)**
Origin fe	Yes	Yes	Yes	No	No	No
Re-exporter fe	Yes	No	Yes	Yes	Yes	No
Importer fe	No	Yes	Yes	No	Yes	Yes
R^2*or Pseudo* R^2	0.97	0.81	0.87	0.96	0.86	0.80
N	56,862	56,862	56,862	56,862	56,862	56,862

Robust standard errors are in parentheses: All inferences are based on a Huber-White sandwich estimate of variance. *Pseudo* R^2 in the table is calculated for PPML estimates by McFadden's Pseudo R^2. * p<0.05; ** p<0.01

Model V explains a large part of dependent variable V_{ijk}, with Pseudo R^2 goodness-of-fit statistics at around 97%. However, given the simultaneous causality between V_{ijk} and X_{jk} in Model V, the high explanatory power of the model is not surprising. The impact of the distance from state of origin *i* to re-exporter state *j* is significantly different than zero. This coefficient is smaller compared to the distance impact estimated by bilateral gravity in the literature.

In Model VI, V_{ijk} is estimated with the exogenous independent variables. All variables are significantly different than zero at 1%. Pseudo R^2 is very high, at around 81%, although smaller than it is for Model V. The GDP impact of re-exporter *j* is around 1. Remoteness impact is positive, as expected. The impact of distance from state *i* to state *j*

($Dist_{ij}$) is relatively smaller compared to the results found in Model V. On the other hand, the impact of distance from *j* to *k* ($Dist_{jk}$) has a negative impact, whose extent is in line with the literature.

Apparently, in the Brazilian example, vertically specialized exports are driven more by the re-exporter's distance from the destination country than its distance from the state of origin. This is an important result, since trade in intermediate goods, which characterizes the first step for the exports – from state of origin to re-exporter – displays a different pattern to the trade in the later steps of the value chain. At aggregate level, the bilateral gravity model would not be able to distinguish these two patterns. It would underestimate the distance impact for final consumption trade and overestimate it for intermediate goods trade.

Lastly, we present the results for Model VII, with fixed effects based on Baldwin and Taglioni (2011). The coefficient of ($Dist_{ij}$) is similar to that of Model V. However, this is an expected result. In Model V, we explain V_{ijk} with origin and re-exporter fixed effects along with bilateral exports (X_{jk}) between *j* and *k,* which capture a large part of the unobservable bilateral characteristics between *j* and *c*. In Model VII, fixed effects for origin, re-exporter and importer also capture the unobservables with a high Pseudo R^2 of around 87%. However, the advantage of Model VII compared to Model V is that it also estimates the impact of distance from re-exporter *j* to *k.* The impact of distance from *j* to *k* is -0.606, slightly lower than found in Model VI (-0.688).

The rest of Table 2 concentrates on analyzing the origin characteristics. Model VIII is inspired by our theoretical insights and is also estimated with state of origin *i*'s observable characteristics, instead of fixed effects. The impact of X_{jk} is similar to that of Model V; hence the model looks coherent. The results for state of origin *i*'s characteristics are significantly different than zero and bear the expected sign. The impact of the state of origin's GDP is relatively strong compared to the literature. Hence, it is an important element explaining trade in a vertical specialization set-up. Remoteness of state of origin *i* from other states has a positive impact on V_{ijk}. To be more precise, state of origin *i*'s value-added re-exported by state *j* is increasing provided the state of origin is distant from other re-exporter states.

In Model IX, we estimate the V_{ijk} on re-exporter and importer fixed effects; hence the problem of simultaneity is resolved. The observable characteristics for state of origin *i* are always significant after correcting the simultaneity bias. The coefficients are very similar to Model VIII; they are slightly higher in absolute terms for all three variables: GDP of *i*, remoteness of *i* and distance of *i* from *j*.

Lastly (Model X), we track the entire vertical specialization structure, looking at the impact of observable characteristics at each step of the value chain. They are in line with previous results. The coefficient for *i*'s GDP is significantly different than zero and has a positive impact on its exported value-added. Re-exporter *j*'s GDP, however, looks to have a moderate impact compared with *i*'s GDP. Hence, the exporter's output capacity seems to be closely related to the potential suppliers. Nevertheless, the distance to the consumer or final market seems more important than the distance to the state of origin. The same holds true for remoteness; remoteness from final destination country *k* is more important than remoteness of the state of origin from the re-exporter.

We believe the above results provide important information as to how the trade structure can differ between two entities trading in the first step of the value chain and trade partners in the third or fourth steps of the chain. The bilateral gravity model would ignore this multilateral character and return biased estimates, under-estimated or over-estimated depending on the nature of the trade, i.e. whether it is dominated by trade in consumer goods or intermediate goods. However, this evidence cannot apply across the board because it only concerns Brazilian states which generally specialize in raw materials and agricultural products located in the first steps of the supply chain.

IX. Conclusion:

Our work discusses the implications of the "new trade paradigm" – reflected in the geographical fragmentation of the production process – on the traditional statistical and empirical trade analysis tools. We take a theoretical approach to show that measuring exports in value-added terms is more appropriate for the gravity model estimates and the model

should be extended to control for the multilateral nature of vertical specialization. Hence, we propose and estimate a trilateral gravity model frame, which is closer to the reality where vertical specialization takes the form of a multilateral relation across trade partners.

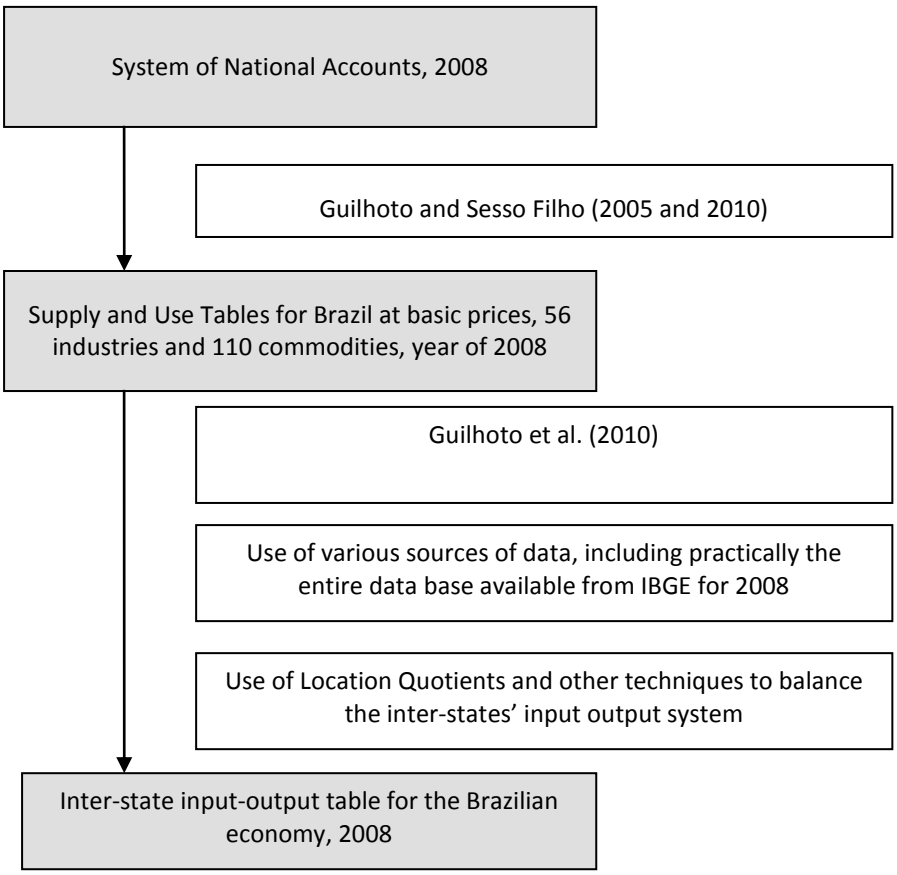
We first use the Brazilian Inter-State Input-Output table for 2008, to calculate states' value-added directly on its own and indirectly via other states. The analysis shows that, with the exception of states that export natural resources, Brazilian states' exports are inter-linked by internal production chains, driven by the demand of rich southern and south-eastern states (São Paulo (SP), Santa Catarina (SC), etc.) and supplied by relatively poorer states (Rondonia (RO), Piauí (PI), etc.). However, our results also find considerable directly exported value-added for some poor states. The analysis further highlights the special status of the state of Amazonas (AM) in Brazilian inter-state vertical specialization. Amazonas (AM) is both a supplier for other states' exports and a consumer of intermediate goods from other states, which are then re-exported to the rest of the world.

In Section VII, the results of the bilateral gravity model for Brazilian states' exports show that GDP impact is fairly similar when the exports are estimated in gross or in value-added terms. However, the coefficient for distance is smaller and less significant when its impact is estimated for exported value-added. This finding needs to be interpreted with care because, given that the sample covers solely Brazilian states' exports, the bilateral distance variable varies more by destination country than it does by state of origin.

On the other hand, the trilateral model shows that the structure of exports from origin to re-exporter and from re-exporter to consumer market is not the same. The distance of the re-exporter state from the importing partner country has a greater impact than distance from the state of origin. The re-exporter's GDP, however, is less important than the state of origin's GDP. Therefore, the gravity model estimated using the traditional bilateral approach may return biased results since it assumes a uniform structure in the trade of consumer goods and re-exported intermediate goods.

ANNEX

Figure 1



Estimating the Inter-State Input-Output System for Brazil for 2008

Table 3: OLS estimates for trilateral model

	I $\ln(V_{ijk})$	II $\ln(V_{ijk})$	III $\ln(V_{ijk})$	IV $\ln(V_{ijk})$	V $\ln(V_{ijk})$	VI $\ln(V_{ijk})$
$\ln(GDP_i)$				1.168	1.179	1.118
				(0.006)**	(0.017)**	(0.020)**
$\ln(R_i)$				0.349	0.375	0.212
				(0.011)**	(0.033)**	(0.038)**
$\ln(Dist_{ij})$	-0.369	-0.204	-0.369	-0.362	-0.360	-0.204
	(0.005)**	(0.018)**	(0.017)**	(0.005)**	(0.017)**	(0.018)**
$\ln(GDP_j)$		1.302				1.295
		(0.014)**				(0.014)**
$\ln(R_j)$		7.691				7.667
		(0.191)**				(0.193)**
$\ln(Dist_{jk})$		-0.330	-0.501		-0.501	-0.332
		(0.065)**	(0.058)**		(0.059)**	(0.066)**
$\ln(GDP_k)$						
$\ln(X_{jk})$	1.013			1.019		
	(0.001)**			(0.001)**		
Constant	-5.283	164.076	10.420	-18.254	-2.762	149.304
	(0 .057)**	(4.632)**	(0.539)**	(0. 111) **	(0.627)**	(4.723)**
Origin fe	Yes	Yes	Yes	No	No	No
Re-exporter fe	Yes	No	Yes	Yes	Yes	No
Importer fe	No	Yes	Yes	No	Yes	Yes
R^2	0.97	0.55	0.67	0.95	0.66	0.54
N	43,420	43,420	43,420	43,420	43,420	43,420

Robust standard errors are in parentheses: All inferences are based on a Huber-White sandwich estimate of variance.* $p<0.05$; ** $p<0.01$

Table 4: List of Countries:

Angola	Ghana	Philippines
United Arab Emirates	Greece	Poland
Argentina	Guatemala	Puerto Rico
Australia	Hong Kong. China	Portugal
Austria	Croatia	Paraguay
Belgium	Indonesia	Qatar
Bangladesh	India	Romania
Bulgaria	Ireland	Russian Federation
Bahrain	Israel	Saudi Arabia
Canada	Italy	Senegal
Switzerland	Jamaica	Singapore
Chile	Jordan	El Salvador
China	Japan	Slovenia
Colombia	Korea. Rep.	Sweden
Costa Rica	Kuwait	Syrian Arab Republic
Cuba	Lebanon	Thailand
Cyprus	Libya	Trinidad and Tobago
Germany	St. Lucia	Tunisia
Denmark	Morocco	Turkey
Dominican Republic	Mexico	Taiwan
Algeria	Malaysia	Ukraine
Ecuador	Nigeria	Uruguay
Egypt. Arab Rep.	Netherlands	United States
Spain	Norway	Venezuela. RB
Finland	Pakistan	Vietnam
France	Panama	Yemen. Rep.
United Kingdom	Peru	South Africa

Table 5: List of Brazilian states by region and their abbreviations:

North		**Center-West**	
ACRE	AC	MATO GROSSO	MT
AMAZONAS	AM	MATO GROSSO DO SUL	MS
AMAPA	AP	GOIAS	GO
PARA	PA	DISTRITO FEDERAL	DF
RONDONIA	RO	**South-East**	
RORAIMA	RR	ESPIRITO SANTO	ES
TOCANTINS	TO	MINAS GERAIS	MG
North-East		RIO DE JANEIRO	RJ
ALAGOAS	AL	SAO PAULO	SP
BAHIA	BA	**South**	
CEARA	CE	PARANA	PR
MARANHAO	MA	RIO GRANDE DO SUL	RS
PARAIBA	PB	SANTA CATARINA	SC
PERNAMBUCO	PE		
PIAUI	PI		
RIO GRANDE DO NORTE	RN		
SERGIPE	SE		

CONCLUSION GENERALE:

En ayant comme objectif d'analyser la structure du commerce brésilien et les interdépendances entre le marché intérieur et le marché international, nous avons mené trois travaux qui ont abordé le sujet sous différents éclairages. En premier on a défini et comparé les capacités d'exportation des états brésiliens vers le marché intérieur et extérieur et tracé leurs évolutions pendant la phase de libéralisation des années 1990 au Brésil. Le deuxième chapitre, a étudié la réponse du commerce inter-états à un choc de politique commerciale et, plus précisément, dans le cadre régional d'une union douanière, le MERCOSUR. Enfin, le dernier chapitre tentait de dépasser les limites des méthodes statistiques et économétriques qui négligent l'origine de la valeur ajoutée des biens exportés et l'impact des chaines de production dans le commerce. De ce fait, on a analysé le commerce international des états brésiliens en contrôlant les éventuels canaux de spécialisation verticale inter-états.

Le premier chapitre a montré que la capacité d'exportation des états a diminué pour les deux marchés de destination, intérieur et extérieur, pendant les années 1990. Néanmoins, quelques états (Mato Grosso (MT), Amazonas (AM), Mato Grosso do Sul (MS) et Paraná (PR)) font figure d'exception car leur capacité d'exportation vers le marché extérieur a augmenté. Les régions du Sud et Sud-est sont mieux intégrés aux deux marchés -intérieur et extérieur- par rapport aux autres régions et sur l'ensemble de la période. Néanmoins au niveau des états, l'intégration au marché intérieur est plus forte pour les états de Sud-est, à l'exception notable de São Paulo, relativement aux états du Sud. Dans la région Nord, la capacité d'exportation vers le marché intérieur de l'état d'Amazonas apparaît particulièrement élevée ce qui attire l'attention sur la Zone franche de Manaus (ZFM), qui y est localisée. A l'inverse, la capacité d'exportation d'un autre grand état amazonien, le Pará, apparait relativement meilleure sur le marché extérieur.

Cependant, l'analyse qui porte sur les orientations des états, calculées par les ratios des capacités d'exportation des états vers le marché intérieur et vers le marché extérieur, nous a montré que, sur la période, les orientations des états ont changé au profit du marché extérieur. Par rapport à la moyenne du Brésil, les états d'Amapá (AP), de Maranhão (MA), de Pará (PA) et d'Espírito Santo (ES) se sont davantage orientés vers le marché extérieur alors que les états de Distrito Federal (DF), d'Amazonas (AM) et de Sergipe (SE) se sont davantage tournés vers le marché intérieur.

Dans le deuxième chapitre, on a mesuré l'impact du MERCOSUR sur le commerce des états brésiliens dans ses trois dimensions : l'effet de la création de commerce avec les pays membres de MERCOSUR, l'effet de détournement de commerce avec les pays non-membres et l'effet d'érosion des préférences dans le commerce inter-états. Malheureusement, la contrainte des données a limité notre analyse aux années 1990 ce qui a néanmoins permis de distinguer la période pré-MERCOSUR de la période post-MERCOSUR. Nos résultats ont confirmé que les états brésiliens commerçaient davantage entre eux qu'avec le marché international, même comparé par le commerce avec les pays membres de MERCOSUR. L'intégration de Brésil reste relativement faible dans le marché international par rapport à la moyenne mondiale.

Le principal résultat de ce chapitre concerne l'impact du MERCOSUR sur le commerce. On montre, dans la limite de la méthode et des données, que, dans la période considérée, il y a eu création de commerce entre les états et les pays membres, sans pour autant diminuer le commerce des états entre eux ou avec le reste du monde. Néanmoins, les crises économiques et monétaires de la fin des années 1990 ont provoqué une diminution du commerce avec le MERCOSUR. Une décomposition de la création de commerce a montré la non-uniformité de l'effet selon les régions du Brésil.

Afin de contrôler l'impact de la spécialisation verticale des états sur leur structure commerciale, le troisième et dernier chapitre a analysé les exportations en valeur ajoutée au lieu des traditionnelles exportations brutes. Notre réflexion théorique visait à montrer les limites d'une approche bilatérale et la nécessité d'une approche plus multilatérale qui prenne mieux en compte la fragmentation internationale des processus de production. Dans cette

perspective, on a calculé le contenu en valeur ajoutée des exportations des états brésiliens à partir d'un tableau Input-Output inter-états pour l'année 2008 et nous avons estimé un modèle de gravité trilatéral, qui lie le commerce inter-états avec leurs exportations vers le monde. Ainsi le tableau Input-Output inter-états nous a permit de faire une analyse de la structure du commerce inter-états pour une année plus récente (2008) que la période des 90s.

L'analyse descriptive menée en terme de valeur ajoutée réexportée par les états brésiliens a confirmé les liens de spécialisation verticale, sauf pour les états qui sont fortement spécialisés dans les ressources naturelles et se situent donc aux premières étapes de la chaine de production. La structure de spécialisation verticale entre les états est définie par la demande de biens intermédiaires des états riches et industriels comme São Paulo (SP), Santa Catarina (SC) etc. avec une réponse de l'offre des états relativement pauvres comme Rondonia (RO), Piauí (PI) etc. Cependant, pour certains états pauvres, la part du contenu en valeur ajoutée de l'état des exportations réalisées directement par cet état, peut être très élevée. L'état d'Amazonas (AM), a montré une structure qui est cette fois encore atypique par rapport aux autres états, en étant à la fois un fournisseur et un demandeur de composants sur le marché intérieur.

Ce chapitre 3 propose également une analyse économétrique. Elle utilise un modèle de gravité qui évalue et contrôle les conséquences de la spécialisation verticale sur la spécification et les résultats du modèle. Selon le modèle bilatéral, l'impact du PIB sur l'exportation brute ou, alternativement, en termes de valeur ajoutée, est similaire tandis que l'impact de la distance est plus faible quand on estime les valeurs ajoutées exportées. Ce résultat peut être dû à la limitation de l'échantillon aux états brésiliens, ce qui implique une variation de la distance bilatérale déterminée en grande partie par le pays de destination. Les effets fixes importateurs captent alors une partie des effets de la distance.

Le modèle de gravité trilatéral a mis en évidence que la structure du commerce, n'est pas le même depuis l'origine vers le ré-exportateur et depuis le ré-exportateur vers la destination finale. La distance de l'état ré-exportateur vers le pays importateur influence davantage le commerce que sa distance avec l'état d'origine de la valeur ajoutée. A l'inverse, l'impact du PIB d'origine est plus important que l'impact du PIB de l'état ré-exportateur. Ces résultats

montrent que le modèle bilatéral estimé traditionnellement peut donner des estimations biaisées, puisqu'il suppose une structure unique pour le commerce des biens de consommation et des biens intermédiaires censés être réexportés.

Les résultats de notre travail a montré l'intérêt par la suite d'analyser de plus près la Zone franche de Manaus à l'état d'Amazonas, qui montre une structure commerciale très différente par rapport aux autres états brésiliens. Ayant des caractéristiques "hors commun" comparés aux autres zones franches dans le monde, dans la région et encore dans le marché intérieur de Brésil; ZFM est à la fois un projet de développement et d'intégration qui lui donne un statut exemplaire et unique dans l'Amérique latine.

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