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Jaime Rafael Ahcar Olmos

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UNIVERSITÉ PARIS-DAUPHINE
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AN INQUIRY ON REGIONAL TRADE INTEGRATION AND TRADE POTENTIALS

THÈSE

Pour l'obtention du titre de Docteur en Sciences Economiques présenté et soutenue publiquement le 15 décembre 2015

Par

Jaime Rafael AHCAR OLMOS

Sous la direction de

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

MEMBRES DU JURY :

RAPPORTEURS :	Daniel MIRZA	Professeur à l'Université de Tours
	Nicolas PÉRIDY	Professeur à l'Université de Toulon
SUFFRAGANTS :	Guillaume DAUDIN	Professeur à l'Université Paris-Dauphine
	Ivan LEDEZMA	Professeur à l'Université de Bourgogne
	Cristina MITARITONNA	Centre d'études prospectives et d'informations internationales (CEPII)
	Nicolas PÉRIDY	Professeur à l'Université de Toulon
	Vincent VICARD	Banque de France

Laboratoire d'Économie de Dauphine - LEDa
Place du Maréchal de Lattre de Tassigny
75775 Paris cedex 16

Laboratoire d'Économie de Dauphine - LEDa
Place du Maréchal de Lattre de Tassigny
75775 Paris cedex 16

Laboratoire DIAL-IRD UMR 225
4, rue d'Enghien
75010 Paris

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And therefore never send to know for whom the bell tolls
John Donne

Nous ne coalisons pas des États, nous unissons des hommes.

Jean Monnet

Un tableau ne vit que par celui qui le regarde.

Pablo Picasso

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General Abstract

Regional trade agreements (RTAs) have surged in a context of stalled multilateral trade negotiations. This doctoral thesis intends to advance scientific knowledge in the field. Thus, thanks to a gravity model theoretical framework, three chapters of applied empirical econometrics analysis have been completed.

The first chapter examines the effects of RTAs, the Generalized System of Preference (GSP) and World Trade Organization memberships on bilateral trade flows. I put into practice different econometric specifications and estimation methods, notably Poisson Pseudo Maximum Likelihood (PPML), which is the one that better seems to contend with well-known biases and endogeneity problems. I conduct this research with an international trade gravity model estimated across 153 countries from the year 1980 to 2012.

I consistently found a strong positive impact of regional trade agreement RTAs on most specifications and low or non-significant results for WTO membership. The estimates from the PPML method that includes controls for unobserved heterogeneity show non-significant effects of the Generalized System of Preference (GSP) on trade.

The second chapter, co-authored with my supervisor Jean-Marc Siroën, explores the effect of heterogeneity of RTAs in the scope of deep integration. We intend to determine if deeper RTAs promote trade more effectively than less ambitious agreements. We make use of two recently available data sets from the World Trade Organization (WTO) and the World Trade Institute (WTI-DESTA) to generate credible indicators of deep integration. Additive and Multiple Correspondence Analysis derived indicators for the depth of the agreements are then computed and their significance is tested in a gravity model. We find that deeper agreements increase trade more than shallow ones, whereas the provisions they included are within or outside of the WTO domain.

The third chapter investigates the existence of trade potentials between Colombia and the EU. I obtain in-sample predictions after the estimation of a gravity model with the Poisson Pseudo Maximum Likelihood estimator. I control for unobserved omitted variable bias by the inclusion of exporter and importer time varying fixed effects, and run a series of sensitivity analysis.

Untapped trade potentials are found between Colombia and a group of EU countries in both directions of the trade flows. Exports from Colombia have a gap to bridge with Austria, Czech Republic, Finland, France, Germany, Hungary, Poland and Sweden. In the other direction, Sweden, Ireland, Finland and Poland have an interesting margin to gain in the Colombian market.

Résumé

Dans un contexte où les négociations commerciales multilatérales languissent dans une impasse, les accords commerciaux régionaux ACR prennent de l'élan. Cette thèse doctorale cherche à faire avancer la connaissance sur ce domaine. C'est grâce au modèle de gravité du commerce que trois chapitres supportés par des analyses économétriques appliqués ont été mis au point.

Le premier chapitre examine les effets sur les flux bilatéraux de commerce attribuables aux ACR, le système généralisé de préférences (SGP) et l'appartenance à l'Organisation mondial du commerce OMC. Plusieurs spécifications économétriques et techniques d'estimation ont été testées. Particulièrement Poisson Pseudo Maximum Likelihood (PPML), qui se présente comme la technique la plus recommandé pour contenir des biais bien connues et des problèmes d'endogénéité. Cette recherche a été conduite avec une modèle de gravité du commerce international qui comporte 153 pays sur la période 1980-2012.

Les résultats montrent systématiquement qu'un effet positif et significatif sur les flux bilatéraux de commerce est à attendre après l'entrée en vigueur d'un ACR. De même, des effets positif mais peu importants, voir nuls sont accordés à la participation au sein de l'OMC. La spécification qui utilise PPML et qui contrôle l'influence de l'hétérogénéité inobservable montre un effet non-significatif pour le SGP.

Le deuxième chapitre, coécrit avec mon directeur de thèse Jean-Marc Siroën, explore quel est l'effet de l'hétérogénéité des ACR sur le cadre de l'approfondissement de l'intégration. Nous envisageons pouvoir déceler si les ACR qui sont plus profonds contribuent plus à la création de commerce que ceux qui sont moins profonds. Nous avons recours à deux bases de données récemment ouverts au public. La première appartenant à l'OMC et la deuxième a la World Trade Institute (WTI-DESTA). Nous procédons à créer des indicateurs crédibles de l'approfondissement de l'intégration pour passer à les tester dans un modèle de gravité. Nous trouvons qu'un effet positif et significatif peut-être accordé aux accords les plus profonds, indépendamment que l'indicateur testé soit un indicateur additive où un indicateur obtenu par l'Analyse de correspondance multiple (ACM). De même cet effet est constaté pas seulement dans les accords qui comportent des clauses classiquement négociées sur le cadre de l'OMC, mais aussi dans les accords qui dépassent cette dimension.

Le troisième chapitre se consacre à étudier l'existence des potentiels de commerce entre la Colombie et l'Union Européenne. Des prédictions dans l'échantillon après des estimations avec PPML et effets fixes qui varient dans le temps nous indiquent que des potentiels de commerce existent avec l'Autriche, la République Tchèque, la Finlande, la France, l'Allemagne, la Hongrie, la Suède et la Pologne. Dans le sens inverse la Suède, l'Irlande, la Finlande et Pologne détiennent une marge importante à gagner dans le marché colombien. Des tests de sensibilité ont été effectués pour garantir la robustesse de ces résultats.

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Introduction générale

La signature d'un accord de principe sur le Partenariat transpacifique (TPP), le 5 octobre 2015, est révélatrice de l'essor des accords commerciaux régionaux (ACR) comme instruments pour la promotion des échanges. Par rapport aux accords passés, ces nouveaux traités vont parfois au-delà d'un cadre intra-continental et introduisent un nombre élargi de sujets. Cette tendance est confirmée par les négociations sur le Partenariat transatlantique de commerce et d'investissement (PTCI) entre l'Union européenne et les Etats-Unis et par plusieurs autres accords où des thèmes tels que les réglementations aux investissements, les droits à la propriété intellectuelle, les règles de concurrence, l'environnement et le travail sont introduits.

La mondialisation commerciale, conçue comme l'augmentation des échanges commerciaux est influencée par la réduction des coûts de transports et de communication Limao and Venables (2001), rendus possibles grâce aux progrès techniques, et la coopération économique et politique qui conduit à la réduction des barrières aux échanges. Keohane and Nye (2000).

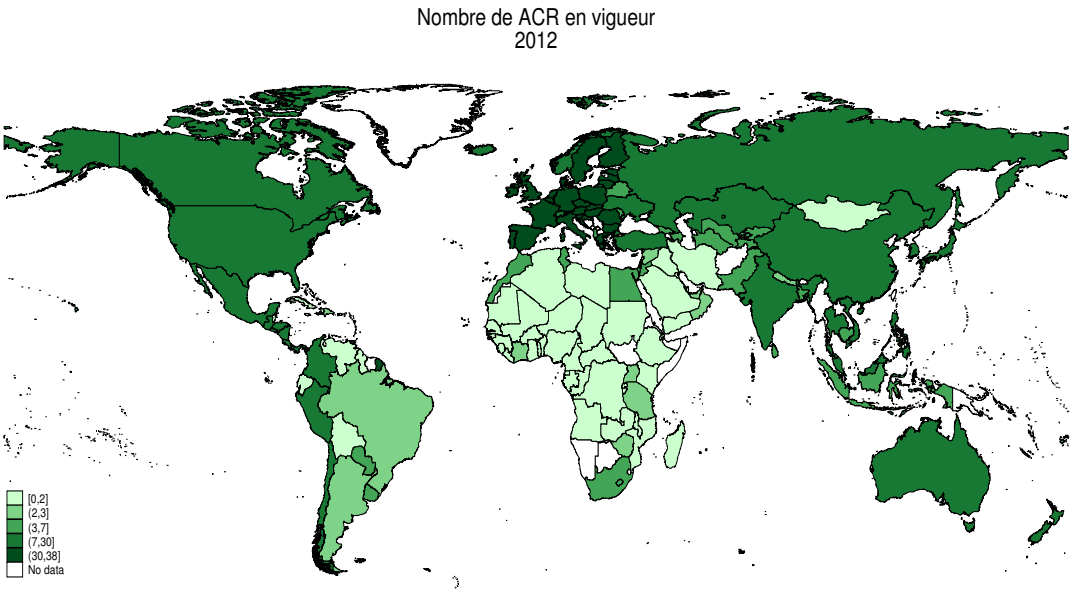
Cette thèse se concentrera sur la libéralisation des échanges commerciaux qui se dessine grâce à une double stratégie d'une part de négociations multilatérales dirigées par l'Organisation Mondiale du Commerce (OMC) et, d'autre part, de négociations bilatérales ou plurilatérales qui se concluent par des Accord Commerciaux Régionaux (ACR).

Le terme (ACR), utilisé par l'OMC, est ambivalent, car il désigne autant des accords intercontinentaux que des accords entre nations géographiquement proches. Ce

« régionalisme » se définit souvent par opposition au processus de libéralisation commerciale multilatérale, bien qu'en parallèle, il soit sensé contribuer à le forger. Les ACR contribuent à un monde plus ouvert aux échanges dans la mesure où les nouveaux accords contiennent des dispositions qui vont au-delà de celles de l'OMC. Bhagwati & Panagariya (1999) ; Siroën, J. M. (2004). OECD (2003).

Certaines nations ont adopté les ACR comme stratégie intermédiaire ou complémentaire d'ouverture commerciale qui se situerait entre l'unilatéralisme, illustré par accords commerciaux préférentiels (ACP), et le multilatéralisme. Les Figures 1 et 2, nous montrent le degré d'implication de différentes nations dans ce mécanisme de libéralisation commerciale. Ainsi, la Figure 1 montre le nombre d'ACR signés par chaque pays et la Figure 2 présente le nombre des pays avec lesquels chaque nation entretien des préférences commerciales.

Figure 1

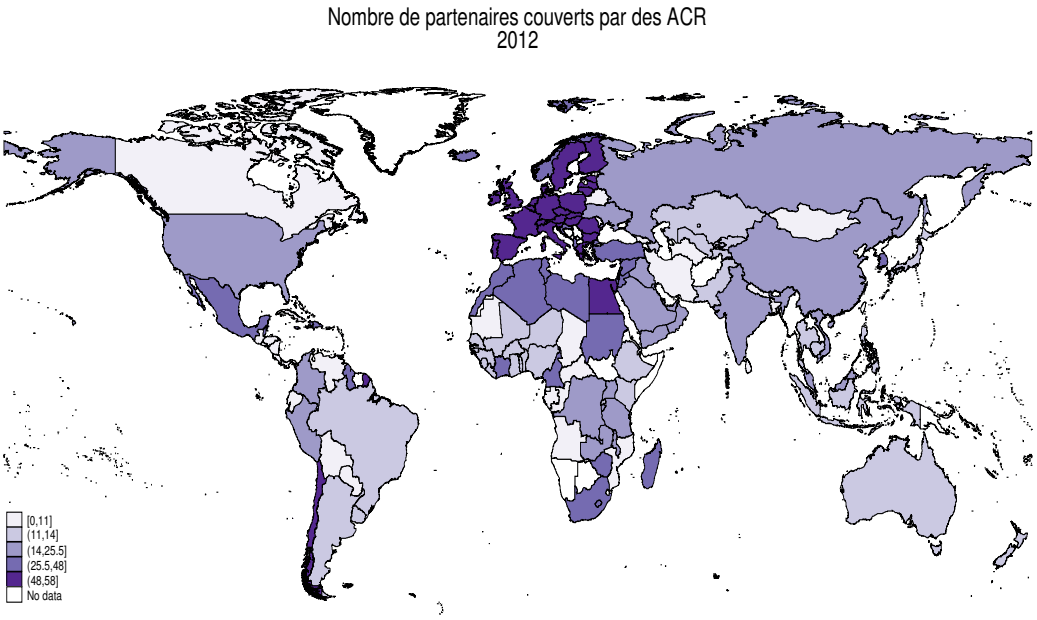


Source : Graphique de l'auteur à partir des données de l'OMC

Les pays de l'UE, le Chili, l'Egypte et la Suisse font partie des nations qui comptent le plus grand nombre de partenaires commerciaux. Avec des couleurs moins intenses qui indiquent un certain isolement commercial nous trouvons des nations comme la Bolivie, la Biélorussie,

le Canada, l'Équateur, l'Iran, la Mongolie et plusieurs pays africains. (Figure 2).Toutefois les accords dits bilatéraux engagent un ou plusieurs blocs de pays. La signature d'un ACR avec l'UE ajoute ainsi 28 nouveaux partenaires. Cela explique, par exemple les cas de l'Australie, du Canada et du Japon qui font partie des pays qui détiennent les plus d'ACR, mais qui en n'ayant pas encore d'ACR ratifiés avec l'UE, présentent un nombre plus limité de partenaires commerciaux.

Figure 2



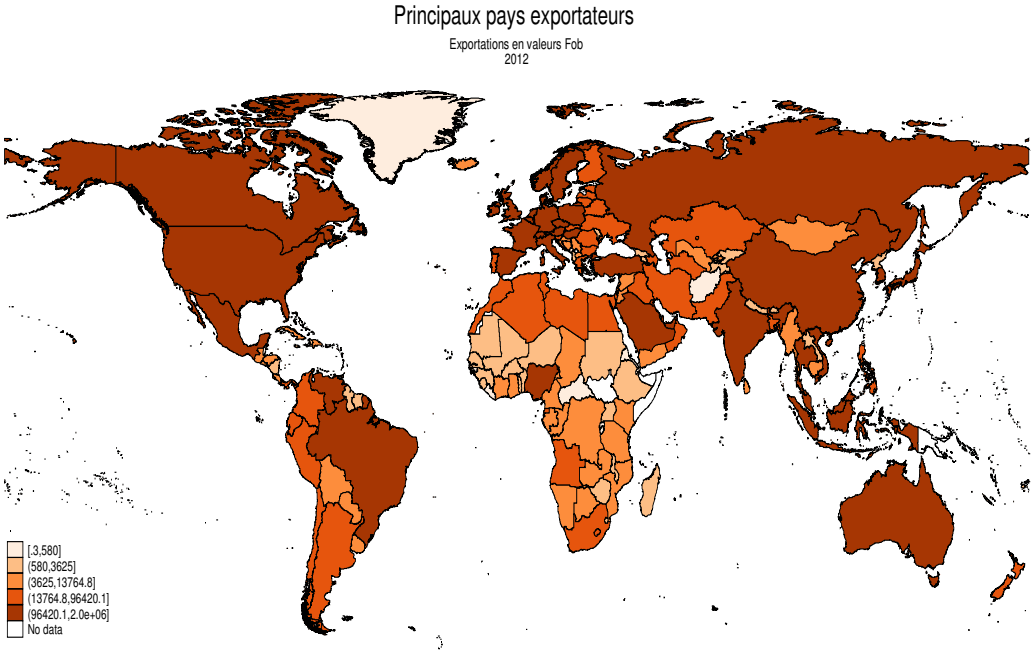
Source : Graphique de l'auteur à partir des données de l'OMC

L'attractivité commerciale d'un pays ou d'un bloc des pays est souvent liée à leur taille, mesurée par leur population ou leurs PIB. Les grands pays comme les Etats-Unis, la Chine, le Japon, l'Allemagne et la France sont importants sur ce plan.

Les pays les plus petits, comme les îles des Caraïbes, les petits Etats européens et certaines nations africaines, passent souvent par une stratégie d'intégration régionale avec leurs voisins. Bien que de petite taille, certaines nations sont d'importantes centres de commerce.

C'est le cas de la Belgique, le Hong Kong et le Singapour. La figure 3 classe les pays selon leur importance dans les échanges mondiaux de marchandises.

Figure 3



Source : Graphique de l'auteur à partir des données de l'OMC

La réduction des obstacles aux échanges, même quand celle-ci est d'ordre régionale, devrait avoir un effet positif sur les flux commerciaux. Le premier chapitre de cette thèse se consacrera à ce sujet.

Béla Balassa (1950) a proposé un cadre systématique d'intégration où le franchissement de chaque étape conduit à un niveau d'intégration plus profond. Ainsi, pour commencer, les pays créent une zone de libre-échange, suivent avec une union douanière, puis ils passent au marché commun avec la libre circulation des facteurs productives; l'étape suivante, comporte la coordination des politiques économiques et les amène à l'union économique et avec plus d'efforts à une union monétaire comme dans le cas de la Zone Euro.

Cette décomposition est devenue critiquable dans la mesure où les traités de libre-échange et, a fortiori, les Unions douanières introduisent des dispositions qui vont au-delà des régimes

douaniers. Les ACR ont ainsi évolué d'un simple modèle de « libre-échange » vers des constructions plus riches et complexes qui renforcent la coopération internationale sur des sujets plus divers. Le fait que l'intensité de l'intégration varie d'un ACR à l'autre, nous amène donc, dans le deuxième chapitre de cette thèse, à examiner les effets de la *deep integration* dans les échanges bilatéraux de marchandises.

Le troisième chapitre présentera une application pratique en établissant quels sont les potentiels de commerce entre la Colombie et l'Union Européenne.

0.1. Les accords commerciaux régionaux comme réponse à la crise du multilatéralisme

Le processus de libéralisation multilatérale du commerce, dans le cadre de l'accord général sur les tarifs douaniers et le commerce, *GATT* en anglais, s'est engagé après la seconde Guerre mondiale. Le traité de Marrakech (1994) sorti de la fin de l'Uruguay Round a fortement contribué à faciliter les échanges commerciaux dans la partie du monde qui a opté pour l'économie de marché et l'ouverture aux échanges. Tamames & Huerta (2010).

A partir de 1996 l'OMC a été un instrument important pour intégrer des nouveaux pays, dont la Chine et la Russie, et ainsi contribuer à la libéralisation multilatérale des échanges. La Banque Mondiale a estimé que l'accession de la Russie à l'OMC rapportera un 3.3 % de plus à son PIB à moyen terme et un 11.0% de plus à long terme. World Bank (2012).

Néanmoins, son agenda d'approfondissement de l'intégration a échoué avec les échecs des sommets de Seattle et de Cancun et l'inachèvement du cycle de Doha. Les limites du multilatéralisme qui doit parvenir à un consensus pour conclure un accord sont devenues plus visibles alors même qu'une partie importante des échanges avait déjà été libéralisée, réduisant ainsi le gain marginal attendu d'un nouveau progrès.

Avant de la création de l'OMC, les accords commerciaux régionaux (ACR) faisaient déjà partie des outils disponibles pour abaisser les barrières aux échanges. Mais, ils étaient peu nombreux, environ une trentaine en 1995: Communauté économique du charbon et de l'acier

(Ceca) 1952, devenue Communauté économique européenne (CEE) 1958, puis Union européenne 1993, Marché commun centraméricain 1961, Communauté andine de nations 1969, Communauté économique des États de l'Afrique de l'Ouest 1975 (CEDEAO), même plus tard NAFTA 1994 et MERCOSUR 1995.

Suite à l'accord de Marrakech, les difficultés de l'OMC pour faire avancer l'intégration commerciale se sont accompagnées de l'essor des ACR comme mécanisme alternatif de libéralisation commercial et d'approfondissement des échanges. En octobre 2015, l'OMC compte 262 ACR notifiés concernant le commerce de marchandises. OMC (2015a).

0.2. L'approfondissement de l'intégration commerciale et les nouveaux sujets à négocier

Traditionnellement, les négociations de libéralisation du commerce avaient pour but principal de garantir l'accès des marchandises aux marchés des pays négociateurs. Les points critiques à négocier étaient la réduction ou la suppression des droits de douane, la coordination en matière de protection des consommateurs avec le respect des normes sanitaires, phytosanitaires et techniques ainsi que le respect des lois de la libre concurrence avec les droits antidumping, les mesures compensatoires ainsi que l'ouverture des marché publics. C'est le début de l'intégration profonde dans le cadre même d'OMC.

Bien que la question de l'accès aux marchés continue à être à l'ordre du jour des négociations de l'OMC et dans les ACR, ce sont les clauses sur les services, la protection des investissements et le règlement des différends entre investisseurs et États, les droits de propriété intellectuelle, ainsi que les clauses connues comme hors du domaine traditionnel de l'OMC qui occupent de plus en plus les équipes négociateurs. Fontagné et Mitaritonna (2013) montrent que certains services comme les télécommunications restent encore très protégés dans les pays en développement. Voir le Tableau 1.

Tableau 1			
Participation (%) des clauses non-traditionnelles de l'OMC dans les ACR. 1980-2012.			
Clause	%	Clause	%
Politique de la concurrence	67%	Petites et moyennes entreprises PMEs	17%
Mesures concernant les investissements	65%	Convergence des législations	15%
Droits de propriété intellectuelle DPI	58%	Droits de l'homme	13%
Mouvements de capitaux	57%	Dialogue politique	13%
Régulation environnementale	45%	Statistiques	13%
Agriculture	31%	Protection des données	12%
Coopération régionale	30%	Drogues illicites	12%
Visas et asile	30%	Immigration illégale	11%
Régulation du marché du travail	29%	Audiovisuel	10%
Recherche et technologie	29%	Dialogue sur la politique économique	10%
Éducation et formation	24%	Blanchiment d'argent	10%
Énergie	24%	Santé	8%
Coopération industrielle	21%	Exploitation minière	8%
Coopération culturelle	20%	Fiscalité	8%
Aspects sociaux	20%	Administration publique	5%
Protection du consommateur	18%	Terrorisme	5%
Société de l'information	18%	Politiques d'innovation	3%
Politique Anti-Corruption	17%	Sécurité nucléaire	3%
Assistance Financière	17%		

Source : L'auteur à partir de la classification de Horn et al (2010)

Des progrès importants ont été obtenus dans les négociations sur ces sujets. Les marchés publics restent une notable exception. L'OMC (2015b) estime qu'ils représentent en moyenne de 10 à 15% du PIB. Shingal (2015) met en évidence l'inefficacité de l'appartenance à l'Accord sur les marchés publics de l'OMC et constate la présence d'un biais important en faveur du marché intérieur dans les cas du Japon et la Suisse.

Il est à noter que plus de deux tiers des ACR comportent des clauses sur la Politique de la concurrence qui visent à l'interdiction des comportements déloyaux dans les affaires et envisagent l'harmonisation des règles sur la concurrence et la création d'autorités indépendantes. C'est un des sujets les plus importants considérés hors des compétences traditionnelles de l'OMC. Solano et Sennekamp (2006) montrent qu'il y a deux familles d'ACR en ce qui concerne la politique de la concurrence : ceux qui contiennent des dispositions pour traiter les comportements anticoncurrentiels et ceux qui vont plutôt dans le sens d'un renforcement de la coopération entre leurs autorités respectives.

Alvarez et al. (2005) s'interrogent si l'inclusion d'une clause de renforcement de la concurrence dans un ACR améliore les compétences en matière de concurrence des pays en

développement. Ils suggèrent que les clauses concernant la politique de la concurrence indiquent le plus souvent une intention de renforcer la coopération plus que les moyens de la faire valoir. En effet, la plupart des ACR n'envisagent pas la mise en place d'un mécanisme efficace de règlement des différends en cas de concurrence déloyale.

Pour certains pays comme l'Equateur qui n'avait pas de législation en matière de concurrence, c'est leur participation à un ACR, en l'occurrence, la Communauté andine des nations (CAN) qui a servi de cadre institutionnel pour combattre les pratiques anticoncurrentielles et qui a conduit le pays à se doter d'une politique et d'une législation en matière de supervision de la concurrence. Marín-Tobar (2013).

Les sujets relatifs aux investissements et aux mouvements de capitaux sont présents dans plus de la moitié des accords. Certains accords comme le Partenariat transpacifique (TPP) signé en octobre 2015 par 12 pays qui représentent le 40% du PIB mondial, et le Partenariat transatlantique de commerce et d'investissement (PTCI) d'une importance équivalente, et qui se négocie actuellement entre les Etats-Unis et l'Union Européenne, misent très fortement sur ces domaines. Ils sont spécialement rigoureux sur les mécanismes de règlement des différends qui visent à faire valoir les droits des investisseurs étrangers, ce qui est actuellement un point d'achoppement dans la négociation.

Büthe et Milner (2008) apportent des résultats empiriques qui mettent en évidence la relation entre les ACR et les flux d'IDE. La valeur des flux d'investissements directs étrangers qu'un pays reçoit augmente avec le nombre d'ACR que ce pays détient.

Le rapport entre la défense des droits de propriété intellectuelle (DPI) et le commerce a été mis en lumière par Maskus et Penubarti (1995). Les pays qui renforcent leurs lois de protection des DPI augment leurs importations bilatérales manufacturières. Awokuse et Yin (2010) confirment cette relation pour le cas des importations chinoises de produits intensifs en connaissance. Babovic & Wasan (2011) ont analysé comment l'Accord sur les aspects des droits de propriété intellectuelle (ADPIC) de l'OMC menaçait les exportations indiennes des médicaments antirétroviraux génériques.

Concernant les règles environnementales, Baghdadi et al (2013) montrent que les couples de pays qui appartiennent à un même ACR qui inclut des clauses environnementales, génèrent des émissions de CO2 qui tendent à converger. Elles sont également plus basses en termes absolus. Ce qui ne va pas de soi pour les couples des pays qui ne font pas partie d'un ACR ou qui**,** en appartenant à un ACR qui n'inclut pas de clauses environnementales.

Environ 30% des ACR comportent des clauses relatives au travail. L'ALENA en 1994 et l'accord Etats-Unis-Jordanie en 2001 sont les premiers exemples d'insertion de clauses relatives au droit du travail. Par exemple, les négociations de l'ACR entre les Etats-Unis et la Colombie se sont prolongées jusqu'à ce que la Colombie finisse par accepter un renforcement de ses normes en matière de droit du travail et de protection des syndicalistes. Il existe une interprétation paradoxale à l'égard de ces clauses **:** d'un côté elles sont perçues comme une réponse aux inquiétudes d'une opinion publique qui s'inquiète des risques d'alignement sur les normes les plus basses (« dumping social ») et, d'un autre côté, sont considérées comme des politiques protectionnistes qui bénéficieraient aux pays les plus développés. Siroën et al (2008).

Certains pays ont introduit dans leurs ACR des clauses concernant la politique de l'emploi qui cherche à créer des emplois de qualité à partir des ACR. Déjà présentes dans la Communauté andine et Mercosur, les clauses de politique de l'emploie deviennent plus visibles dans les nouveaux accords conduits par les Etats-Unis, Canada et l'UE. Delpech & Ebert (2014).

Compte tenu des difficultés liées à la mise en place de ces compromis sociaux dans les ACR, les clauses du marché du travail semblent être plutôt un moyen pour rassurer l'opinion publique dans les pays développés que d'améliorer réellement les conditions du marché du travail. Siroën (2013).

Concernant les migrations, Orefice et al (2014) mettent en évidence que les flux migratoires bilatéraux sont d'autant plus stimulés avec la présence d'un ACR que l'accord contient une clause qui vise à réduire les démarches administratives nécessaires pour obtenir un visa ou le droit d'asile. Ce type de clause est présent dans près d'un tiers des ACR.

17% des ACR comportent des clauses de lutte contre la corruption, par exemple, en prévoyant la mise en place des réformes dans la législation nationale visant à durcir les sanctions. Ces clauses, apparues dès les années 2000, sont loin d'être généralisées dans les nouveaux accords. Majeed (2014) montre qu'un lien non linéaire a été établi entre ouverture commerciale et baisse du niveau de corruption. Cet effet est renforcé par des interactions avec des réformes dans le secteur financier et le niveau de bureaucratie.

Certaines clauses sont présentes dans moins des 15% des accords. C'est le cas de la protection des données, des drogues illicites, de l'immigration illégale, de l'audiovisuel, du dialogue sur la politique économique, du blanchiment d'argent, de la santé, les mines, de la fiscalité, de l'administration publique, du terrorisme, des politiques d'innovation et de la sécurité nucléaire.

Mirza et Verdier (2014) montrent que les mesures antiterroristes réduisent les importations aux Etats-Unis en provenance des pays où des actes de terrorisme ont ciblé des intérêts américains. La nécessité de créer des moyens pour garantir la sécurité, augmente les coûts de transactions et réduit les gains à l'échange. L'introduction des clauses antiterroristes, contre le blanchiment d'argent et le trafic de drogues illicites dans les ACR pourraient faciliter la coopération entre les États et aider à mitiger ces effets.

La négociation du PTCI a buté sur l'un de ces nouveaux sujets, la protection des données, que l'UE considère comme un droit fondamental à la différence des Etats-Unis. Bien que de gains auraient été possibles à atteindre, la solution a été de les exclure des négociations pour avancer avec des sujets moins épineux.

0.3. Motivations

Les principales motivations pour la réalisation de cette thèse sont d'abord le besoin de mieux comprendre le rôle des accords commerciaux régionaux ACR en ce qui concerne le dynamisme des échanges commerciaux. Les ACR deviennent de plus en plus hétérogènes et complexes. Ce qui nous a amené à vérifier si cette hétérogénéité se retrouve dans les résultats qui indiquent une création de commerce à partir de l'entrée en vigueur d'un ACR.

Nous avons choisi d'explorer l'hétérogénéité des ACR dans le sens de la *deep integration* parce que ce sujet émergent reste encore peu exploré. L'enseignement et la recherche académique restent en effet dominés par une relation commerce-accords commerciaux qui transite par le canal des droits de douane et, éventuellement les « équivalents-tarifaires » des mesures non tarifaires. De plus, de nouvelles bases de données devenaient disponibles pour la réalisation d'analyses empiriques et à la création de connaissances.

La Colombie, qui fait partie de la nouvelle génération de pays émergents, s'est récemment ouverte à l'échange via la conclusion d'accords commerciaux (Etats-Unis, Canada, AELE et UE) et constitue à ce titre une bonne application des méthodes et résultats trouvés précédemment. La quantification des potentiels de commerce pourrait ainsi contribuer à éclairer la politique commerciale. En même temps, nous espérons offrir aux entreprises des éléments utiles pour l'élaboration de leurs plans d'expansion internationale.

0.4. Hypothèses et Objectifs

Nous avons trois hypothèses principales : 1) les ACR créent du commerce et améliorent le bien-être, 2) plus les ACR sont profonds plus ils créent du commerce, et 3) Des potentiels de commerce existent entre l'Union Européenne et la Colombie.

Cette thèse envisage d'atteindre les objectifs suivants afin d'enrichir l'état actuel des connaissances dans le domaine du commerce international :

- Construire une base de données, assez fournie en nombre de pays et d'échelle temporelle. Celle-ci permettra de réduire le biais de sélection et de tester des hypothèses sur les ACR dans un modèle de gravité.
- Evaluer l'influence des ACR sur les échanges commerciaux bilatéraux.
- Produire des indicateurs crédibles concernant la « profondeur des ACR dans le sens de la deep integration et évaluer l'influence de l'hétérogénéité de ces ACR sur les échanges commerciaux bilatéraux.
- Identifier et mesurer les potentiels de commerce entre la Colombie et les pays de l'Union Européenne.

0.5. Structure de la thèse

Cette introduction a souligné le rôle des ACR comme mécanisme adopté par les Etats pour avancer dans l'ouverture commerciale et l'approfondissement de l'intégration économique. Ce choix peut répondre à la fois aux carences de la négociation multilatérale ou à une tentation de discriminer plus finement entre partenaires commerciaux, ce qui serait contraire aux principes mêmes du multilatéralisme.

Le chapitre 1 révise la littérature concernant les effets de l'ouverture commerciale sur le commerce bilatéral. Pour évaluer la robustesse des résultats, de nombreuses méthodes d'estimation et spécifications économétriques seront utilisées. Par ailleurs, ce chapitre cherchera à établir si l'effet des ACR sur le commerce varie selon leur niveau de développement. Il présentera des estimations de l'effet des ACR à un niveau désagrégé (UE, CAN, ALENA, etc.) et prendra en considération les possibles effets de la diversion de commerce, pour un groupe d'accords.

Le chapitre 2, s'intéresse à l'impact sur les flux de commerce bilatéraux de l'hétérogénéité des accords en termes de *deep integration*. Ce chapitre commence par une revue de la littérature sur le sujet et présente les bases de données de l'OMC et du World Trade Institute (WTI-DESTA). Celles-ci proposent une classification détaillée de différentes clauses présentes dans les ACR. Par la suite nous abordons le thème de l'élaboration d'indicateurs de profondeur des ACR pour les tester dans un modèle de gravité. Plusieurs spécifications et méthodes seront testées afin de déterminer la robustesse et la sensibilité des résultats.

Le troisième chapitre s'intéresse au potentiel de commerce. Le chapitre s'ouvre sur une revue de la littérature sur les potentiels de commerce et se poursuit par la présentation du modèle économétrique et les spécifications adoptées pour estimer les potentiels de commerce. Les résultats présentés concernent les potentiels d'exportation colombiens vers l'UE et vers un ensemble de grands marchés (Etats-Unis, Chine, etc.). Symétriquement, le chapitre présente les potentiels d'exportation des pays de l'UE vers la Colombie ainsi que vers un groupe de grandes économies. Une analyse de sensibilité est réalisée pour évaluer la robustesse des résultats.

Abstracts

Abstract of Chapter 1:

Regional trade agreements (RTAs) have emerged as the leading mechanism for liberalizing international trade flows. The purpose of this paper is to estimate the effect of RTAs on bilateral exports. Different econometric specifications and estimation methodologies are contrasted by means of a gravity model based on panel data on 153 countries from 1980 to 2012. In particular, Baier and Bergstrand estimates will suggest an RTA effect of about 36.2%, their method permits to control for omitted variable bias and endogeneity problems. Instrumental variable techniques are tested to deal with endogeneity problems. The Poisson Pseudo Maximum Likelihood (PPML) estimator is used to contend with heteroscedasticity problems and biases derived from the high proportion of zero-registered trade flows.

Our own results confirm that RTAs generate a sizable positive impact on bilateral exports. This effect is consistent across different models and specifications. Once multilateral resistance and other unobserved variable biases are controlled by the inclusion of time-varying country fixed effects in a PPML regression, we find that RTAs increase bilateral exports by 48.7%. Thus, the RTA time-invariant country fixed effect estimate of 48.6% would be relatively insensitive to the relaxation of the assumption of constant country trends over time.

In consequence, multilateral resistance and other unobserved variable biases could be dealt with by the less time consuming practice of including time-invariant country fixed effects, without losing much precision. The Baier and Bergstrand method facilitates controlling for country-pair and time varying fixed effects in the same regressions. This result suggests an RTA effect of about 36.2%.

The RTA effect attributable to each particular trade agreement displays a high variability. While most of the RTAs successfully increase trade, some others present non-significant results or even a significant negative sign. This could be explained by the fact that RTAs differ in scope and depth; a line of research worth exploring. Although for certain RTAs trade

diversion effects are found to mitigate trade creation effects, the latter tends to predominate in most cases.

Key words
International Trade, Trade Liberalization, Regional Trade Agreements RTA, Gravity Model, Economic Integration.

JEL Classification: F14 ; F15 ; F53 ; F55

Abstract of chapter 2:

Regional trade agreements (RTAs) have emerged in the context of stalled multilateral trade negotiations. Their impact on international trade has been well documented, while scant attention has been paid to empirical studies exploring their heterogeneity in the scope of deep integration.

We intend, in this paper, to determine whether deeper RTAs promote trade more effectively than less ambitious agreements. We proceed to generate credible deep integration indicators by exploiting two recently available data sets from the World Trade Organization (WTO) and the World Trade Institute (WTI-DESTA), and subsequently test their significance in a gravity model.

We find that deeper agreements increase trade more than shallow agreements, whereas the provisions they include are within or outside the WTO domain.

Treating additive indicators as factor variables and the use of Multiple Correspondence Analysis MCA to obtain distilled indicators of deep integration, allows us to offer a new insight and to confirm recent findings in the field of deep integration.

Key words: Deep integration, gravity model, regional trade agreements, trade liberalization, international trade.

Abstract of chapter 3

A free trade agreement between the European Union EU and Colombia has come into effect in 2013. In this paper we intend to identify trade potentials between Colombia and the EU. These results are a valuable input to focus trade policy where it could be more effective and help define sells expansion plans in the international markets at the firm level.

To do it, we obtain in-sample predictions after the estimation of a gravity model with the Poisson Pseudo Maximum Likelihood estimator. We control for unobserved omitted variable bias by the inclusion of exporter and importer time varying fixed effects on a sample of 153 countries from 1980 to 2012.

We find that untapped trade potentials exist between Colombia and a group of EU countries in both directions of the flows. Exports from Colombia have a gap to bridge with Austria, Czech Republic, Finland, France, Germany, Hungary, Poland and Sweden. In the other direction, Sweden, Ireland, Finland and Poland have a margin to gain in the Colombian market.

As far as I know, this is the most exhaustive study realised to define Colombia's trade potentials and open up a way for future research on the ex post impact of this agreement.

Key words

International trade, gravity model, trade potentials, Colombia, European Union, Regional Trade Agreements

JEL Classification: F13 ; F14 ; F15 ; F53 ; F55

Chapter 1
Measuring the effects of Regional Trade Agreements in a Gravity Model Framework

1.1 Introduction

Regional trade agreements, RTAs, have proliferated in the bogged-down multilateral trade liberalization environment that has existed during the last two decades of negotiations. But do free trade agreements really increase trade flows? The aim of this paper is to answer this question. To achieve this, we resort to the widely accepted approach of the gravity model of international trade, traced back to (Tinbergen, 1962). A sensitivity analysis based on different regression methods and specifications will allow us to establish which determinants of bilateral trade flows are statistically and economically significant.

Gravity model estimations define what should be the normal pattern of trade, and then enable researchers to seek deviations from these patterns, originating, for example, in the implementation of an institutional arrangement, as in (Frankel & Rose, 2002) who found that trade between countries that share a common currency is three times greater than the normal pattern for similar countries that have different currencies.

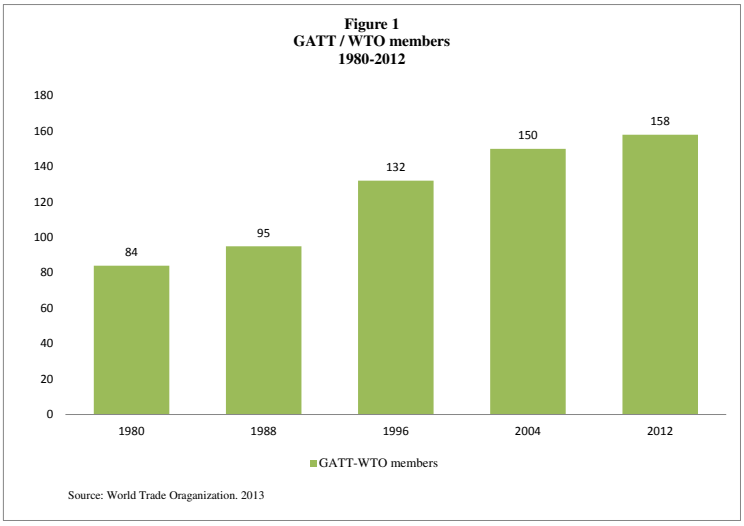
One important advantage of gravity models according to (Bussière, 2007) is that their results stem not only from a measure of multilateral trade integration (a country against all its trading partners), but also of bilateral trade integration (a country and each of its trading partners).

(Kepaptsoglou, et al, 2010) carried out a 10-year review of empirical studies related with the gravity model specification for modelling international trade flows. They considered 60 studies between 1999 and 2009 and found that trade policy effects topics were customary. Given the counterfactual it offers and its widespread application, the gravity model is widely tenable for calculating outcomes such as the expected gains from the entry into force of an RTA, or other institutional changes.

Our interest in finding the effects of RTAs in bilateral trade flows, hinges on the belief that higher international competition leads to greater productivity and higher cross-border exchanges increase wellbeing. Nevertheless, this research has its limits and does not disentangle this effect, although from (Sachs et al, 1995) and (Wacziarg and Welch, 2008) we have evidence that international trade promotes economic growth and then wellbeing. Examining the Chilean case Bas & Ledezma (2010) found evidence of trade barriers reduction and with-in plant productivity increases.

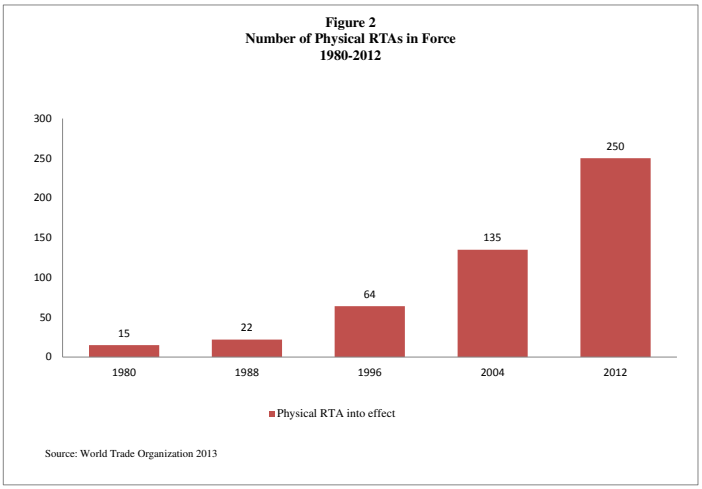
There is also a long-standing debate on the optimal mechanism for liberalizing international trade, confronting the multilateral negotiation approach to RTAs. The main multilateral institution for the promotion of trade has been the General Agreement on Tariffs and Trade (GATT) and subsequently the World Trade Organization (WTO). (Siroën, 2002). Figure 1 shows the rise in GATT and WTO accessions from 1980 to 2012. As can be seen, in 1980 the GATT counted up 84 signatories. In 2012 the number practically doubles, reaching 158 countries, now under the label of the WTO.

It can be expected that membership of these institutions would show a strong positive effect on trade. This was not what (Rose, 2004) found on his first approach to the problem, but after controlling for individual RTAs he reported stronger evidence for a positive WTO membership effect (Rose, 2005). This result was corroborated by (Subramanian and Wei, 2007) and (Kim, 2011), after partially controlling for multilateral resistance. Nevertheless, (Eicher and Henn, 2011) found evidence of an attenuated WTO membership impact, after preferential trade agreements had entered into force. In view of the historical importance of this institution, this paper will control for country membership status in the WTO.



The number of physical RTAs in force has increased from 1980 to 2012. This trade liberalization strategy has been particularly vigorous during the last decade. They increased from only 8 RTA in 1982 to 64 in 1996 to reach the impressive number of 250 in 2012. This dynamic can be observed in figure 2. During the last three years, 25 new RTAs have been added.

Literature on RTAs has experienced similar success. Cipollina and Salvatici (2010) ran a meta-analysis on RTAs, where they summarize (1827 estimates included in 85 papers). They found that studies consistently show a positive RTA impact on bilateral trade, but the strength of this effect varies widely, and is greatly determined by the sample and econometric methods used.



Special attention has been paid to (Baier and Bergstrand, 2007) who, by first differencing data, found that the average treatment effect of a free trade agreements implies an increase of bilateral exports around 100% in 10 years. Also influential (Magee, 2008) let the RTA

dummy take leads and lags, thus finding significant anticipatory and slow motion impacts. In the long-run, an RTA increases trade on average by 89%. Regarding dynamics (Martínez et al, 2009) remark that bilateral exports are persistent and find significant effects for the lagged bilateral export flows, as well as for RTA coefficients at the disaggregated level.

RTA estimates have recently been reviewed downwards, possibly showing an eroding impact over time. Applying Bair and Bergstrand's technique consisting of first differencing data, (Kohl; 2014) found that RTAs increase trade by at most 50%.

This chapter is structured in four parts, including the previous introduction; the second part lays out the micro-foundation gravity model, discusses theoretical issues and presents methodology and data. The third part presents results, leading into the fourth section with conclusions.

1.2 Gravity model methodology and data

This section is divided into four parts. First, in 1.2.1 we present the theory behind the gravity model. Section 1.2.2 continues with a discussion centred on the empirical approach and the strategies to deal with endogeneity and omitted variable bias, which takes us to section 1.2.3, where we present the econometric specification to be estimated. Finally, section 1.2.4 presents the sources of the data.

1.2.1 The Theory behind the Gravity Model

Important advances in the micro-foundation of the gravity model are attributed to (Anderson, 1979), who set up a model in which consumers maximize a homothetic Cobb-Douglas utility function that is identical in all countries; goods are differentiated by their country of origin and iceberg costs are assumed where only a fraction of the goods arrive at destination.

The mathematical approach developed by (Anderson and Van Wincoop, 2003) put multilateral resistance in the center of the analysis improving the micro-foundation of the gravity model. Their procedure can be resumed as follows:

Assumptions

- Homothetic CES (constant elasticity of substitution) consumers' preferences.
- Unitary income elasticity.
- Goods are differentiated by place of origin
- Each region is specialized in the production of only one good
- The Supply of each good is fixed.
- Prices differ between locations due to trade cost.
- Trade costs (shipping, transport and others) are borne by the exporter.
- For each good shipped from i to j the exporter incurs export cost $t_{ij} - 1$
- All supply prices p_i are equal to 1 and so the scaled price $[\beta_i p_i] = 1$
- Trade barriers are symmetric $t_{ij} = t_{ji}$, then $\Pi_i = P_i$

Variable definition

- $\alpha_{1...n}$ *are parameters to estimate*
- σ *is the elasticity of substitution between all goods* > 1
- t_{ij} *trade cost factor between i and j*
- p_i *is the exporter supply price, net of trade cost*
- P_{ij} *is the price of region i goods for region j consumers*
- Π_j *and* P_j *represent the average multilateral resistance to trade for countries i and j*
- c_{ij} *is consumption by region j of goods from region i*
- β_i *is a distribution parameter,* $\beta_i > 0$
- x_{ij} *is export from region i to region j*
- y_i *and* y_j *are GDP in region i and region j*
- $y^W = \sum_j y_j$ is world nominal income ; $\theta_j = y_j / y^W$ is region j's income share.
- d_{ij} *is the distance between i and j* ,
- b_{ij} is 1 for a same country border and one plus a tariff when i and j are different countries.

- k is a constant, $(1-\sigma)$ and $(1-\sigma)\rho$ are coefficients.

Mathemathical Framework

- (1) $\sum_i (\beta_i^{(1-\sigma)/\sigma} \; c_{ij}^{(1-\sigma)/\sigma})^{\sigma/(1-\sigma)}$
- (2) $\sum_i p_{ij}\, c_{ij} = y_j\,, \quad then\; p_{ij} = p_i t_{ij}$

  Equation (3) shows nominal demand for country i goods by country j consumers satisfying maximization of (1) subject to (2)
- (3) $x_{ij} = \left(\frac{\beta_i p_i t_{ij}}{p_j}\right)^{(1-\sigma)} \; y_j$
- Where P_j is the consumer price index of j given by,
- (4) $P_j = \left[\sum_i (\beta_i p_i t_{ij})^{(1-\sigma)}\right]^{1/(1-\sigma)}$
- Market clearance as a consequence of the general-equilibrium structure implies:
- (5) $y_i = \sum_j x_{ij}$
- $= \sum_j (\beta_i t_{ij} p_j / P_j)^{1-\sigma} \; y_j$
- $= (\beta_i p_i)^{1-\sigma} \sum_j (t_{ij}/p_j)^{1-\sigma} \; y_i \quad ,\forall\, i.$
- (6) $x_{ij} = \frac{y_i y_j}{y^W} \left(\frac{t_{ij}}{\Pi_i P_j}\right)^{1-\sigma}$
- Where
- (7) $\Pi_i = \left(\sum_j \left({t_{ij}}/{P_j} \right)^{1-\sigma} \theta_j \right)^{1/(1-\sigma)}$
- Substituting the equilibrium scaled prices into (4), we obtain:
- (8) $P_j = \left(\sum_i \left({t_{ij}}/{\Pi_i} \right)^{1-\sigma} \theta_i \right)^{1/(1-\sigma)}$
- From (7) and (8) we derive:
- (9) $P_j^{1-\sigma} = \sum_i P_i^{\sigma-1} \theta_i t_{ij}^{1-\sigma} \quad ,\forall\, j\,,$
- The gravity equation then becomes:
- (10) $x_{ij} = \frac{y_i\, y_j}{y^w} \left(\frac{t_{ij}}{P_i P_j}\right)^{1-\sigma}$
- Where multilateral resistance for countries i and j ($P_i\; and\; P_j$) are non-observable variables.

- (11) $t_{ij} = b_{ij} d_{ij}^{p}$
- (12) $lnx_{ij} = k + lny_i + lny_j + (1-\sigma)\rho\, ln\, d_{ij} + (1-\sigma)\ln b_{ij} - (1-\sigma) lnP_i - (1-\sigma) lnP_j$

Where x_{ij} represents exports form country i to country j and $\ln x_{ij}$ is is natural logarithm; y^w , y_i and y_j stand for world, country i and country j's GDPs respectively; t_{ij} is a trade cost factor between i and j. For simplification, here it consists of only distance, $dist_{ij}$ and the existence of a border $contig_{ij}$. After a logarithmic transformation, k is a constant term and ρ and σ are parameters. The model can be "augmented" adding more control variables as can be seen in the econometric specification section.

As we have no data for P_i and P_j, and the procedure to estimates its values implies an extremely complex non-linear procedure, we will use fixed effects for importer and exporter countries to avoid endogeneity and control for omitted variable bias.

The Gravity equation is compatible with many underlying theories. Deardorff (1995) derived a gravity equation from a neoclassical Heckscher-Ohlin framework. Monopolistic competition models such as those in Feenstra, (2004b) inspired by Dixit and Stiglitz (1977) and Krugman (1979) where the inclusion of a preference for variety assumption, instead of the more restrictive assumption of country differentiation, have also been proved suitable. A more detailed discussion about the gravity model micro-foundation is available in Archanskaia and Daudin (2012) and in Head and Mayer (2013).

1.2.2 Empirical Approach: Dealing with omitted variable bias and endogeneity problems

The gravity model permits controlling for confounders which, if omitted, would bias the estimate of our parameter of interest on RTAs. Hence, we control for the border effect or contiguity (Feenstra, 2004a); (McCallum, 1995) and other cultural or institutional variables such as the use of a common language (Melitz, & Toubal, 2014) and colonial links (Head, Mayer and Ries, 2010).

In Anderson and van Wincoop (2003) the threat of omitted variable bias derived from multilateral resistance and the difficulties in estimating unbiased coefficients through cross

section estimation is stressed. Given that P_i and P_j, the so-called multilateral resistance terms from equation (1) are unobservable, and that the procedure to estimate their values implies a complex non-linear routine, fixed effects models have provided tools to deal with this hurdle. De Benedictis & Taglioni (2011) examine the sensitivity of OLS estimates to variations in fixed effects. These procedures control for endogeneity due to unobservable heterogeneity and then for omitted variable bias derived from multilateral resistance, the introduction of time-varying fixed effects for importing and exporting countries being considered a robust solution.

To deal with the challenges mentioned above and to successfully estimate our variables of interest, this research set up an exhaustive data set to run a gravity model. It consists of bilateral trade flows for 153 countries from 1980 to 2012 that add up to 613,030 individual bilateral trade flows and an extensive set of control variables. A table with the countries selected for the research is presented in appendix B.

Apart from the multilateral resistance difficulty, the possibility of some kind of endogeneity between bilateral trade and institutional trade liberalization variables is also prominent. Trefler (1993) pointed out that a country's decision to sign a regional trade agreement could not be completely exogenous. In the same vein, Ghosh and Yamarik (2004) based on extreme bounds analysis showed that the RTAs coefficient computed with cross-sectional data could be biased in the presence of endogeneity and Baldwin and Jaimovich (2012) found that free trade agreements could be contagious (domino effect). When endogeneity is present, as Antonakis et al (2010) have stressed, traditional estimation methods could result in inconsistent estimates, therefore this is a problem that must be dealt with in social science studies, where we work most of the time with non-experimental data. Instrumental variable methods can deal with endogeneity, allowing for strong causal claims (Angrist and Pischke, 2014).

Thus, Baier and Bergstrand (2002) and Magee's (2003) early attempts to use the instrumental variable technique to contend with RTA suspected endogeneity merely offered non-conclusive evidence of unbiased estimates. Hence, Baier and Bergstrand (2007, 92) stated "standard cross-section techniques using instrumental variables and control functions do not provide stable estimates of RTA average treatment effect in the presence of endogeneity, and tests of over-identifying restrictions generally fail". They suggested that panel data methodologies must be implemented to estimate the RTA coefficient.

A panel approach will then be preferred over cross-section because it accounts better for country observed and unobserved time-varying or time-invariant heterogeneity. It provides the possibility of controlling for relevant relationships over time, avoiding the risk of choosing an unrepresentative year (Antonucci and Manzocchi, 2006). Panels also improve the efficiency of the estimates (Cheng Hsiao, 2003). The panel structure would deal relatively well with the endogeneity problem considering that the reasons linked to RTAs not being exogenous should most probably be related to time-invariant heterogeneity (huge pre-existing trade flows, or contiguity).

This paper mainly follows a static model approach that makes the assumption that the effect of an RTA is immediate, so bilateral exports flows jump to a new long-run equilibrium.

1.2.3 Econometric specifications

The equation to estimate with OLS, with time-fixed effects and exporter and importer time-invariant fixed effects is presented in eq. 4 below:

$$(4) \quad lnX_{ijt} = \beta_0 + \beta_1 RTA_{ijt} + \psi_h \boldsymbol{S_{it}} + \phi_h \boldsymbol{M_{jt}} + \varphi_g \boldsymbol{Z_{ijt}} + \alpha_t + \alpha_i + \alpha_j + \mathcal{E}_{ijt}$$

Where, the dependant variable lnX_{ijt} represents the natural logarithm of current dollar fob export values from country i to country j;[1] β_1 is the RTA coefficient, our parameter of interest; β_0 is a constant term, α_t represents the time-fixed effects, α_i represents time-invariant exporter fixed effects, α_j are the importer time-invariant fixed effects and $\mathcal{E}_{ijt}$ is an idiosyncratic error term.

Likewise, $\boldsymbol{S}_{it}$ and $\boldsymbol{M_{jt}}$ are vectors of time-varying monadic controls for exporters and importers respectively composed of h variables: $lnGDP_{it}$, $lnpop_{it}$, $urpart_{it}$, $OECD_{it}$ and $GATT_{it}$, $gsppprovider_{it}$, $gspben_{it}$ as well as, $lnGDP_{jt}$, $lnpop_{jt}$, $urpar_{jt}$, $OECE_{jt}$ and $GATT_{jt}$.

Here, ψ and ϕ are vectors of coefficients to be estimated concerning the above control variables, and the subscript h indicates variables.

[1] "The gravity model can by estimated using imports or exports as the dependant variable. Imports are traditionally reported at CIF values. We choose to work with exports because the IMF DOTs statistics provide reliable FOB values data for exports and this serves to avoid endogeneity problems that stem from the fact that transport cost will be included in imports CIF values as well as being implicit in transaction cost explanatory variables such as distance. Furthermore, thinking in terms of exports is sometimes more intuitive, as trade policy is often defined to promote export potentials".

We define $lnGDP_{it}$ and $lnGDP_{jt}$ as the natural logarithms for current dollar GDPs from countries *i* and *j*; $lnpop_{it}$, $lnpop_{jt}$ are natural logarithms for the population in number of habitants of countries *i* and *j*; $urpart_{it}$ and $urpart_{jt}$ stand for the percentage of urban population in country *i* and *j* respectively; this could be seen as a measure of the degree of development of countries, as more developed countries tend to be relatively more urbanized.

Other non-dyadic variables attempt to control for institutional traits related to commerce; these are $gatt_{it}$ and $gatt_{jt}$ that take on 1 if countries *i/j* belong to the GATT/WTO respectively. Developed countries grant unilateral tariff reductions to a group of developing countries in an attempt to spur their exports and contribute to their development process. We use variable $gspben_{it}$ to distinguish if country *i* is a beneficiary of the generalized system of preference or other unilateral trade preferences offered from country *j*, it takes on 1 under these circumstances, otherwise 0; $gspprovider_{it}$ takes on1 if country *i* is granting the generalized system of preferences or any other unilateral preference scheme to country *j;* $oecd_{it}$ and $oecd_{jt}$ take on 1 if the countries *i/j* belong to the Organization of Economic Cooperation and Development OECD.

When no country fixed effects are introduced, controlling for time-invariant nomadic variables such as the total surface of a country, the fact of being an island or being landlocked, helps to improve results. These particular characteristics can generate a differentiated pattern of trade. Then, vectors $\boldsymbol{S_{it}}$ and $\boldsymbol{M_{it}}$ are augmented with variables $lnarea_{it}$, isl_{it} and $landlocked_{it}$ *and* $lnarea_{jt}$, isl_{jt} and $landlocked_{jt}$ respectively. Here, $lnarea_{it}$ and $lnarea_{jt}$ are the natural logarithms for the surface in square km of country i and j; *Isl* take on 1 if country i/j is an island or can be understood as an island economy, otherwise 0; and *landlocked* takes on 1 if country i/j is deprived of a direct access to the sea, otherwise 0.

Finally, $\boldsymbol{Z_{ijt}}$ is a vector dyadic variables that helps to minimize possible bias, composed of g variables: $contg_{ijt}$, $comlang_{ijt}$, $col45_{ijt}$ *and* $lndist_{ijt}$ and φ is a vector of coefficients to be estimated concerning these dyadic variables; the subscript g is to indicate variables, where $lndist_{ijt}$ is the natural logarithm for the weighted distance between countries i and j; $contig_{ijt}$ takes on 1 if there is a common land frontier between i and j, otherwise 0; $comlang_eth9_{ijt}$ takes on 1 if at least 9% of the pair population share the same language, otherwise 0, $col45_{ijt}$ takes on 1 if both countries were under a colonial relationship before 1945, otherwise 0, and

finally our variable of interest rta_{ijt} takes on 1 if both countries share a free trade agreement, otherwise 0.

The equation to be estimated with random effects or with country-pair fixed effects is presented in eq(5) below. Here we follow eq(6) assumption.

$$(5) \quad lnX_{ijt} = \beta_0 + \beta_1 RTA_{ijt} + \psi_h \boldsymbol{S_{it}} + \phi_h \boldsymbol{M_{it}} + \alpha_t + \alpha_{ij} + \mathcal{E}_{ijt}$$

$$(6) \quad Cov(EV_{ijtg}\ ,\ \alpha_{ij}) = 0\,, \qquad t = 1,2,\dots,T\ ;\ ij = 1,2\dots,N\ ;\ g = 1,2\dots,k.$$

Where EV stands for explanatory variables, (ij) represents the entities which, in a gravity model, are bilateral trade flows between country i and country j or a country pair, t represents years, and g is to enumerate the explanatory variables.

α_{ij} represent pair-country fixed effects, in other words the fixed effect for every bilateral trade flow which is random in the random effect model, and non-random or correlated with the explanatory variables in the within transformation or fixed effect model.

For the traditional fixed effect model (within transformation) eq(6) assumption is modified to allow for a differential intercept for each country pair ij, then, a correlation between at least some of the explanatory variables and the the pair-country fixed effects is permitted. This method does not allow controlling for time-invariant exporter and importer fixed effects at the same time, as the pair-fixed effects are collinear with country fixed effects. Thus, all time-invariant variables are dropped by the within transformation (Greene, 2011) :

$$(7) \quad Cov(EV_{ijtg}\ ,\ \alpha_{ij}) \neq 0\,, \qquad t = 1,2,\dots,T\ ;\ ij = 1,2\dots,N\ ;\ g = 1,2\dots,k.$$

Increasing acceptance to estimate gravity models is acknowledged to the Poisson Pseudo Maximum Likelihood PPML estimator. This technique has been defended by (Santos Silva and Tenreyro, 2006; 2011) as the more reliable method to estimate the gravity equation because it deals with heteroscedasticity problems better than traditional OLS methods. Furthermore, in their work of 2011, they presented further evidence that the PPML estimator generates consistent estimates, even in the presence of a large number of zero values in the data set, a recurrent difficulty in gravity models. Table 4 presents results derived from this estimator.

The equation to estimate with Poisson Pseudo Maximum Likelihood PPML derives from an exponential specification of the gravity model that presents a multiplicative error term u_{ijt}. This requires the dependent variable to be presented in levels. Eq(8) present the PPML specification when we introduce year fixed effects and exporter and importer time-invariant fixed effects:

$$(8a) \quad X_{ijt} = exp(\beta_0 + \beta_1 RTA_{ijt} + \varphi_g \boldsymbol{Z_{ijt}} + \psi_h \boldsymbol{S_{it}} + \phi_h \boldsymbol{M_{jt}} + \alpha_t + \alpha_i + \alpha_j)\, u_{ijt}$$

Here, X_{ijt} represents the value of the fob merchandise exports from country i to country j in current dollars and $u_{ijt} = \exp((1-\sigma)\mathcal{E}_{ijt})$. We chose this specification to evaluate trade diversion (Vinner, 1950) for a set of interesting RTAs. Thus we introduce a vector of $\mathbf{RTA}_{it}$ trade diversion dummies next to their associated vector of $\mathbf{RTA}_{ijt}$. The subscript k stands for the number of RTA dummies included. Eq (8a) can now be read as :

$$(8b) \quad X_{ijt} = exp(\beta_0 + \beta_k \boldsymbol{RTA_{ijt}} + \Upsilon_k \boldsymbol{RTA_{it}} + \varphi_g \boldsymbol{Z_{ijt}} + \psi_h \boldsymbol{S_{it}} + \phi_h \boldsymbol{M_{jt}} + \alpha_t + \alpha_i + \alpha_j)\, u_{ijt}$$

In Eq. (9) where we relax the assumption of the maintenance of unchanging gaps among different intecepts, or stable tendencies, through time. The inclusion of time-varying country fixed effects in the PPML specification leads us to estimate.

$$(9) \quad X_{ijt} = \exp(\beta_0 + \beta_1 RTA_{ijt} + \varphi_g \boldsymbol{Z_{ijt}} + \psi_h \boldsymbol{S_{it}} + \phi_h \boldsymbol{M_{jt}} + \alpha_t + \alpha_i + \alpha_j + \alpha_{it} + \alpha_{jt}) u_{ijt}$$

Where α_{it} stands for time varying exporter fixed effects and α_{jt} are the importer time-varying fixed effects.

To analyse the evolution of the RTAs effect on trade over time we will run a series of 33 cross-section regressions with PPML; one for each year in our sample. Using this thecnique (De Sousa, 2012) found that the currency union effect on trade decreased over time. Eq. (10) summarizes this specification.

$$(10) \quad X_{ij} = \exp(\beta_0 + \beta_1 RTA_{ij} + \beta_2 lndist_{ij} + \beta_3 contig_{ij} + \beta_4 comlang_{eth9_{ij}} + \beta_5 col45_{ij} + \alpha_i + \alpha_j)\, u_{ij}$$

For more details, a list including names and definitions of variables, as well as their unity of measure and source of origin can be found in Appendixes C and D.

1.3 Results

Section 1.3.1 presents results from traditional methods of estimation. Thus, OLS estimates are presented in section 1.3.1.1, section 1.3.1.2, shows random effects estimates and results for the within transformation are presented in section 1.3.1.3. Then, section 1.3.2 presents current methods of estimation. Thus, section 1.3.2.1 provides results for PPML estimations and the evolution of the RTA estimate over time while section 1.3.2.2 presents results from the Baier and Bergstrand method. Section 1.3.3 puts forward instrumental variable methods and dynamics. Thus, section 1.3.3.1 is devoted to the Hausman and Taylor estimator and section 1.3.3.2 applies the Arellano and Bond estimator. We wrap up results in section 1.3.4. Then, section 1.3.5 explores the OCDE status implications on the effects of RTAs. Section 1.3.6 presents RTAs effects at the disaggregated level, and finally 1.3.7 provides RTA estimates at the disaggregated level where trade diversion is analysed.

In accordance with Baldwin and Taglioni (2006) this paper includes specifications that control for the passing of time using time-fixed effects. This approach allows us to work properly with GDP dollars, avoiding the so-called bronze medal mistake, which occurs when deflating these time series to obtain their real values. Non-averaged bilateral trade data to avoid the silver medal mistake is also used.
The inclusion of time-invariant country fixed effects permits the partial offsetting of the endogeneity problem caused by omitted variables, in what is known as the gold medal mistake.

Under the OLS and PPML method, this paper also controls for time-varying country fixed effects for importers and exporters. This procedure would furnish a robust estimate of RTAs that controls from multilateral resistant and other omitted variables that change with the passing of time.

1.3.1 Traditional methods of estimation

1.3.1.1 Pooled OLS Specifications results

Table 1 presents results based on the pooled OLS specifications. Column 1 does not include any kind of country fixed effects. Column 2 introduces time-fixed effects, column 3 deals with county time-invariant fixed effects, but does not control for time-fixed effects; column 4 controls for country time-invariant fixed effects, and time-fixed effects at the same time. Finally, colomn 5 includes a regression with time-varying exporter and time-varying importer fixed effects, country time- invariant fixed effects and time-fixed effects.

An analysis of the RTA coeffictients shows that the model with no fixed effects in column 1, which estimates a rise of 45.2%, ($e^{0.373}$ -1) in bilateral exports affected by RTAs relative to flows not influenced by them, underestimates the impact of RTAs on international bilateral trade with respect to other OLS models that control for fixed effects.

When only time-fixed effects are controlled for, the RTA coefficient overreacts, see column 2 of table 1, equivalent to a rise of 110.4%, ($e^{0.744}$ -1) in bilateral exports affected by a RTA with respect to bilateral trade not affected by RTAs. This is by far the highest global RTA estimate computed in this paper.

The introduction of country time-invariant fixed effects in columns 3 and 4 reduces the OLS estimate, compared to the model that only controls for time fixed effect, column 2, while providing a larger estimate than the reference model in column 1. The estimate of the model in column 4, which includes time fixed and country time-invariant fixed effects, predicts a larger increase in bilateral export flows affected by a RTA than the model in column 3 that omits time fixed effects while still controling for time- invariant country fixed effects.

A rise of 81.8%, ($e^{0.598}$ – 1) for colomn 4 compared to a rise of 76.8%, ($e^{0.570}$ – 1) in colomn 3. Introducing time-varying fixed effects moves the estimate downwards . Thus, the model in column 5 calculates an increase in bilateral exports flows of around 65.9%, ($e^{0.506}$ – 1), a more cautious estimate than in column 3 and 4, and still larger than the model with no fixed effects.

Table 1
OLS Regression on 153 countries from 1980-2012

	(1)	(2)	(3)	(4)	(5)
	lnx_{ijt}	lnx_{ijt}	lnx_{ijt}	lnx_{ijt}	lnx_{ijt}
rta_{ijt}	0.373***	0.744***	0.570***	0.598***	0.506***
	(0.014)	(0.014)	(0.013)	(0.013)	(0.013)
$gatt_{it}$	-0.077***	0.158***	-0.071***	-0.073***	
	(0.012)	(0.012)	(0.017)	(0.017)	
$gatt_{jt}$	-0.328***	-0.085***	0.050***	0.046***	
	(0.010)	(0.010)	(0.015)	(0.015)	
$gspprovider_{it}$	0.026**	0.133***	0.257***	0.262***	
	(0.012)	(0.012)	(0.012)	(0.012)	
$gspben_{it}$	0.087***	0.191***	0.303***	0.311***	
	(0.016)	(0.016)	(0.016)	(0.016)	
$lnGDP_{it}$	0.857***	1.121***	0.529***	0.653***	
	(0.006)	(0.006)	(0.011)	(0.014)	
$lnGDP_{jt}$	0.483***	0.724***	0.478***	0.587***	
	(0.005)	(0.005)	(0.0010)	(0.012)	
$lndist_{ijt}$	-1.183***	-1.163***	-1.550***	-1.546***	-1.508***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$contig_{ijt}$	1.296***	1.197***	0.744***	0.740***	0.708***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
$comlang_eth9_{ijt}$	0.775***	0.696***	0.627***	0.627***	0.639***
	(0.010)	(0.0010)	(0.011)	(0.011)	(0.011)
$col45_{ijt}$	1.440***	1.382***	1.511***	1.508***	1.532***
	(0.025)	(0.024)	(0.025)	(0.025)	(0.025)
$oecd_{it}$	0.657***	-0.016	0.102***	0.119***	
	(0.013)	(0.013)	(0.022)	(0.022)	
$oecd_{jt}$	0.862***	0.235***	-0.042	-0.015	
	(0.014)	(0.015)	(0.032)	(0.032)	
$lnpop_{it}$	0.387***	0.174***	-0.647***	-0.402***	
	(0.007)	(0.007)	(0.035)	(0.037)	
$lnpop_{jt}$	0.475***	0.290***	-0.012	0.251***	
	(0.006)	(0.006)	(0.030)	(0.031)	
$urpart_{it}$	0.013***	0.007***	0.016***	0.023***	
	(0.000)	(0.000)	(0.001)	(0.001)	
$urpart_{jt}$	0.010***	0.004***	0.012***	0.019***	
	(0.000)	(0.000)	(0.001)	(0.001)	
isl_{it}	0.189***	0.078***			
	(0.011)	(0.011)			
isl_{jt}	0.141***	0.037***			
	(0.012)	(0.011)			
$landlocked_{it}$	-0.265***	-0.044***			
	(0.012)	(0.011)			
$landlocked_{jt}$	-0.917***	-0.709***			
	(0.011)	(0.011)			
$lnarea_{it}$	-0.134***	-0.127***			
	(0.003)	(0.003)			
$lnarea_{jt}$	-0.141***	-0.143***			
	(0.003)	(0.003)			
Observations	397,625	397,625	397,625	397,625	411,175
Exporter FE	NO	NO	YES	YES	NO
Importer FE	NO	NO	YES	YES	NO
Time- Varying Exporter FE	NO	NO	NO	NO	YES
Time- Varying Importer FE	NO	NO	NO	NO	YES
Country-pair FE	NO	NO	NO	NO	NO
Time FE	NO	YES	NO	YES	NO
R^2_a	0.626	0.646	0.715	0.715	0.727

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, Source: Elaborated by the author.

1.3.1.2 Random Effects specifications results

A random effects model which assumes that unobserved individual effects are uncorrelated with the explanatory variables (Wooldridge, 2009) has been run. Its results will be compared with pooled OLS estimates, as well as with the fixed effect model and the PPML specification. The random effect model moves RTA estimates downward with respect to pooled OLS, yet a positive and significant effect is persistent. Comparing column 1 estimates, the random effect model predicts a rise of 17.6%, while column 1 of pooled OLS predicts a rise in bilateral trade around 45.2%. The same phenomenon consisting of an increase in estimates, observed with pooled OLS estimates is visible under the random effects model, when time-fixed effects or time-invariant fixed effects are included. The random effects model in column 2 estimates that flows affected by RTAs, experience an increase of about 32,8%, ($e^{0.284} - 1$), with respect to bilateral exports that do not profit from any RTA.

Time-fixed effects and exporter and importer time-invariant fixed effects introduced together as in column 4, produce an RTA estimate of 0.272, equivalent to an increase of about 31.3% in bilateral exports. This estimate is larger than that predicted by a random effect model including country time- invariant fixed effect and no time effects, equivalent to a rise in bilateral trade flows around 26.0%, ($e^{0.231}$ -1). Yet, the RTA random effect estimate in column 4 implies a slightly less important increase in trade than the model in column 2, controlling for time-fixed effects but omitting time-invariant fixed effects. This is the same pattern detected under the pooled OLS method.

Technical difficulties arose in computing time-varying country fixed effects under the random effects specification, nevertheless, we could expect a downward estimate with respect to the estimate in column 4 and a larger number than those in column 1.

To distinguish which model performs better between OLS and random effects, (Breusch and Pagan, 1980) developed a straightforward test that checks if random effects are present. On the basis of their Lagrangian multiplier test for random effects, the OLS pooled model is outperformed by the random effect model. This test was applied to results from column 1 models in table 1 and table 2 corresponding to specifications that does not control for any kind of fixed effect. It is also interesting to note that other trade-related variables included in the regression present troubling results under the random effect model. This is the case of the exporting country membership in the GATT-WTO mechanism, which is non-significant, and also the case of being a beneficiary of the GSP scheme, which presents a negative and

significant at the 5% level under the time-invariant country fixed effects and time-fixed effect specification for the random effect regression.

Table 2
Random Effects Regression on 153 countries from 1980-2012

	(1)	(2)	(3)	(4)
	lnx_{ijt}	lnx_{ijt}	lnx_{ijt}	lnx_{ijt}
rta_{ijt}	0.162***	0.284***	0.231***	0.272***
	(0.023)	(0.024)	(0.023)	(0.024)
$gatt_{it}$	-0.046*	0.028	0.031	0.024
	(0.025)	(0.025)	(0.027)	(0.027)
$gatt_{jt}$	0.069***	0.142***	0.132***	0.125***
	(0.022)	(0.022)	(0.023)	(0.023)
$gspprovider_{it}$	0.197***	0.183***	0.142***	0.143***
	(0.028)	(0.027)	(0.028)	(0.028)
$gspben_{it}$	-0.120***	-0.122***	-0.089**	-0.082**
	(0.041)	(0.040)	(0.041)	(0.040)
$lnGDP_{it}$	0.596***	0.839***	0.555***	0.675***
	(0.015)	(0.018)	(0.018)	(0.023)
$lnGDP_{jt}$	0.479***	0.684***	0.572***	0.676***
	(0.013)	(0.014)	(0.015)	(0.018)
$lndist_{ijt}$	-1.396***	-1.346***	-1.616***	-1.611***
	(0.022)	(0.021)	(0.022)	(0.022)
$contig_{ijt}$	1.331***	1.360***	0.989***	0.983***
	(0.089)	(0.090)	(0.097)	(0.097)
$comlang_eth9_{ijt}$	0.659***	0.763***	0.763***	0.763***
	(0.043)	(0.040)	(0.041)	(0.041)
$col45_{ijt}$	2.361***	1.824***	1.627***	1.624***
	(0.107)	(0.121)	(0.126)	(0.126)
$oecd_{it}$	0.484***	0.325***	0.114***	0.117***
	(0.032)	(0.031)	(0.035)	(0.036)
$oecd_{jt}$	0.348***	0.189***	0.052	0.065
	(0.045)	(0.044)	(0.055)	(0.055)
$lnpop_{it}$	0.355***	0.414***	-0.239***	-0.012
	(0.024)	(0.023)	(0.064)	(0.065)
$lnpop_{jt}$	0.282***	0.379***	0.116**	0.366***
	(0.021)	(0.021)	(0.054)	(0.057)
$urpart_{it}$	0.015***	0.019***	0.013***	0.020***
	(0.001)	(0.001)	(0.003)	(0.003)
$urpart_{jt}$	0.004***	0.010***	0.010***	0.017***
	(0.001)	(0.001)	(0.002)	(0.002)
isl_{it}	0.210***	0.146***		
	(0.047)	(0.044)		
isl_{jt}	0.136***	0.086**		
	(0.048)	(0.044)		
$landlocked_{it}$	-0.613***	-0.235***		
	(0.044)	(0.041)		
$landlocked_{jt}$	-1.034***	-0.667***		
	(0.044)	(0.042)		
$lnarea_{it}$	0.016	-0.113***		
	(0.013)	(0.012)		
$lnarea_{jt}$	-0.008	-0.143***		
	(0.013)	(0.012)		
Observations	397,625	397,625	397,625	397,625
Exporter time- invariant FE	NO	NO	YES	YES
Importer time- invariant FE	NO	NO	YES	YES
Country-pair FE	NO	NO	NO	NO
Time- FE	NO	YES	NO	YES
R^2_o	0.604	0.637	0.710	0.711

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1; Source: Elaborated by the author.

1.3.1.3 Fixed Effects Model (Country-pair fixed effects)

When we relax the assumption that individuals effects are uncorrelated with covariates, we obtain a fixed effect model. This model creates fixed effects for each bilateral export flow that remains invariant through time. Thus, observed and unobserved time-invariant heterogeneity at the pair-country level is kept at bay.

The fixed effects model in column 1 estimates that bilateral exports sharing a RTA increase by 21.8%, ($e^{0.197}$ -1) relative to flows without RTAs. This impact moves upward to 26.7%, ($e^{0.237}$ – 1) when time-fixed effects are added.

Results concerning other variables seem coherent with theory, with the exception of exporter membership to the GATT-WTO, the logarithm of its population and importer affiliation to the OECD, which are shown to be non-significant. Also puzzling is the negative and significant sign presented by exporters that profit from unilateral trade advantages from their importing partner.

A test to identify which model between random or fixed effects fits better in panel data was developed by (Hausman,1978). Here again comparisons are made between the specifications that omit time- fixed effects, namely column 1 in table 2 against column 1 in table 3.

Results from the Hausman's specification test, establish that the fixed effect model fits better than the random effects. Particularities at individual level are then correlated with the explanatory variables.

Nevertheless, the fixed effect regression at the individual country-pair level generates estimates that could be underestimating the RTA effect on bilateral trade, particularly when time- fixed effects are accounted for.

Table 3
Fixed Effects Regression on 153 countries from 1980-2012

	(1)	(2)
	lnx_{ijt}	lnx_{ijt}
rta_{ijt}	0.197***	0.237***
	(0.024)	(0.024)
$gatt_{it}$	0.041	0.034
	(0.027)	(0.027)
$gatt_{jt}$	0.140***	0.133***
	(0.023)	(0.023)
$gspprovider_{it}$	0.120***	0.119***
	(0.029)	(0.029)
$gspben_{it}$	-0.134***	-0.135***
	(0.044)	(0.044)
$lnGDP_{it}$	0.561***	0.680***
	(0.018)	(0.023)
$lnGDP_{jt}$	0.581***	0.684***
	(0.015)	(0.018)
$lnpop_{it}$	-0.210***	0.020
	(0.064)	(0.066)
$lnpop_{jt}$	0.120**	0.374***
	(0.055)	(0.057)
$urpart_{it}$	0.013***	0.020***
	(0.003)	(0.003)
$urpart_{jt}$	0.009***	0.017***
	(0.002)	(0.002)
$oecd_{it}$	0.111***	0.114***
	(0.035)	(0.036)
$oecd_{jt}$	0.063	0.076
	(0.055)	(0.055)
Constant	-12.704***	-26.226***
	(1.076)	(1.484)
Observations	397,625	397,625
Number of pairs	20,475	20,475
Exporter Fixed Effects	NO	NO
Importer Fixed Effects	NO	NO
Country-pair Fixed Effects	YES	YES
Time- FE	NO	YES
R^2_o	0.430	0.477

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: Elaborated by the author.

1.3.2 Current methods of estimation

1.3.2.1 PPML specification results

Table 4 presents the results for models estimated with the PPLM method. This seems to be the more reliable method to estimate the gravity model. Recent literature (Martínez-Zarzoso, 2013) validates it through a series of Monte Carlo experiments.

In the specification without time-fixed effects or country fixed effects, Column 1, the PPML estimate of RTA comes near the fixed effect model estimate. A rise of 21.0%, ($e^{0.191}$ -1) for

PPML against a rise of 21.4%, ($e^{0.197}$ -1) for the pair-country fixed effects. The introduction of time-fixed effects and country fixed effects corrects PPML estimates upwards, as it does throughout preceding estimation methods. This correction is sufficiently important to surpass random effects and fixed effects models estimates while remaining below OLS estimates.

One of the most interesting results we find is that PPML estimations of RTA with time-invariant fixed effects are insensitive to the introduction of time-varying fixed effect for exporters and importers countries, the latter being very difficult to estimate due to computational restraints derived from the huge number of dummy variables that need to be computed, see table 4. This could also imply that the introduction of time- invariant exporter and importer fixed effects sufficiently control for multilateral resistance that could affect RTA estimates.

Accordingly, under the time-invariant fixed country effect model estimated by PPML, see column 4, bilateral exports affected by a RTA should increase by 48.6%, ($e^{0.396}$ -1) compared with bilateral export flows that do not profit from any RTA; the comparable result using time-varying country fixed effect estimated by PPML in column 5 model is 48.7%, ($e^{0.397}$ - 1). This estimate is just slightly larger than the increase predicted by the time- invariant country fixed effects specification. Other variable results show behaviours that are coherent with theory expectations. PPML regressions help us better disentangle complicated relationships that showed contradictory results under traditional estimation methods. Thus, GATT-WTO membership for exporting as well as importing countries presents a positive, significant and economically important coefficient.

Being an exporting country that receives unilateral preferences to access its partner market is non-significant. These results do not contradict significant findings concerning these variables at the product level, or in the case of studies with focussed smaller samples, for example, only for beneficiaries of the UE SPG exports to the UE. Cipollina & Pietrovito (2011) and Cipollina & Salvatici (2011).

Another corollary of the non-significance of the unilateral preferential variables could be linked with some developing countries which prefer to sign deeper RTAs to effectively promote trade even at the expense of reciprocity.

Table 4
PPLM Regression on 153 countries from 1980 to 2012

	(1)	(2)	(3)	(4)	(5)
	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}
rta_{ijt}	0.191***	0.351***	0.397***	0.396***	0.397***
	(0.022)	(0.021)	(0.018)	(0.018)	(0.018)
$gatt_{it}$	-0.132***	-0.094***	0.314***	0.279***	
	(0.026)	(0.026)	(0.040)	(0.040)	
$gatt_{jt}$	0.073***	0.110***	0.210***	0.172***	
	(0.024)	(0.023)	(0.033)	(0.032)	
$gspprovider_{it}$	-0.271***	-0.192***	0.009	0.012	
	(0.025)	(0.024)	(0.021)	(0.021)	
$gspben_{it}$	-0.187***	-0.110***	-0.037	-0.036	
	(0.039)	(0.038)	(0.028)	(0.028)	
$lnGDP_{it}$	0.771***	0.963***	0.661***	0.725***	
	(0.012)	(0.015)	(0.020)	(0.024)	
$lnGDP_{jt}$	0.702***	0.891***	0.575***	0.642***	
	(0.011)	(0.012)	(0.019)	(0.023)	
$lndist_{ijt}$	-0.700***	-0.676***	-0.763***	-0.763***	-0.770***
	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)
$contig_{ijt}$	0.627***	0.580***	0.487***	0.487***	0.471***
	(0.022)	(0.022)	(0.016)	(0.016)	(0.016)
$comlang_eth9_{ijt}$	0.528***	0.510***	0.260***	0.260***	0.261***
	(0.016)	(0.015)	(0.016)	(0.016)	(0.016)
$col45_{ijt}$	-0.032	0.032	0.248***	0.246***	0.251***
	(0.037)	(0.034)	(0.041)	(0.041)	(0.039)
$oecd_{it}$	-0.360***	-0.713***	0.279***	0.240***	
	(0.035)	(0.039)	(0.043)	(0.044)	
$oecd_{jt}$	-0.131***	-0.476***	0.195***	0.157***	
	(0.024)	(0.025)	(0.037)	(0.038)	
$lnpop_{it}$	0.126***	-0.029*	-0.223***	-0.176**	
	(0.015)	(0.016)	(0.078)	(0.076)	
$lnpop_{jt}$	0.179***	0.028**	-0.418***	-0.364***	
	(0.012)	(0.012)	(0.064)	(0.063)	
$urpart_{it}$	0.008***	0.004***	0.001	0.002	
	(0.001)	(0.001)	(0.002)	(0.002)	
$urpart_{jt}$	0.009***	0.005***	0.001	0.002	
	(0.001)	(0.001)	(0.002)	(0.002)	
isl_{it}	0.468***	0.436***			
	(0.021)	(0.020)			
isl_{jt}	0.314***	0.275***			
	(0.020)	(0.019)			
$landlocked_{it}$	-0.230***	-0.188***			
	(0.027)	(0.028)			
$landlocked_{jt}$	-0.212***	-0.175***			
	(0.024)	(0.024)			
$lnarea_{it}$	-0.060***	-0.060***			
	(0.007)	(0.007)			
$lnarea_{jt}$	-0.056***	-0.059***			
	(0.006)	(0.006)			
Observations	585,786	585,786	585,786	585,786	606,710
R^2	0.7516	0.7771	0.8974	0.8998	0.906
Exporter time-invariant FE	NO	NO	YES	YES	YES
Importer time-invariant FE	NO	NO	YES	YES	YES
Time-Varying Exporter FE	NO	NO	NO	NO	YES
Time-Varying Importer FE	NO	NO	NO	NO	YES
Country-pair FE	NO	NO	NO	NO	NO
Time- FE	NO	YES	NO	YES	YES

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Elaborated by the author.

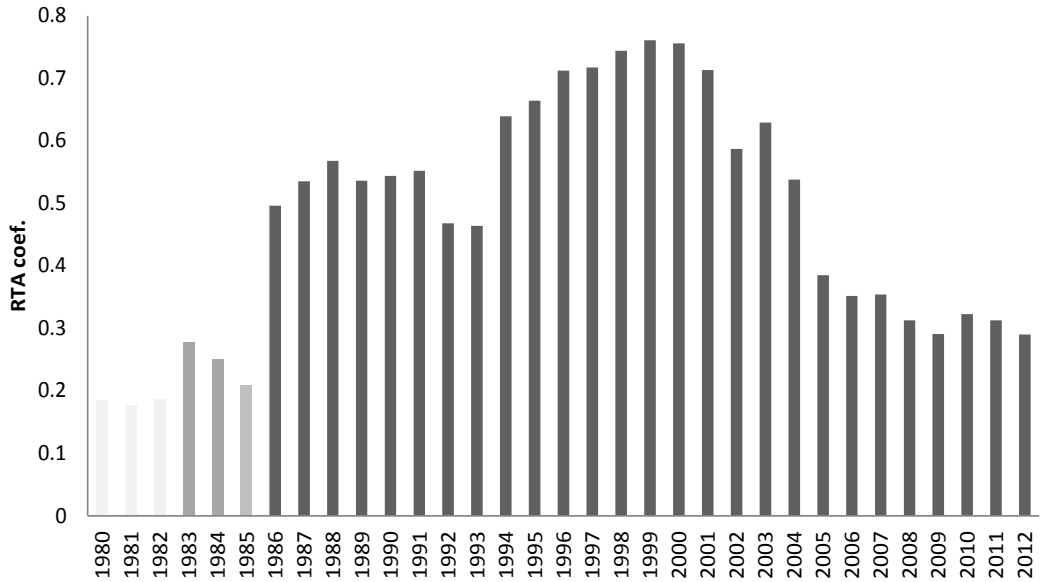
We can observe in figure 3 a series of PPML cross-sections on a yearly basis. These successive regressions also control for country exporter and importer fixed effects and a set of dyadic variables, namely dummies for distance, the presence of a common land border, common language and colonial links.

RTA cross-sections coefficients from 1980 to 1982 are non-significant. They become significant at the 1% confidence interval from 1986. The evolution of this coefficient through time describes an inverted U form. The highest RTA estimates, 0.761, is obtained from the 1999 cross-section and implies an increase in bilateral export flows by 114% relative to flows that are not covered with a RTA.

The erosion of the RTA estimate after 1999 could be associated to many causes. One plausible hypothesis to consider could be the entry into effect of diminishing returns giving the popularization of RTA the preferred mechanism to liberalize international trade flows, in what could be understood as a spaghetti bowl effect. (Bhagwati and Panagariya, 1999).

After 1999, the RTA coefficient attained its lowest level in 2012 when it falls below the 0.3 level to 0.290, meaning an increase in bilateral exports of 33.6%.

Figure 3
RTA estimates from PPML cross-sections
1980-2012



Source: Own calculations.

1.3.2.2 The Baier and Bergstrand Method

We apply the Baier and Bergstrand technique that consists of controlling for multilateral resistance and endogeneity of RTA by the means of introducing pair-country fixed effects and time varying fixed-effects on a panel of non-successive years that we call periods.

As Baier and Bergstrand did we also estimated our model keeping 9 periods, so we retain information for intervals of four years, Baier and & Bergstrand kept data for intervals of five years. The results we show are estimated with data for years 1980, 1984, 1988, 1992, 1996, 2000, 2004, 2008 and 2012.

Baier and Bergstrand's method reduces the time dimension from 33 years to 9. This has two advantages: first, it gives sufficient time for the effect of the treatment, the RTA, to develop, and second, and possibly more important, it reduces the demands on software computing power to make possible the computation of pair country fixed effects and time-varying country fixed effects at the same time. This allows us to fully control for endogeneity of RTAs and multilateral resistance omitted variable bias, delivering the average treatment effect or the net effect of the introduction of an RTA.

Results in columns 9 and 10 where country-pair and time-varying country fixed effects are included merit special attention,. Thus, the introduction of a RTA will increase bilateral exports by around 36.2%, ($e^{0.309}$ -1).

It implies an upward bias compared with the increase of 43.3%, %, ($e^{0.360}$ -1) estimated in column 1, where all fixed effects are opted out, but a downward bias compared with the 113,18%, %, ($e^{0.757}$ -1) expansion predicted by the specification in column 2 that omits country fixed effects, but controls for time fixed effects.

Note that including time fixed effect has no incidence on the RTA coefficient when time-varying fixed effects are accounted for as can be seen in columns 7 to 10. The highest RTA estimates under the Baier and Bergstrand method come from specifications where importer and exporter time-invariant fixed effects are accounted for.

Table 5
Baier & Bergstrand Regression on 153 countries for 9 periods from 1980 to 2012

	(1) lnxij	(2) lnxij	(3) lnxij	(4) lnxij	(5) lnxij	(6) lnxij	(7) lnxij	(8) lnxij	(9) lnxij	(10) lnxij
rta_{ijt}	0.360***	0.757***	0.222***	0.249***	0.624***	0.645***	0.699***	0.699***	0.309***	0.309***
	(0.026)	(0.026)	(0.028)	(0.028)	(0.025)	(0.025)	(0.026)	(0.026)	(0.030)	(0.030)
$lnGDP_{it}$	0.819***	1.106***	0.548***	0.649***	0.521***	0.612***				
	(0.011)	(0.011)	(0.021)	(0.026)	(0.018)	(0.023)				
$lnGDP_{jt}$	0.452***	0.713***	0.590***	0.670***	0.482***	0.557***				
	(0.010)	(0.010)	(0.017)	(0.020)	(0.018)	(0.022)				
$lnpop_{it}$	0.422***	0.193***	-0.374***	-0.139*	-0.835***	-0.615***				
	(0.013)	(0.013)	(0.074)	(0.077)	(0.060)	(0.064)				
$lnpop_{jt}$	0.503***	0.306***	0.092	0.347***	-0.073	0.159**				
	(0.011)	(0.011)	(0.062)	(0.065)	(0.057)	(0.062)				
$ocde_{it}$	0.737***	-0.001	0.102**	0.120***	0.071	0.100*				
	(0.024)	(0.026)	(0.043)	(0.043)	(0.058)	(0.058)				
$ocde_{jt}$	0.938***	0.266***	0.038	0.067	-0.086	-0.047				
	(0.028)	(0.028)	(0.067)	(0.068)	(0.060)	(0.060)				
$gatt_{it}$	-0.076***	0.178***	0.078**	0.071**	-0.073**	-0.077**				
	(0.024)	(0.024)	(0.032)	(0.032)	(0.030)	(0.031)				
$gatt_{jt}$	-0.367***	-0.100***	0.123***	0.118***	0.020	0.017				
	(0.020)	(0.020)	(0.028)	(0.028)	(0.030)	(0.030)				
$urpart_{it}$	0.015***	0.008***	0.018***	0.024***	0.021***	0.027***				
	(0.001)	(0.001)	(0.003)	(0.003)	(0.002)	(0.002)				
$urpart_{jt}$	0.010***	0.004***	0.012***	0.018***	0.016***	0.022***				
	(0.001)	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)				
$gspben_{it}$	0.015	0.142***	-0.029	-0.037	0.307***	0.312***				
	(0.031)	(0.030)	(0.049)	(0.049)	(0.029)	(0.029)				
$gspprovider_{it}$	-0.003	0.133***	0.103***	0.086**	0.249***	0.251***				
	(0.023)	(0.022)	(0.034)	(0.034)	(0.027)	(0.028)				
$lndist_{ijt}$	-1.172***	-1.147***			-1.534***	-1.531***	-1.520***	-1.520***		
	(0.012)	(0.011)			(0.012)	(0.012)	(0.011)	(0.011)		
$contig_{ijt}$	1.323***	1.227***			0.765***	0.763***	0.740***	0.740***		
	(0.040)	(0.040)			(0.041)	(0.041)	(0.040)	(0.040)		
$comlang_{ijt}$	0.794***	0.712***			0.634***	0.635***	0.636***	0.636***		
	(0.019)	(0.019)			(0.021)	(0.021)	(0.020)	(0.020)		
$col45_{ijt}$	1.435***	1.359***			1.518***	1.514***	1.465***	1.465***		
	(0.049)	(0.048)			(0.062)	(0.062)	(0.060)	(0.060)		
isl_{it}	0.168***	0.062***								
	(0.021)	(0.020)								
isl_{jt}	0.145***	0.047**								
	(0.022)	(0.022)								
$landlocked_{it}$	-0.297***	-0.045**								
	(0.023)	(0.022)								
$landlocked_{jt}$	-0.943***	-0.708***								
	(0.022)	(0.022)								
$lnarea_{it}$	-0.139***	-0.132***								
	(0.005)	(0.005)								
$lnarea_{jt}$	-0.139***	-0.142***								
	(0.005)	(0.005)								
Observations	106,538	106,538	106,538	106,538	106,538	106,538	106,538	106,538	111,265	111,265
R-squared	0.623	0.646	0.256	0.259	0.714	0.714	0.737	0.737	0.368	0.368
Exporter TIFE	NO	NO	NO	NO	YES	YES	YES	YES	NO	NO
Importer TIFE	NO	NO	NO	NO	YES	YES	YES	YES	NO	NO
Country-pair FE	NO	NO	YES	YES	NO	NO	NO	NO	YES	YES
Time FE	NO	YES	NO	YES	YES	YES	NO	YES	NO	YES
Exporter TVFE	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
Importer TVFE	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Elaborated by the author.
Note: TIFE stands for Time-invariant fixed effects. TVFE stands for time-varying fixed effects.

The Baier and Bergstrand method simplifies the analysis of the dynamics of RTA through time. Variable rta_{ijt-1} and rta_{ijt-2} will capture the impact of RTAs on bilateral exports four and eight years before their entry into force or phase-in effects. It also allows to evaluate anticipatory effects, rta_{ijt+1} describes the effects of announcement and pre-entry into be force adaptations. Table 6 resumes these results.

Table 6
Dynamics Baier & Bergstrand Regression on 153 countries for 9 periods from 1980 to 2012

	(1) lnxij	(2) lnxij	(3) lnxij	(4) lnxij
rta_{ijt}	0.309***	0.127***	0.092***	0.138***
	(0.030)	(0.030)	(0.032)	(0.038)
rta_{ijt-1}		0.294***	0.217***	0.250***
		(0.032)	(0.033)	(0.034)
rta_{ijt-2}			0.160***	0.224***
			(0.033)	(0.038)
rta_{ijt+1}				0.026
				(0.036)
Constant	14.734	14.810	14.268	14.966***
	(.)	(.)	(.)	(0.298)
Observations	111,265	100,020	88,003	70,732
R-squared	0.368	0.360	0.339	0.317
Exporter FE	NO	NO	NO	NO
Importer FE	NO	NO	NO	NO
Country-pair FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
Time Varying Exporter FE	YES	YES	YES	YES
Time Varying Importer FE	YES	YES	YES	YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Source: Elaborated by the author.

Using the Baier and Bergstrad method, the first and second lags of RTAs are positive and significant. RTAs produce a cumulative increase of 52.3% in bilateral exports during the first four year of the entry into force of the agreement and approximately a 59.8% cumulative effect during the 8 first years.

The four years prior to its entry into force anticipatory effect of RTAs is economically small and non-significant, which confirms strict exogeneity of RTAs, mitigating doubts about reversal causality where an increase in trade could cause RTA appearance.

1.3.3 Instrumental variable methods and dynamics

1.3.3.1 The Hausman and Taylor instrumental variable estimator

To deal with RTA endogeneity problem of the type suggested by Baldwin and Jaimovich (2012) where a new free trade agreement between A and B increases the probability that C will sign a RTA with A or B or due to pre-existing overtrading patterns raised by Baier and Bergstrand (2007), we resort to the Hausman and Taylor (1981) estimator. These authors have proposed an instrumental variables estimator that uses only the information within the model by taking deviations from group means that can be used as instrumental variables. (Greene, 2011).

The Hausman–Taylor estimator assumes that some of the explanatory variables are correlated with the individual-level random effects, α_i, while none of the explanatory variables are correlated with the idiosyncratic error, $\mathcal{E}_{ijt}$. In addition to standard assumptions we also assume that RTA was the only endogenous variable in the model. Table 5 below presents results using the instrumental variables method of Hausman and Taylor. Through Monte Carlo simulations, this estimator has proved to be robust for endogenous time-varying variables in large sample and perfect knowledge gravity model frameworks. (Mitze, 2010).

H-T estimates of RTA could be biased downward; they predict an increase in bilateral trade between 21.5% and 30.5%. We should take these estimates with prudence as the Hausman test applied indicate that we should prefer the fixed effects estimator over the Hausman and Taylor estimator. Nevertheless, being the Hausman and Taylor estimator an instrumental variable estimator we should gain some confidence on making causal claims about the RTA effect. H-T estimates of RTA could be biased downward. They predict an increase in bilateral trade between 21.5% and 30.5%. We should take these estimates with caution as the Hausman test applied indicate that we should prefer the fixed effects estimator over the Hausman and Taylor estimator. Nevertheless, being the Hausman and Taylor estimator an instrumental variable estimator we should gain some confidence on making causal claims about the RTA effect.

Other instrumental variable techniques were also considered. The instrumental variable fixed effect and random effects estimators were computed using as instruments for RTA its lags on t-3 and t-4, under the assumption that these variables only influence bilateral exports by the influence they exert on the variable of interest RTA. Results suggest an upward bias for RTA and can be seen in Appendix E.

Table 7
Hausman and Taylor IV Regression on 153 countries from 1980 to 2012

	(1)	(2)	(3)	(4)
	lnxij	lnxij	lnxij	lnxij
rta_{ijt}	0.195***	0.269***	0.227***	0.264***
	(0.012)	(0.013)	(0.013)	(0.013)
$gatt_{it}$	-0.000	0.020*	0.038***	0.032***
	(0.011)	(0.011)	(0.012)	(0.012)
$gatt_{jt}$	0.113***	0.135***	0.131***	0.124***
	(0.011)	(0.011)	(0.011)	(0.011)
$gspprovider_{it}$	0.180***	0.163***	0.150***	0.145***
	(0.016)	(0.016)	(0.016)	(0.016)
$gspben_{it}$	-0.122***	-0.134***	-0.096***	-0.097***
	(0.017)	(0.017)	(0.017)	(0.018)
$lnGDP_{it}$	0.576***	0.790***	0.548***	0.675***
	(0.007)	(0.008)	(0.007)	(0.009)
$lnGDP_{jt}$	0.511***	0.690***	0.571***	0.679***
	(0.006)	(0.008)	(0.007)	(0.008)
$lndist_{ijt}$	-1.613***	-1.384***	-1.661***	-1.664***
	(0.038)	(0.031)	(0.028)	(0.028)
$contig_{ijt}$	0.911***	1.244***	0.862***	0.844***
	(0.172)	(0.153)	(0.115)	(0.115)
$comlang_eth9_{ijt}$	0.569***	0.769***	0.786***	0.781***
	(0.070)	(0.063)	(0.056)	(0.056)
$col45_{ijt}$	2.534***	1.840***	1.618***	1.625***
	(0.254)	(0.227)	(0.182)	(0.182)
$ocde_{it}$	0.292***	0.239***	0.108***	0.112***
	(0.020)	(0.020)	(0.021)	(0.021)
$ocde_{jt}$	0.181***	0.128***	0.066***	0.074***
	(0.022)	(0.021)	(0.023)	(0.023)
$lnpop_{it}$	0.171***	0.378***	-0.206***	0.007
	(0.016)	(0.016)	(0.023)	(0.025)
$lnpop_{jt}$	0.180***	0.400***	0.127***	0.359***
	(0.016)	(0.016)	(0.023)	(0.024)
$urpart_{it}$	0.014***	0.021***	0.013***	0.020***
	(0.001)	(0.001)	(0.001)	(0.001)
$urpart_{jt}$	0.006***	0.013***	0.010***	0.017***
	(0.001)	(0.001)	(0.001)	(0.001)
isl_{it}	0.272***	0.262***	-1.587***	-0.882***
	(0.074)	(0.066)	(0.258)	(0.260)
isl_{jt}	0.168**	0.156**	-2.224***	-0.437*
	(0.074)	(0.066)	(0.366)	(0.262)
$landlocked_{it}$	-0.807***	-0.303***	-2.367***	-1.296***
	(0.067)	(0.060)	(0.313)	(0.315)
$landlocked_{jt}$	-1.142***	-0.644***	-2.570***	-3.635***
	(0.067)	(0.060)	(0.376)	(0.366)
$lnarea_{it}$	0.147***	-0.036**	0.541***	0.368***
	(0.016)	(0.014)	(0.027)	(0.028)
$lnarea_{jt}$	0.046***	-0.133***	0.265***	-0.151***
	(0.016)	(0.014)	(0.049)	(0.028)
Observations	399,564	399,564	399,564	399,564
R-squared	20,477	20,477	20,477	20,477
Exporter time-invariant Fixed Effect	NO	NO	YES	YES
Importer time-invariant Fixed Effect	NO	NO	YES	YES
Time-Varying Exporter Fixed Effect	NO	NO	NO	NO
Time-Varying Importer Fixed Effect	NO	NO	NO	NO
Country-pair Fixed Effect	NO	NO	NO	NO
Time- Fixed Effect	NO	YES	NO	YES

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Elaborated by the author.

1.3.3.2 GMM regression and the Arellano and Bond estimator

The main purpose of the (Arellano and Bond, 1991) is to consistently estimate the dependant variable lags. Our results support the inclusion of the first lag of bilateral trade as it shows a positive and significant sign. This technique allows setting some explanatory variables as endogenous. We profit from this possibility and intend to use it here to correct endogeneity bias on the RTA estimates.

This estimation method uses GMM-type instruments to compute the causal effects of endogenous covariates, which in our case are rta_{ijt} and $rta_{ijt-1.}$ Interpretation of the RTA coefficients could be tricky as they are sensitive to dummy year inclusion.

They make the contemporaneous effect of RTA disappear, see column 2 in table 8, while the presence of a lag on RTA and dummy years, seems to suggest that the introduction of a RTA is positive and the withdrawal from it is negative, see column 4, which is not robust to results in column 3.

Dynamics in the dependant variable introduce autocorrelation into the model. The Arellano-Bond estimator intends to correct this problem. Nevertheless, the test for first- and second-order correlation shows strong evidence against the hypothesis of no autocorrelation. See arm1 and arm2 in table 8. Furthermore, the Sargan test of over-identifying restrictions is rejected.

These estimates should be read with caution as the test applied suggests misspecification. We decide keep the Arellano-Bond estimation results. They could be interpreted as evidence of the static approach strength and also as an invitation for further research on dynamics of the dependant variable.

Table 8
Arellano-Bond IV Regression on 153 countries from 1980 to 2012

	(1)	(2)	(3)	(4)
VARIABLES	lnxij	Lnxij	lnxij	lnxij
lnxijt-1	0.224***	0.212***	0.222***	0.211***
	(0.005)	(0.005)	(0.005)	(0.005)
rta_{ijt}	0.142***	0.038	-0.071	0.286**
	(0.050)	(0.055)	(0.099)	(0.114)
rta_{ijt-1}			0.339***	-0.237*
			(0.109)	(0.128)
$lnGDP_{it}$	0.330***	0.268***	0.330***	0.263***
	(0.014)	(0.015)	(0.014)	(0.015)
$lnGDP_{jt}$	0.580***	0.495***	0.575***	0.490***
	(0.014)	(0.016)	(0.014)	(0.016)
$lnpop_{it}$	-0.493***	-0.417***	-0.514***	-0.415***
	(0.068)	(0.069)	(0.068)	(0.069)
$lnpop_{jt}$	-0.290***	-0.135**	-0.304***	-0.123*
	(0.063)	(0.065)	(0.063)	(0.065)
$ocde_{it}$	0.160***	0.153***	0.151***	0.147***
	(0.036)	(0.037)	(0.036)	(0.037)
$ocde_{jt}$	0.087**	0.063	0.071*	0.055
	(0.042)	(0.042)	(0.042)	(0.042)
$gatt_{it}$	-0.015	0.008	-0.022	0.002
	(0.023)	(0.023)	(0.023)	(0.023)
$gatt_{jt}$	0.107***	0.112***	0.100***	0.107***
	(0.022)	(0.023)	(0.023)	(0.023)
$urpart_{it}$	0.013***	0.018***	0.014***	0.019***
	(0.002)	(0.002)	(0.002)	(0.002)
$urpart_{jt}$	0.010***	0.014***	0.010***	0.015***
	(0.002)	(0.002)	(0.002)	(0.002)
$gspprovider_{it}$	0.073**	0.051	0.023	0.117***
	(0.034)	(0.035)	(0.040)	(0.043)
$gspben_{it}$	0.037	0.022	-0.002	0.074**
	(0.029)	(0.029)	(0.033)	(0.036)
Observations	329,055	329,055	329,055	329,055
Number of pairs	18,072	18,072	18,072	18,072
Time Fixed Effects	NO	YES	NO	YES
Sargan	2936	2123	2882	2073
Arm2	10.60	10.44	10.45	10.20
Arm1	-103.9	-114.5	-103.2	-113.8

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Elaborated by the author.

1.3.4 RTA estimates compilation

Table 9 summarizes RTA estimates results, taking into account the econometric method and the fixed effect mix introduced. As a whole, in static models the RTA coefficient is positive and significant but depending on the method used, it can vary from an estimate of 0.162 to 0.757.

With the caveat that the dynamic of the dependant variable is not theoretically supported and that test for autocorrelation and over-identification have failed, we also present the Arellano and Bond RTA estimates. They suggest the lowest effects of RTA on bilateral trade.

Table 9
Summary of RTA coefficients on bilateral exports.
Estimated across 153 countries from 1980-2012

Fixed Effects Controls	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Time invariant Exporter Fixed Effects	NO	NO	NO	NO	YES	YES	NO	YES	NO	NO
Time invariant Importer Fixed Effects	NO	NO	NO	NO	YES	YES	NO	YES	NO	NO
Time Varying Exporter Fixed Effects	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
Time Varying Importer Fixed Effects	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
Country-pair Fixed Effects	NO	NO	YES	YES	NO	NO	NO	NO	YES	YES
Time Fixed Effects	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Econometric Method										
Pooled OLS	0.373***	0.744***			0.570***	0.598***	0.506***	T.D.	T.D.	T.D.
Random Effects	0.162***	0.284***			0.231***	0.272***				
Fixed Effects (within)			0.197***	0.237***						
PPML	0.193***	0.355***			0.404***	0.403***	T.D.	0.397***	T.D.	T.D.
Baier and Bergstrand (OLS)	0.360***	0.757***	0.222***	0.249***	0.624***	0.645***	0.699***	0.699***	0.309***	0.309***
IV: Hausman and Taylor	0.195***	0.269***			0.227***	0.264***	T.D.	T.D.	T.D.	T.D.
IV-Dynamics: RTA lags 3 and 4	0.318***	0.495***	0.381***	0.439***						
IV-Dynamics : Arellano-Bond (GMM)	0.142***	0.038								

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Elaborated by the author.

1.3.5 OECD status implications on the effects of RTAs

It is important to acknowledge that the RTA effect continues to be positive and significant when we discriminate between a proxy of developed and non-developed countries, consisting of the membership to the OECD. To be accepted as a member of the OECD, a country must fulfil an important number of conditions that are highly correlated with the fact of being a developed country. It has its own pitfalls, for example, Hong Kong and Singapore are usually considered as developed countries, but are not members of the OECD, and Mexico has many institutional problems despite being a member. There are many other examples.

In practice a definitive definition of what a developed country is remains a thorny issue, therefore the OECD criteria would be understood only as proxy for development status applied as a tool to make the following analysis possible. These results are presented in table 10, where columns (1) and (2) correspond to the OLS method, (3) and (4) to random effects, (5) and (6) to the fixed effect (within transformation) and (7) and (8) to PPML. Even columns include only developed countries by OECD membership criteria. Odd columns stand for only non-developed countries considering the same argument.

Table 10
Regression Results discriminated by OECD membership. 153 countries. 1980-2012

	OLS		Random Effects		Fixed Effects		PPML	
	OECD	Non-OECD	OECD	Non-OECD	OECD	Non-OECD	OECD	Non-OECD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	lnx_{ijt}	lnx_{ijt}	lnx_{ijt}	lnx_{ijt}	lnx_{ijt}	lnx_{ijt}	X_{ijt}	X_{ijt}
rta_{ijt}	0.516***	0.940***	0.337***	0.225***	0.333***	0.135***	0.651***	0.122***
	(0.024)	(0.020)	(0.042)	(0.038)	(0.042)	(0.040)	(0.033)	(0.033)
$gatt_{it}$		-0.141***		-0.051		-0.039		0.162***
		(0.022)		(0.036)		(0.036)		(0.047)
$gatt_{jt}$		0.059***		0.115***		0.122***		0.124***
		(0.021)		(0.034)		(0.034)		(0.045)
$lndist_{ijt}$	-1.086***	-1.593***	-1.246***	-1.693***			-0.786***	-1.002***
	(0.014)	(0.008)	(0.057)	(0.027)			(0.016)	(0.019)
$lnGDP_{it}$	0.876***	0.622***	0.856***	0.609***	0.855***	0.610***	0.785***	0.730***
	(0.035)	(0.021)	(0.052)	(0.034)	(0.052)	(0.034)	(0.046)	(0.039)
$lnGDP_{jt}$	0.851***	0.567***	0.821***	0.630***	0.821***	0.635***	0.734***	0.538***
	(0.035)	(0.018)	(0.052)	(0.028)	(0.052)	(0.028)	(0.041)	(0.038)
$lnpop_{it}$	-0.739***	-0.302***	-0.142	0.027	-0.122	0.062	-1.070***	0.224*
	(0.173)	(0.056)	(0.335)	(0.100)	(0.335)	(0.101)	(0.204)	(0.124)
$lnpop_{jt}$	-0.080	0.387***	0.318	0.378***	0.331	0.365***	-1.207***	-0.131
	(0.149)	(0.051)	(0.262)	(0.092)	(0.262)	(0.093)	(0.181)	(0.150)
$contig_{ijt}$	0.276***	0.788***	0.225**	1.214***			0.444***	0.374***
	(0.023)	(0.026)	(0.110)	(0.105)			(0.019)	(0.032)
$comlang_eth9_{ijt}$	0.356***	0.662***	0.425***	0.851***			0.154***	0.360***
	(0.022)	(0.015)	(0.097)	(0.050)			(0.023)	(0.032)
Observations	22,019	199,694	22,019	199,694	22,019	199,694	22,175	365,722
R2	0.906	0.599			0.745	0.195	0.946	0.919
R2_o			0.903	0.590	0.601	0.253		
Exporter Time-Invariant FE	YES	YES	YES	NO	NO	YES	YES	YES
Importer Time-Invariant FE	YES	YES	YES	NO	NO	YES	YES	YES
Country-pair Fixed Effects	NO	NO	NO	NO	YES	YES	NO	NO
Time-Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Elaborated by the author.

Under the PPML method, the RTA effect on bilateral trade is more important when only OECD countries are put into the equation; one explanation is that this can stem from the depth of the agreements signed, where we expect developed countries to commit to deeper agreements. The PPML specification for non-developed countries includes around a third

more observations than the others because it accounts for zero-valued flows. The more a nation is developed, the fewer zeros we expect. This could be part of the reason that the RTA coefficient for OLS, random and fixed effects appears to be less economically significant when only OECD countries are evaluated, as well as why the opposite can be said about non-OECD members.

Table 11

Regression Results discriminated by OECD membership as origin or destination. 153 countries. 1980-2012

	OLS		Random Effects		Fixed Effects		PPML	
	OECD. to Non OECD.	Non OECD. to OECD.	OECD. to Non OECD..	Non OECD. to OECD..	OECD. to Non OECD.	Non OECD. to OECD..	OECD. to Non OECD.	Non OECD. to OECD..
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	lnx_{ijt}	lnx_{ijt}	lnx_{ijt}	lnx_{ijt}	lnx_{ijt}	lnx_{ijt}	X_{ijt}	X_{ijt}
rta_{ijt}	0.242***	0.105***	0.212***	0.113***	0.206***	0.111***	0.237***	0.257***
	(0.030)	(0.018)	(0.046)	(0.030)	(0.046)	(0.031)	(0.039)	(0.026)
$gatt_{it}$	0.142***		0.146***		0.143***		0.269***	
	(0.028)		(0.045)		(0.046)		(0.054)	
$gatt_{jt}$		0.115***		0.125***		0.124***		0.233***
		(0.017)		(0.027)		(0.027)		(0.028)
$lndist_{ijt}$	-1.777***	-1.694***	-1.777***	-1.722***			-0.573***	-0.877***
	(0.018)	(0.013)	(0.068)	(0.050)			(0.025)	(0.018)
$lnGDP_{it}$	0.841***	0.633***	0.849***	0.632***	0.850***	0.632***	0.887***	0.453***
	(0.026)	(0.030)	(0.042)	(0.050)	(0.042)	(0.050)	(0.039)	(0.064)
$lnGDP_{jt}$	0.268***	0.752***	0.402***	0.762***	0.417***	0.760***	0.476***	0.797***
	(0.051)	(0.015)	(0.081)	(0.024)	(0.081)	(0.024)	(0.074)	(0.028)
$lnpop_{it}$	-1.010***	2.091***	-0.811***	2.047***	-0.783***	2.051***	-0.609***	0.722***
	(0.078)	(0.146)	(0.138)	(0.281)	(0.139)	(0.281)	(0.156)	(0.244)
$lnpop_{jt}$	3.077***	-0.451***	3.323***	-0.314***	3.357***	-0.294***	1.364***	-0.445***
	(0.217)	(0.041)	(0.400)	(0.078)	(0.401)	(0.079)	(0.361)	(0.053)
$contig_{ijt}$	1.205***	1.059***	1.084***	0.780***			1.252***	1.059***
	(0.069)	(0.057)	(0.263)	(0.224)			(0.061)	(0.050)
$comlang_eth9_{ijt}$	0.703***	0.782***	0.742***	0.799***			0.612***	0.493***
	(0.026)	(0.017)	(0.097)	(0.071)			(0.036)	(0.025)
Observations	83,184	92,728	83,184	92,728	83,184	92,728	98,780	99,109
R2	0.699	0.822			0.159	0.367	0.825	0.894
R2_o			0.696	0.820	0.214	0.409		
Exporter Time- Invariant FE	YES	YES	YES	YES	NO	NO	YES	YES
Importer Time- Invariant FE	YES	YES	YES	YES	NO	NO	YES	YES
Country-pair Fixed Effects	NO	NO	NO	NO	YES	YES	NO	NO
Time- FE	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Elaborated by the author.

In table 11 above, columns (1) and (2) correspond to the OLS method, (3) and (4) to random effects, (5) and (6) to the fixed effect (within transformation) and (7) and (8) to PPML. Now, even columns report only trade between non-OECD exporters and OECD importers. Odds columns present OECD countries exports to non-OECD countries.

The RTA estimates continue to be positive and significant when the export relationship between non-developed countries and those which are developed. The same is true for the trade flows that range from developed nations to those which are undeveloped. The GATT-WTO institutions also play a positive role in promoting trade between developed and undeveloped countries, and these estimates appear more stable, irrespective of which regression method is used, with respect to their capacity to foster trade between non-developed countries alone.

1.3.6 RTAs effects at the disaggregated level

The effect of particular RTAs computed by means of dummy variables for each scheme such as EU, NAFTA or MERCOSUR has been reviewed in (Magee, 2008) ; (Eicher and Henn, 2011) ; (Kohl; 2014) among others. A list of the RTAs that had entered into force until 2012 and were notified to the WTO is available in Appendix C.

Most of the preceding studies on the effects of particular RTAs are estimated by OLS techniques. This paper offers estimates based on PPML over a database across 153 countries and observations from 1980 to 2012. Besides covariates in Eq(8a), we control for RTA membership other than the RTA of interest, as well as for time-invariant country fixed effects.

As can be seen in table 7, most of the RTA estimates, 78 out of the 103, equivalent to 75.7% of the sample show a positive sign. These results point to a larger proportion of trade agreements that are successful in promoting trade than in (Kohl; 2014), who reported that only 44 out of 166 RTAs, equivalent to 26.5% of their sample, presenting a positive and significant effect.

The median RTA on this sample increases trade by 61.9%, ($e^{0.503} - 1$). Despite the dispersion, around 41.7% of RTA's estimates fall within one standard deviation of this median effect, and 95.1%, within two standard deviations.

Some straightforward outliers are the Gulf Council Countries GCC, USA-Australia and USA-Morocco agreements, which seem to be highly counterproductive to trade creation, while the

Table 12

PPML estimates for a group of 103 regional trade agreements from a 153 countries 1980-2012 data set

Agreement	Year	RTA coef.	Agreement	Year	RTA coef.
ASEAN free trade area	1992	0.180***	EC-Mexico	2000	-0.128**
ASEAN-Australia	2010	0.401***	EC-Morocco	2000	0.671***
ASEAN-India	2010	0.512***	ECOWAS	1993	1.179***
ASEAN-Korea	2010	0.823***	EC-South Africa	2000	0.614***
ASEAN-New Zealand	2010	0.412***	EC-Syria	1977	0.325***
Australia-New Zealand	1983	1.418***	EC-Tunisia	1998	0.933***
Australia-Singapore	2003	0.333***	EC-Turkey	1996	0.586***
Australia-Thailand	2005	0.855***	EFTA-Israel	1993	0.417***
CAFTA-DR	2006	1.193***	EFTA-Korea	2006	0.414***
CAN	1988	1.009***	EFTA-Peru	2012	0.228
Canada Colombia	2012	-0.544**	GCC	2003	-1.105***
Canada-EFTA	2009	0.327**	Group of Three	1995	0.563***
Canada-Peru	2009	1.322***	India-Japan	2011	-0.386***
CEFTA	2007	0.740**	India-Malaysia	2011	0.645***
Chile Colombia1	1994	0.802***	India-Singapore	2005	0.591***
Chile Colombia2	2009	1.033***	India-Sri Lanka	2001	1.399***
Chile-Australia	2009	-0.569***	Japan-ASEAN	2008	0.592***
Chile-China	2006	1.507***	Japan-Indonesia	2008	0.685***
Chile-Japan	2007	0.876***	Japan-Malaysia	2006	0.704***
Chile-Korea	2004	1.721***	Japan-Mexico	2005	-0.1
Chile-Peru1	1999	1.149***	Japan-Peru	2012	0.518
Chile-Peru2	2009	0.777***	Japan-Philippines	2008	0.374***
China-ASEAN	2005	-0.091**	Japan-Singapore	2002	0.238***
China-Hong Kong	2004	0.503***	Japan-Switzerland	2009	0.815***
China-New Zealand	2008	0.093	Japan-Thailand	2007	0.881***
China-Pakistan	2007	-0.197**	Japan-Vietnam	2009	0.662***
China-Peru	2010	1.355***	Korea, Republic of-India	2010	0.312***
China-Singapore	2009	-0.185***	Korea, Republic of-Singapore	2006	0.693***
CIS	1994	1.554***	Korea-Peru	2012	1.491***
COL (CAN) MERCOSUR	2005	0.082	MERCOSUR	1991	1.328***
Colombia Cuba	2002	-0.372**	MERCOSUR-India	2009	0.572***
Colombia EFTA	2011	0.461	Mercosur-Peru	2006	0.212*
Colombia Northern Triangle	2009	0.825***	NAFTA	1991	0.793***
COMESA	1994	1.465***	PAFTA	1998	-0.688***
EAEC	1997	2.778***	Russian Federation-Ukraine	1994	1.158***
EC Enlargement (10)	1958	0.373***	SAFTA	2006	0.376***
EC Enlargement (12)	1986	0.367***	Southern African Develop. Comm.	2000	1.938***
EC Enlargement (15)	1995	0.404***	Turkey-EFTA	1992	0.165*
EC Enlargement (25)	2004	0.400***	Ukraine-Belarus	2006	1.549***
EC Enlargement (27)	2007	0.508***	Ukraine-Kazakhstan	1998	1.936***
EC-Albania	2006	0.756***	Ukraine-Turkmenistan	1995	3.798***
EC-Algeria	2005	0.304***	US-Australia	2005	-0.741***
EC-Cameroon	2009	0.624***	US-Bahrain	2006	-0.024
EC-CARIFORUM	2008	-0.516***	US-Chile	2004	-0.281**
EC-Chile	2003	0.324***	US-Colombia	2012	0.383***
EC-Côte d'Ivoire	2009	0.361***	US-Israel	1985	1.101***
EC-Croatia	2002	0.565***	US-Jordan	2001	0.210***
EC-Efta	1973	0.304***	US-Morocco	2006	-0.704***
EC-Egypt	2004	0.264***	US-Oman	2009	-0.598***
EC-Israel	2000	0.121**	US-Peru	2009	-0.086
EC-Jordan	2002	-0.243***	US-Singapore	2004	-0.003
EC-Lebanon	2003	0.298***			

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Source: Elaborated by the author.

The largest positive effects are posted by Ukraine-Turkmenistan, the Eurasian Economic Community EAEC and the Ukraine-Kazakhstan agreement. The latest impressive results of these cases concern former Soviet Union countries and could be attributed to some kind of transition effect or measurement error that could bias their estimates upward.

United States agreements present mixed results, showing trade creation with Israel, Jordan and Colombia while agreements with Bahrein, Peru and Singapore are non-significant. Counterproductive effects seem to appear with Australia, Chile, Morocco and Oman.

On the other side of the Pacific Ocean, 75% of the RTAs signed by Japan create trade. The balance for EU agreements is even more encouraging. More than 90% of the RTAs signed by the EU are effective in promoting trade.

A final caveat: RTA coefficients at the disaggregated level should be read with caution. The scope and depth of the agreements change considerably from one RTA to the other.

In theory it could be expected that deeper agreements produce higher increases in cross-border flows than those which are shallow. Equally important is the enforceability of these arrangements, especially in the case of politically unstable developing countries.

1.3.7 RTAs trade creation or trade diversion

Viner (1950) warned about the possible drawbacks of trade regionalism, suggesting that a trade block should create trade in detriment of more productive third countries excluded from the agreement, in what he defined as trade diversion. Following Ghosh and Yamarik, (2004) and Eicher, Henn and Papageorgiou (2012) we use two sets of dummy variables to pick up RTA trade creation and trade diversion effects. The first, RTA_{ijt}, as before, implies that both trading partners are members of the same RTA, the second, $DivRTA_{it}$ indicates that only one country is present in a given bilateral trade flow, whereas exporter or importer is a member of this RTA, in a particular year.

Ghosh and Yamarik, (2004) define DivRTAit as a vector of variables which measures current membership of either country i or j in a RTA and thus captures the external effects of the

RTA on trade with countries outside the zone. The coefficient Υ_k for DivRTAit is interpreted as a measure of lower or higher than normal trade between nations in the trading bloc, and a country outside the bloc relative to a random pair of countries.

Hence, a negative sign for Υ_k indicates less trade with non-members and is interpreted as evidence of trade diversion. Correspondingly, a positive value for Υ_k in Eq(8b) implies that trade between a country within the bloc and countries outside the bloc is higher than trade with a random pair of countries, which is considered as the receptiveness of that region to imports from outside the region.

The variables defined above isolate the three distinct effects that RTAs may induce in bilateral trade flows. Thus, a positive coefficient on RTA_{ijt} picks up trade creation among RTA partners, while trade diversion implies a negative $DivRTA_{it}$ coefficient. Open bloc trade creation is defined as the opposite of trade diversion, featured by a positive $DivRTA_{it}$ coefficient.

In this section we select a group of 23 interesting RTAs to evaluate whether trade diversion is actually mitigating the impact of RTAs on trade. That seems to be the case for a third of the agreements. In 4 cases the intra-block trade creation effect is sufficiently strong to resist trade diversion as in CARICOM, the Group of 3, ECOWAS and NAFTA.

Nevertheless, the trade diversion effect outstrips the trade creation intra-block effect in ASEAN-Japan and adds to intra-block negative effects in Canada - Colombia and Chile - EU. For the larger proportion of analysed RTAs the extra-block effect reinforces the intra-block trade creation effects. See table 13.

Table 13

Trade Creation and Trade Diversion : PPML estimates for a group RTAs from a 153 countries 1980-2012 data set

Agreement	Intra-block effect	Extra-block effect	Net effect
	RTA_{ijt}	$DivRTA_{it}$	
Andean Community	0.829***	0.011	0.840
	(0.124)	(0.060)	
Association of Southeast Asian Nations ASEAN	0.242***	0.154***	0.396
	(0.057)	(0.028)	
ASEAN – Japan	0.210***	-0.301***	-0.091
	(0.066)	(0.032)	
Canada – Colombia	-0.477*	-0.152***	-0.629
	(0.249)	(0.059)	
Caribbean Community CARICOM	1.949***	-0.489***	1.460
	(0.222)	(0.115)	
Chile – Colombia	0.917***	0.156***	1.073
	(0.136)	(0.052)	
Chile - European Union	-0.160*	-0.142***	-0.302
	(0.083)	(0.027)	
Common Market for Eastern and Southern Africa COMESA	1.440***	0.021	1.461
	(0.142)	(0.050)	
Colombia – EFTA	0.221	0.000	0.221
	(0.493)	(0.077)	
Colombia-(Guatemala-El Salvador-Honduras)	0.765***	0.048	0.813
	(0.183)	(0.050)	
Colombia-Mexico-Venezuela (The Group of 3)	0.357**	-0.008	0.349
	(0.146)	(0.052)	
Colombia - United Estates	0.517***	0.057	0.574
	(0.104)	(0.066)	
Economic Community of West African States ECOWAS	0.977***	-0.088*	0.889
	(0.100)	(0.047)	
European Free Trade Association EFTA	0.563***	0.112***	0.675
	(0.071)	(0.032)	
European Union EU(27)	0.477***	0.062**	0.539
	(0.047)	(0.029)	
European Union – Israel	-0.008	-0.000	-0.008
	(0.082)	(0.052)	
European Union – Lebanon	0.123	-0.064	0.059
	(0.147)	(0.078)	
European Union - South Africa	0.776***	0.106**	0.882
	(0.102)	(0.052)	
European Union – Tunisia	0.851***	0.001	0.852
	(0.101)	(0.047)	
European Union – Turkey	0.511***	0.003	0.514
	(0.071)	(0.037)	
Southern Common Market MERCOSUR	1.370***	0.052	1.422
	(0.070)	(0.036)	
North American Free Trade Agreement NAFTA	0.440***	-0.189***	0.251
	(0.049)	(0.024)	
Peru - United States	-0.222	-0.101***	-0.323
	(0.151)	(0.035)	
Observations	588,262	588,262	
R-squared	0.904	0.904	
Time-invariant Exporter Fixed Effects	YES	YES	
Time-invariant Importer Fixed Effects	YES	YES	
Country-pair Fixed Effects	NO	NO	
Time Fixed Effects	YES	YES	

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Elaborated by the author.

1.4 Conclusion

This paper examines the effect of regional trade agreements RTAs on bilateral cross-border trade flows by means of a model estimated on the basis of a panel dataset for 153 countries, and observations from 1980 to 2012. Different econometric specifications and estimation methods are contrasted. Particular attention is given to Poisson Pseudo Maximum Likelihood (PPML), which is the method that best seems to contend with heteroscedasticity problems and bias from a high proportion of zero registered trade flows. (Head and Mayer, 2014)

A strong positive impact for RTA is consistently found on most specifications. Once multilateral resistance and other unobserved variable bias are controlled by the introduction of time-varying country fixed effects in a PPML regression, we find that RTAs increase bilateral trade flows by 48.7%, with respect to those trade flows with no agreements.

This result is important, not only because it confirms that efforts to close international trade deals are fruitful, but also because we find that the difference with the RTA estimation based on time-invariant country fixed effects, 48.6% is relatively small. This could mean that multilateral resistance and other unobserved variable bias could be overcome with the more parsimonious model that includes only time-invariant country fixed effects. This will give reassurance to results from applications that use this technique, given the computational restrictions for practical applications derived from time-varying country fixed effects models.

The economic effect of RTA (the size of the coefficient) seems to have been eroding during the last fifteen years after reaching their peak in the period 1995-1999.

Baier and Bergstrand's method to provide an average treatment effect for RTA that is purged of endogeneity and suggests a downward bias in PPML estimates in the cases where comparisons with PPML results are possible. Conversely, the Hausman and Taylor estimator that introduces instrumental variables to deal with endogeneity suggests an upward bias in the PPML RTA coefficient, yet it is still sizable and significant.

The effect of RTA continues to be positive and significant when we discriminate between OECD and non-OECD countries. Under the PPML method, the RTA effect on bilateral trade flows is more important among OECD members, a result that could reflect institutional or structural deficiencies in a developing country.

We found considerable variations in the estimates of RTAs at the disaggregated level. While most of these successfully increase trade, others seem to destroy it or are in no way significant. Enforceability, RTAs that are not implemented in practice and remain as only a written statement could explain these results. The fact that RTAs are heterogeneous in scope and depth would also be a plausible hypothesis.

Trade diversion effects were computed for a sample of RTAs. At large, trade creation effects tend to be stronger than trade diversion effects or even be reinforced by an open trade block expansion effect. Nevertheless, in certain cases trade diversion is found to outstrip trade creation effects, so the potentiality of RTA to improve well-being must not be given for granted.

GSP and WTO estimates are highly unstable across specifications and models. Their estimates from the PPML method that includes controls for time-invariant unobserved heterogeneity show non-significant effects of GSP on trade and positive, significant and economically important results for WTO membership.

Appendix 1A: List of Regional Trade Agreements and Entry into Force Year

Andean Community (CAN) 1993
ASEAN - Australia - New Zealand 2010
ASEAN - China 2005
ASEAN - India 2010
ASEAN - Japan 2009, Vietnam 2010
ASEAN - Korea, Republic 2010
ASEAN Free Trade Area (AFTA) 1992
Asia Pacific Trade Agreement (APTA)
Asia Pacific Trade Agreement (APTA) - Accession of China 2002
Australia - Chile 2009
Australia - New Zealand (ANZCERTA) 1983
Australia - Papua New Guinea (PATCRA) 1977
Brunei Darussalam - Japan 2008
Canada - Chile 1998
Canada - Colombia 2006
Canada - Costa Rica 2003
Canada - Israel 1997
Canada - Peru 2010
Caribbean Community and Common Market (CARICOM) 1973 Haiti 2003
Central American Common Market (CACM) 1980
Central European Free Trade Agreement (CEFTA) 2007
Chile - China 2007
Chile - Colombia 2009
Chile - Costa Rica y El Salvador(Chile - Central America) 2002
Chile - Guatemala (Chile - Central America) 2010
Chile - Honduras (Chile - Central America) 2009
Chile - India 2008
Chile - Japan 2008
Chile - Malaysia 2012
Chile - Mexico 2000
China - Costa Rica 2012
China - Hong Kong, China 2003
China - New Zealand 2009
China - Singapore 2009 (2005 ASEAN)
Colombia - Mexico 1995
Colombia - Northern Triangle (El Salvador, Guatemala, Honduras) 2010
Common Economic Zone (CEZ)
Common Market for Eastern and Southern Africa (COMESA) 1995, Egy 1999, Lib 2005
Commonwealth of Independent States (CIS)
Costa Rica - Mexico 1995
Dominican Republic - Central America 2002
Dominican Republic - Central America - United States Free Trade Agreement (CAFTA-DR) 2006
East African Community (EAC) 2001, Kenya, Tanzania, and Uganda
East African Community (EAC) - Accession of Burundi and Rwanda 2008
EC (12) Enlargement
EC (15) Ennlargement
EC (25) Enlargement
EC (27) Enlargement
EC Treaty and its enlargements to EU_28 (1958, 1977_9, 1981_10, 1986_12, 1995_15, 2004_25, 2007_27)
Economic and Monetary Community of Central Africa (CEMAC) 1999
Economic Community of West African States (ECOWAS) 1993
Economic Cooperation Organization 1992 (ECO)
EFTA - Albania 2005
EFTA - Canada 2010
EFTA - Chile 2004
EFTA - Colombia 2012
EFTA - Croatia 2002
EFTA - Egypt 2008
EFTA - Hong Kong, China 2012
EFTA - Israel 1993
EFTA - Jordan 2003
EFTA - Korea, Republic of 2007
EFTA - Lebanon 2007
EFTA - Mexico 2002
EFTA - Morocco 2000
EFTA - Peru 2012
EFTA - SACU 2008
EFTA - Singapore 2003
EFTA - Tunisia 2005
EFTA - Turkey 1992
EFTA - Ukraine 2012
EFTA accession of Iceland 1970
Egypt - Turkey 2007
EU - Albania 2007
EU - Algeria 2006
EU - Cameroon 2010
EU - CARIFORUM States EPA 2009
EU - Central America 2013
EU - Chile 2003
EU - Colombia and Peru 2013
EU - Côte d'Ivoire 2009
EU - Croatia 2002
EU - Eastern and Southern Africa States Interim EPA 2012
EU - Egypt 2004
EU - Iceland 1973
EU - Israel 2000
EU - Jordan 2002
EU - Korea, Republic of 2012
EU - Lebanon 2003
EU - Mexico 2000
EU - Morocco 2000
EU - Norway 1973
EU - Papua New Guinea 2010 / Fiji (pending)
EU - South Africa 2000
EU - Switzerland - Liechtenstein 1973
EU - Syria 1977
EU - Tunisia 1998
EU - Turkey 1996
Eurasian Economic Community (EAEC) 1998
European Free Trade Association (EFTA) 1960
Georgia - Azerbaijan 1997
Georgia - Kazakhstan 2000
Georgia - Russian Federation 1994
Georgia - Turkmenistan 2000
Georgia - Ukraine
Gulf Cooperation Council (GCC) 2003
Hong Kong, China - New Zealand 2005
India - Japan 2012
India - Malaysia 2012
India - Nepal 2010
India - Singapore 2006
India - Sri Lanka 2002
Israel - Mexico 2001
Japan - Indonesia 2009
Japan - Malaysia 2007
Japan - Mexico 2005
Japan - Peru 2012
Japan - Philippines 2009
Japan - Singapore 2003
Japan - Switzerland 2010
Japan - Thailand 2008
Japan - Viet Nam 2010
Jordan - Singapore 2006
Korea, Republic of - Chile 2004
Korea, Republic of - India 2010
Korea, Republic of - Singapore 2006
Korea, Republic of - US 2012
Kyrgyz Republic - Kazakhstan 1996
Kyrgyz Republic - Moldova 1997
Kyrgyz Republic - Russian Federation
Kyrgyz Republic - Ukraine 1998
Kyrgyz Republic - Uzbekistan 1998
Latin American Integration Association (LAIA)
Melanesian Spearhead Group (MSG) Fiji y PNG 1994
MERCOSUR - India 2010
Mexico - Guatemala, El Salvador, Honduras (Mexico - Northern Triangle) 2001
Mexico - Nicaragua 1999
New Zealand - Malaysia 2005
New Zealand - Singapore 2001
North American Free Trade Agreement (NAFTA) 1994, Canada-USA 1989
Pacific Island Countries Trade Agreement (PICTA) 2003
Pakistan - China 2008
Pakistan - Malaysia 2008
Pakistan - Sri Lanka 2005
Panama - Chile 2008
Panama - Costa Rica (Panama - Central America) 2008
Panama - El Salvador (Panama - Central America) 2003
Panama - Honduras (Panama - Central America) 2009
Panama - Nicaragua (Panama - Central America) 2010
Panama - Peru 2012
Panama - Singapore 2007
Pan-Arab Free Trade Area (PAFTA) 1998, Yem, Argelia 2009
Peru - Chile 2009
Peru - China 2010
Peru - Korea, Republic of 2012
Peru - Mexico 2012
Peru - Singapore 2010
Russian Federation - Azerbaijan 1993
Russian Federation - Belarus 1993
Russian Federation - Belarus - Kazakhstan 1993 y 1995
Russian Federation - Kazakhstan 1993
Russian Federation - Republic of Moldova 1993
Russian Federation - Tajikistan 1993
Russian Federation - Turkmenistan 1993
Russian Federation - Uzbekistan 1993
Singapore - Australia 2004
South Asian Free Trade Agreement (SAFTA) 2006
South Asian Preferential Trade Arrangement (SAPTA) 1996
South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA)
Southern African Customs Union (SACU)
Southern African Development Community (SADC) 2001
MERCOSUR - Chile (ACE 35) 1997
CAN-MERCOSUR. ACE-36 (1997), ACE-58 (2006), ACE-Nº 59 (2005)
Southern Common Market (MERCOSUR) 1992 Ven (2012)
Thailand - Australia 2005
Thailand - New Zealand 2006
Trans-Pacific Strategic Economic Partnership 2006
Turkey - Albania 2008
Turkey - Chile 2005
Turkey - Croatia 2004
Turkey - Georgia 2009
Turkey - Israel 1997
Turkey - Jordan 2005
Turkey - Morocco 2006
Turkey - Syria 2007
Turkey - Tunisia 2006
Ukraine - Azerbaijan 1997
Ukraine - Belarus 2007
Ukraine - Kazakhstan 1999
Ukraine - Moldova 2005
Ukraine - Russian Federation 1994
Ukraine - Tajikistan 2003
Ukraine - Uzbekistan 1996
Ukraine -Turkmenistan
US - Australia 2005
US - Bahrain 2007
US - Chile 2004
US - Colombia 2012
US - Israel 1986
US - Jordan 2002
US - Morocco 2006
US - Oman 2009
US - Panama 2012
US - Peru 2009
US - Singapore 2004
West African Economic and Monetary Union (WAEMU) 2000

Source: WTO. RTA database. 2013. Marzo 5 de 2013: http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx

Appendix 1B:

List of Countries in the Gravity Model Data Set

Albania	Djibouti	Korea, South	Russia
Algeria	Dominican Republic	Kuwait	Rwanda
Angola	Ecuador	Kyrgyzstan	Samoa
Argentina	Egypt	Latvia	Saudi Arabia
Australia	El Salvador	Lebanon	Senegal
Austria	Equatorial Guinea	Liberia	Sierra Leone
Azerbaijan	Estonia	Libya	Singapore
Bahrain	Ethiopia	Lithuania	Slovakia
Bangladesh	Fiji	Luxembourg	Slovenia
Barbados	Finland	Madagascar	South Africa
Belarus	France	Malawi	Spain
Belgium	Gabon	Malaysia	Sri Lanka
Belize	Gambia, The	Mali	Sweden
Benin	Georgia	Malta	Switzerland
Bermuda	Germany	Mauritania	Syria
Bolivia	Ghana	Mauritius	Tajikistan
Brazil	Greece	Mexico	Tanzania
Brunei	Grenada	Moldova	Thailand
Bulgaria	Guatemala	Mongolia	Togo
Burkina Faso	Guinea	Morocco	Tonga
Burundi	Guinea-Bissau	Mozambique	Trinidad and Tobago
Cambodia	Guyana	Nepal	Tunisia
Cameroon	Haiti	Netherlands	Turkey
Canada	Honduras	New Zealand	Turkmenistan
Cape Verde	Hong Kong	Nicaragua	Uganda
Central African Republic	Hungary	Niger	Ukraine
Chad	Iceland	Nigeria	United Arab Emirates
Chile	India	Norway	United Kingdom
China	Indonesia	Oman	United States
Colombia	Iran	Pakistan	Uruguay
Congo, Deomocratic	Iraq	Panama	Uzbekistan
Congo, Republic of the	Ireland	Papua New Guinea	Venezuela
Costa Rica	Israel	Paraguay	Vietnam
Cote d'Ivoire	Italy	Peru	Yemen
Croatia	Jamaica	Philippines	Zambia
Cuba	Japan	Poland	Zimbabwe
Cyprus	Jordan	Portugal	
Czech Republic	Kazakhstan	Qatar	
Denmark	Kenya	Romania	

Appendix 1C: List of Variables

- X_{ijt} : value of the fob merchandise exports from country i to country j in current dollars
- lnx_{ijt} : natural logarithm for usd fob exports values from country i to country j.
- $lnGDP_{it}$, $lnGDP_{jt}$: natural logarithm for usd current gdp from countries i and j.
- $lnpop_{it}$, $lnpop_{jt}$: natural logarithm for the population of countries i and j.
- $lnarea_{it}$ and $lnarea_{jt}$: natural logarithm for surface in squaqre km from country i and j
- $lndist_{ijt}$: natural logarithm for weighted distance between I and j
- isl_{it} and isl_{jt}: 1 if country i and country j respectively is an island or can be understood as an island economy
- $landlocked_{it}$ and $landlocked_{jt}$: 1 if country i and country respectively has not a direct access to the sea.
- $gatt_{it}$, $gatt_{jt}$: 1 if countries i/j. belong to the GATT/WTO
- RTA_{ijt} : 1 If both countries share a free trade agreement.
- $gspben_{it}$: 1 if country j is a beneficiary of the generalized system of preference from country i.
- $gspprovider_{it}$: 1 if country i is a donor of the generalized system of preference to country j.
- $oecd_{it}$, $oecd_{jt}$: 1 if the countries i/j. belong to the OECD
- $urpart_{it}$ and $urpart_{jt}$: the percentage of urban population in country i and j
- contig_{ijt}: 1 if there is a common land frontier between i and j
- $comlang_eth9_{ijt}$: 1 if at least 9% of the pair population share the same language
- $col45_{ijt}$: 1 if both countries were under a colonial relationship before 1945.
- $\boldsymbol{Z_{ijt}}$ **:** Vector of dyadic variables
- $\boldsymbol{S_{it}}$ **:** Vector of nomadic variables concerning the exporter country
- $\boldsymbol{M_{jt}}$ **:** Vector of nomadic variables concerning the importer country
- φ_g : Vector of coefficients related to the vector of dyadic variables
- ψ_h : Vector of coefficients related nomadic variables concerning the exporter country
- ϕ_h : Vector of coefficients related nomadic variables concerning the importer country
- α_t : fixed effect for years
- α_{ij} : county-pair fixed effects or individual fixed effects
- α_i and α_j : time-invariant fixed effect for exporter and importer countries, respectively. Also denoted tivfe.
- α_{it} and α_{jt} : time-varying fixed effect for exporter and importer countries, respectively. Also denoted tvfe.
- $\mathcal{E}_{ijt}$ *or* U_{ijt} : idiosyncratic error terms.

Appendix 1D: Variables, unity of measure and their original source

Bilateral Exports fob values in current dollars. (X_{ijt} ; lnx_{ijt}): International Monetary Fund (IMF), Direction of Trade Statistics Database DOTS (2013).

- Current GDP in dollars, population in number of habitants and urban participation in percentages ($lnGDP_{it}$; $lnGDP_{jt}$; $lnpop_{it}$; $lnpop_{jt}$; $urpart_{it}$; $urpart_{jt}$): World Development Indicators (WDI) database, World Bank, (2013).

- Area in square meters, island and landlocked status ($lnarea_i$; $lnarea_j$; isl_{it} ; isl_{jt} ; $landlocked_{it}$; $landlocked_{jt}$) constructed by the author based on the World Factbook from the Central Intelligence Agency of the United States of America (CIA, 2013)

- Weighted distance in Km, Common land border and Colonial Links ($lndist_{ijt}$; $contig_{ijt}$; $comlang_eth9_{ijt}$; $col45_{ijt}$) : CEPII (2013): Head, K., Mayer, T. & Ries, J. (2010), Gravity dataset.

- Regional Trade Agreements (rta_{ijt}): constructed by the author, based on the Regional Trade Agreements Information System (RTA-IS), World Trade Organization WTO (2013). Also de Sousa, J. (2012), "The currency union effect on trade is decreasing over time", Economics Letters, 117(3), 917-920. http://jdesousa.univ.free.fr/data.htm

- Generalized System of Preferences GSP ($gspben_{it}$; $gspprovider_{it}$): constructed by the author, based on the Database on Preferential Trade Arrangements of the World Trade Organization WTO (2013). CEPII: Head, K., Mayer, T. & Ries, J. (2010), Gravity dataset, obs. Till 2006.
  Rose, A. (2005) data set on The Multilateral (GATT/WTO) System and Trade obs. Till 1999

- GATT membership ($gatt_{it}$; $gatt_{jt}$): constructed by the author based on the World Trade Organization WTO information (2013).

- OECD membership ($oecd_{it}$; $oecd_{jt}$) : constructed by the author based on information from the Organisation de Coopération et de Développement Economiques OECD (2013).

Appendix 1E: Main gravitational relationships correlations

A positive relationship between bilateral trade flows and the size of the market measured by its combined GDP as well as the negative relationship between bilateral trade flows and distance are at the heart of the gravity model. Figure 4 shows the positive relationship between bilateral exports and Gross Domestic Product (GDP). On the y-axis, the natural logarithm of the bilateral exports is displayed and in the x-axis we present the product of the natural logarithms of the GDPs from country i and j, or combined GDP. Figure 5 depicts the relationship between the logarithms of bilateral exports and the log of distance. As theory predict a linear negative trend fits the data.

Figure 4 Scatter plot and line of best fit for Exports and GDPs in 2012

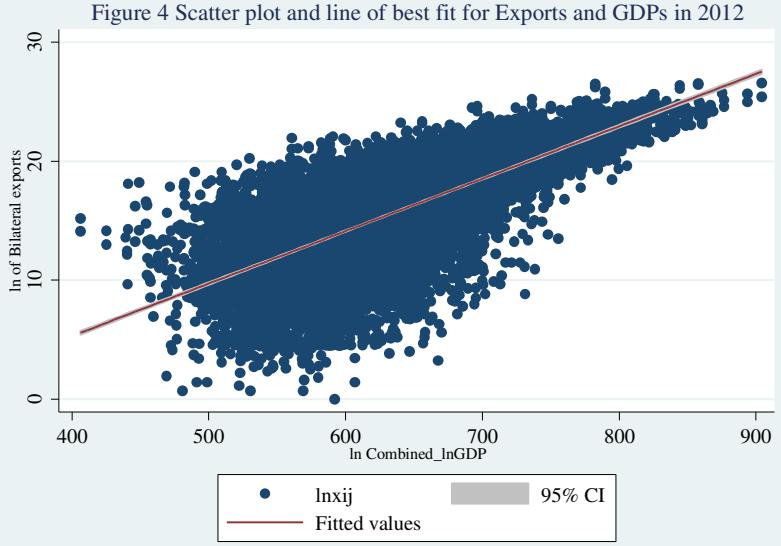
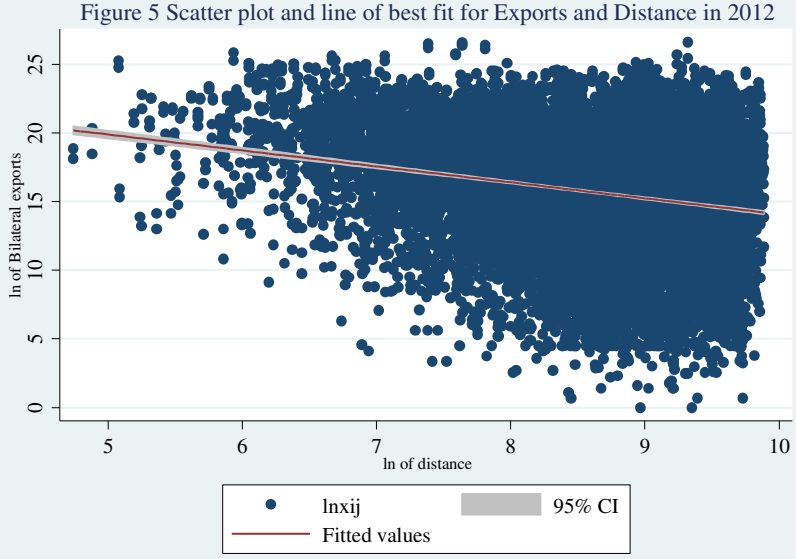


Figure 5 Scatter plot and line of best fit for Exports and Distance in 2012



Appendix 1F : Other Instrumental Variables Specifications

Instrumental Variables Random Effects and Fixed Effects Regressions on 153 countries from 1980 to 2012

	Instruments for rta_{ijt} : rta_{ijt-3} and rta_{ijt-4}			
	(1)	(2)	(3)	(4)
	lnxij	lnxij	lnxij	lnxij
rta_{ijt}	0.318***	0.495***	0.381***	0.439***
	(0.021)	(0.021)	(0.022)	(0.022)
$lnGDP_{it}$	0.567***	0.838***	0.522***	0.660***
	(0.007)	(0.008)	(0.008)	(0.010)
$lnGDP_{jt}$	0.437***	0.675***	0.549***	0.674***
	(0.007)	(0.008)	(0.008)	(0.009)
$lnpop_{it}$	0.508***	0.481***	-0.014	0.196***
	(0.013)	(0.013)	(0.027)	(0.029)
$lnpop_{jt}$	0.408***	0.415***	0.242***	0.477***
	(0.013)	(0.013)	(0.027)	(0.029)
$ocde_{it}$	0.507***	0.321***	0.044*	0.071***
	(0.021)	(0.021)	(0.024)	(0.024)
$ocde_{jt}$	0.373***	0.180***	0.012	0.044*
	(0.022)	(0.022)	(0.025)	(0.025)
$gatt_{it}$	-0.052***	0.027**	0.033**	0.021
	(0.013)	(0.013)	(0.013)	(0.013)
$gatt_{jt}$	0.016	0.096***	0.085***	0.074***
	(0.012)	(0.012)	(0.013)	(0.013)
$urpart_{it}$	0.020***	0.020***	0.012***	0.020***
	(0.001)	(0.001)	(0.001)	(0.001)
$urpart_{jt}$	0.009***	0.011***	0.013***	0.021***
	(0.001)	(0.001)	(0.001)	(0.001)
$gspben_{it}$	-0.045**	-0.052***	-0.054***	-0.059***
	(0.019)	(0.019)	(0.020)	(0.020)
$gspprovider_{it}$	0.269***	0.255***	0.208***	0.198***
	(0.017)	(0.017)	(0.018)	(0.018)
$lndist_{ijt}$	-1.389***	-1.331***		
	(0.020)	(0.019)		
$contig_{ijt}$	1.305***	1.330***		
	(0.098)	(0.091)		
$comlang_{ijt}$	0.676***	0.779***		
	(0.040)	(0.037)		
$col45_{ijt}$	2.168***	1.697***		
	(0.147)	(0.137)		
isl_{it}	0.228***	0.149***		
	(0.041)	(0.039)		
isl_{jt}	0.159***	0.092**		
	(0.042)	(0.039)		
$landlocked_{it}$	-0.566***	-0.235***		
	(0.038)	(0.036)		
$landlocked_{jt}$	-1.010***	-0.684***		
	(0.038)	(0.036)		
$lnarea_{it}$	-0.046***	-0.140***		
	(0.010)	(0.009)		
$lnarea_{jt}$	-0.053***	-0.153***		
	(0.010)	(0.009)		
Constant	-13.612***	-24.589***	-16.387***	-31.405***
	(0.226)	(0.263)	(0.473)	(0.716)
Observations	358,540	358,540	358,540	358,540
Time-invariant exporter fixed effect	NO	NO	NO	NO
Time-invariant importer fixed effect	NO	NO	NO	NO
Country-pair fixed effects	NO	NO	YES	YES
Time fixed effects	NO	YES	NO	YES

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Elaborated by the author.

Chapter 2

Deep Integration: The Heterogeneity of Free Trade Agreements and their impact on Bilateral Trade[2]

2.1 Introduction

Substantial progress has been made to resolve the following question: do regional trade agreements (RTA) increase trade flows? see (Rose, 2004), (Baier & Bergstrand, 2007), (Martínez-Zarzoso et al., 2009)) Nevertheless, estimates of RTAs have been frequently obtained while neglecting thorny issues such the heterogeneity of free trade agreements, and the concept of deep integration. A survey on the subject is provided by Kohl (2014).

One question poses renewed interest: are all free trade agreements comparable? This paper seeks to gain an insight into the nature of free trade agreements, their design and contents, to shed light on the implications of deep integration on bilateral trade flows.

Although all free trade agreements share an inherent intention to liberalize and regulate international trade, they also present outstanding differences: they vary in the number of signatories, their economic size and the distance between them, as well as in the level of development among partners, and their implementation periods.

No less important, they also vary in their depth, i.e. the number and nature of provisions included in the agreement. Beyond the traditional provisions on tariffs and rules of origin, the agreements often go deeper into issues that are subject to agreements administered by the WTO (e.g. intellectual property rights or sanitary and phytosanitary rules) or outside the

[2] A first draft of this chapter has been published as DIAL working paper N°2014-25, Jaime Rafael Ahcar and Jean-Marc Siroën, *Deep integration: free trade agreements heterogeneity and its impact on bilateral trade*, 31 pages. http://www.dial.ird.fr/publications/documents-de-travail-working-papers

WTO field, such as competition or labour standards. Non-tariff barriers could be the main explanation behind a domestic market bias, see Wei (1996), and they can take many forms, as in the case of the EU labelling regulation concerning imports of genetically modified organism. Isaac and Kerr (2003); Guillochon and Kawecki (2009).

Introducing the effect of a RTA in the gravity model by the means of a dummy variable, as is common practice, is equivalent to assuming that we give the same treatment dose to any pair of countries, whatever the scope of the trade agreement.

The subject of Regional Trade Agreements' (RTA) heterogeneity has not been sufficiently explored in current literature. A better understanding of this topic should lead us to recognize its importance, evaluate its implications, and redefine our interpretation of the RTA coefficient and the limits of trade liberalization.

Finding a way to measure this heterogeneity, and being able to associate it with a scale of the depth for the agreements themselves, allows us to set up some indicators that would clarify the impact of this heterogeneity on bilateral trade flows.

This research finds that a 10% increase on a measure of the depth of the integration increases bilateral international trade flows by around 4.0%.

This paper improves on previous studies (Shahid 2011; Orefice & Rocha 2013; Kohl et al 2013; Dür et al 2014)), thanks to the use of MCA indicators, which is a Principal Components Analysis PCA related method that is better suited for qualitative variables applications (Booysen et al, 2008). We also provide a clear visualization of the impact of trade deepening on bilateral export by treating additive indicators as factor variables with regrouped ranges.

After this introduction, section 2 provides a review of the most important contributions of literature on the subject of deep integration, section 3 presents our data set resources and methodological approach, and we introduce our econometric model and the four main specifications we employ to estimate the impact of the depth of the agreements on bilateral trade flows. Section 4 displays results; section 5 presents a series of robustness checks, and finally, section 6 offers our conclusion.

2.2 Literature review

Since they are largely shared by academics and international trade researchers, we follow the definitions suggested by the WTO. On the one hand (WTO, 2014) defines Regional Trade Agreements (RTAs) as "reciprocal trade agreements between two or more partners". They contain free trade agreements and customs unions, together with more advanced schemes like the EU single market. On the other, "Preferential trade arrangements (PTAs) are non-reciprocal trade agreements. They include Generalized System of Preferences GSP schemes, as well as other schemes granted a waiver by the General Council". Throughout this paper we will work basically with RTAs, referred as free trade agreements (FTAs).

RTAs not only pursue market access, but also seek broader international trade regulation which does not automatically mean creating more trade.

For example, the RTA between the European Union (EU), Colombia and Peru (OJEU 354, 2012) states a commitment to protect intellectual property rights (IPR). It also includes a provision to engage in disarmament and non-proliferation of weapons of mass destruction. In both cases, the main objective of these provisions is first to encourage innovation, and second to maintain peace; not directly the creation of trade.

In the IPR case, a nation that subscribes to this commitment might undergo a reduction in its non-patented trade, not necessarily offset by a rise in trade of patented goods if these are essential, non-substitutable goods that present low price elasticity.

In the second case, a country that commits to non-proliferation of weapons of mass destruction would abstain from exporting or importing minerals such as uranium or plutonium, or industrial goods such as nuclear reactors. In order to estimate the impact of the depth of the agreements, (Magee, 2008) presented a classification including preferential agreement (PAs), free trade agreements (FTAs), customs unions (CUs) and common markets (CMs). Following a similar classification, Vicard (2009) found that "once self-selection into agreement is controlled, their trade creation effect does not statistically differ according to the depth of the RTA, so creating a FTA, a CU or a CM had a comparable impact on trade among members.

However, by introducing terms of interaction among RTA and some country characteristics, Magee (2008), and Vicard (2011), find that some trade agreements are more effective than others. In fact, those signed by large, similar and neighbouring countries tend to perform better in term of trade creation than smaller, more distant and dissimilar ones. They estimate different RTAs effects for CUs, FTA, and PAs in what could be seen as a measure of their depth.

Although, not using exactly the same trade integration categories of previous studies, (Baier, Bergstrand and Feng, 2014) provided evidence of the differential partial effect of various levels of Economic Integration Agreements EIAs on the intensive and extensive margin of trade.

These approaches are not completely focused on the dose, design or content of the agreements, but on the intrinsic and observable characteristics of the countries. At the same time, they rely on a (Balassa, 1961) like representation of economic integration levels that is no longer suitable with the degree of complexity introduced by recent generations of RTAs.

RTAs may typically include the following provisions: market access for goods (including tariffs and non-tariff barriers), services, intellectual property rights, "Singapore issues" (investment, government procurement, trade facilitation and competition), labour standards, environment and food standards issues. (Khor, 2008).

To quantify the implications of a deeper RTA Hoekman and Konan (2001) performed simulations based on a general equilibrium model for the EU-Egypt RTA and found a welfare increasing effect from potentially deeper agreements. This effect must not be neither generalized nor taken for granted, because in exchange for bigger market access, developing countries could be abandoning valuable industrial policy tools and then hampering their upward mobility in the international configuration of market specialization. Harrison & Rodríguez-Clare (2010); Shadlen (2005), Rodrik et al (2004).

(Bourgeois, Dawar & Evenett, 2007) carried out a qualitative legal analysis of the contents of 27 RTAs. They compare and describe the discrepancies between these agreements by analysing five provisions (labour market, competition policy, government procurement, environmental laws and non-tariff barriers). Another qualitative study analysing ASEAN's

external PTAs is provided by (Kleimann, 2014). It concludes that bilateral PTAs between ASEAN members and the same external partners result in deeper commitments.

Much of the current evolution on the subject of deep integration is owed to (Horn et al, 2010) who codified provisions for EU and United Statas RTAs and introduced non-traditional WTO-X provisions in the analysis. Their work also served as a model for the construction of the 100 free trade agreements database analysing provision for the (World Trade Report, 2011). They also explored legal enforcement effects by identifying the nuances of language in RTAs texts. In the paper we opt to avoid this kind of subjective judgment, even at the cost of assuming that all RTAs' provisions are equally enforceable.

Based on data from the research division of the WTO for the (World Trade Report, 2011), (Shahid 2011; Orefice & Rocha 2013; Kohl 2013) moved forward on taking up the content of the agreements and implementing empirical analysis. Shahid (2011) concludes that the nature of RTAs matters, while the magnitude and the direction of the relationship remain unclear as deeper agreements can be exposed to diminishing returns.

Results from (Orefice & Rocha, 2013) using Principal Component Analysis PCA and additive indicators find that on average, deep agreements increase trade in production networks between member countries by almost 12 %. Kohl (2014) finds a positive correlation between the number of institutional quality provisions contained in RTAs and their average treatment effect.

Mixed results were found in (Kohl et al, 2013) where RTAs heterogeneity influenced positively or negatively on bilateral trade depending on the provisions scope. Traditional WTO provisions presented a positive effect and the opposite was found for non-traditional clauses.

Finally, (Dür et al, 2014) construct their own enlarged database for 587 FTAs of which 356 are listed by the WTO. The authors also introduced latent trade analysis to compute a distilled indicator for the depth of the agreements. Their results also show a significant and positive relationship between deeper agreements and bilateral trade flows.

2.3 Data and Methodology

One of the main hurdles deep integration literature has faced is related to the lack of publicly available data sets documenting the contents of a reasonably large sample of RTAs.

This problem has recently been attenuated by the appearance of two independent projects that codify RTAs by the different provisions they contain: first, WTO (2011) research division for the World Trade Report, and second, Design of Trade Agreements DESTA-WTI (2014). We resort to these two data sets to account for the presence of a provision in an RTA, an invaluable input needed to produce credible deep integration indices.

Following the approach of (Horn *et al*., 2010), the first data set creates two main categories: WTO+ and WTO-X. The first of these registers provisions which are under the competence of the WTO agreements (Table 1), and the second (Table 2), codifies provisions for issues outside the current competences of the WTO but in some way negotiated in RTAs worldwide as they are related to trade. Because of a lack of variability or relevance, we do not include some of the areas initially proposed by Horn et al (2010).

1Table 1

WTO+ Policy Areas Negotiated in RTAs
Anti-dumping
Countervailing Measures
GATS General Agreement on Trade in Services
Public Procurement
Sanitary and Phytosanitary Measures
State Aid (Subventions)
State Trading Enterprises
Technical Barriers to Trade
Trade Related Aspects of Intellectual Property
TRIMs Trade-Related Investment Measures

Source: Authors' based on Horn et al. (2010)

It is worth noting that TRIPs and IPR are closely related, as are TRIMs and investment measures, at the same time being negotiated within and outside the scope of WTO. When we find these provisions present in RTAs, codified under the category WTO-X, we must assume that these agreements have gone further than what WTO commonly envisions.

Another difficult case arises with the agriculture provision in WTO-X, because much of Table 1 provisions are also applied to agricultural issues. To deal with these cases we compute indicators with and without these provisions. When a restrained dimension that

excludes agriculture, IPR and investment appears in the analysis, we would mark that variable with an *r* after their name.

Table 2

WTO-X Provisions Negotiated in RTAs	
Agriculture	Innovation policies
Anti-corruption	Investment measures
Approximation of	Intellectual Property Rights
Audiovisual	Labour market regulation
Competition policy	Mining
Consumer protection	Money laundering
Cultural cooperation	Movement of capital
Data protection	Nuclear safety
Economic policy	Political dialogue
Education and training	Public administration
Energy	Regional cooperation
Environmental laws	Research and technology
Financial assistance	Small and Medium
Health	Social matters
Human rights	Statistics
Illegal immigration	Taxation
Illicit drugs	Terrorism
Industrial cooperation	Visa and asylum
Information society	

Source: Authors' based on Horn *et al.* (2010)

The WTO (2011) data set is exploited by (Orefice and Rocha, 2013). Their regressions account for 66 RTA and 200 countries from 1980–2007. It is also explored by (Shahid, 2011) who works with 97 RTAs and 132 countries for the 1994-2010 period. We build on the WTO (2011) including in our calculations 103 RTAs from 1980-2012, and our gravity model counts 153 countries.

Differences in country samples and periods of analysis explain divergences in the RTAs considered in this paper with respect to previous literature. We coded and included new agreements for Colombia and Peru[3] that were not available in the original WTO (2011) database to offset by the loss in RTAs that were subscribed by countries like the Faroe Islands, Montenegro or San Marino which are absent from our gravity model sample of countries. See Appendices E and F.

[3] The following are the RTAs we coded based on Horn et al (2010) : Canada-Colombia, Canada-Peru, Central America-Colombia, Chile-Colombia, Chile-Peru, Colombia-Cuba, Colombia-EFTA, Colombia-Mercosur, Colombia-USA, EFTA-Peru, Group of 3, Japan-Peru, Peru-Mercosur, Peru-Republic of Korea and Peru-USA.

We consider that free trade agreements are heterogeneous, and vary according to the number and the combination of provisions they include. This variability can be understood as a proxy of the depth of the integration.

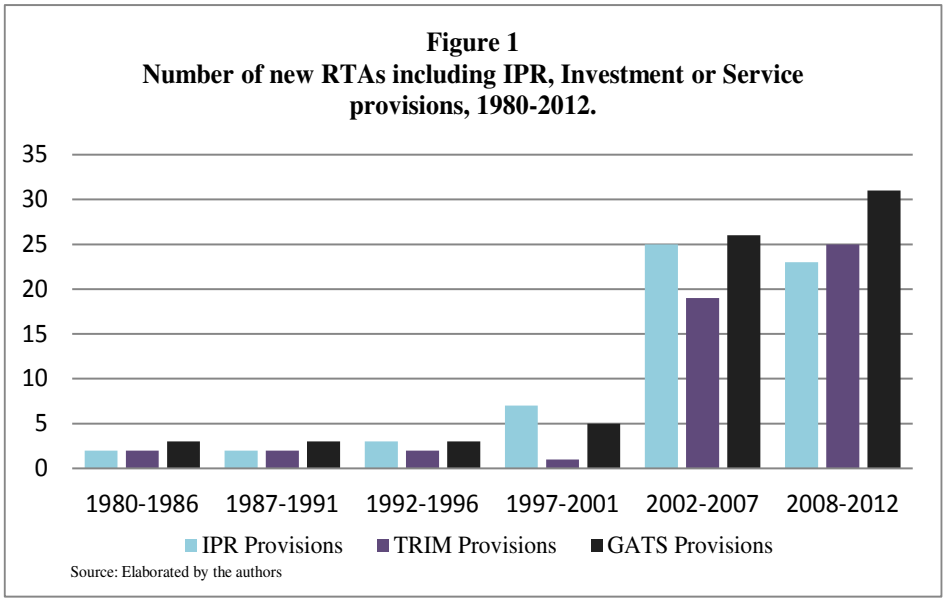
We introduce our depth indicator into our gravity model data set for 153 countries, amounting to 613.030 bilateral trade flows from 1980 to 2012. We use an unbalanced panel data set, due mainly to the disappearance and appearance of countries during this period. For example, the dissolution of the Soviet Union in 1991 and the break-up of the former Yugoslavia during the 90s gave birth to a group of new countries for which international trade statistics are only available after their creation. Details of the sources for this data set are available in Appendix A and a table displaying the countries included can be found in Appendix D.

To measure the impact of deep integration on trade we would capture most of the variability of the provisions in just one indicator.

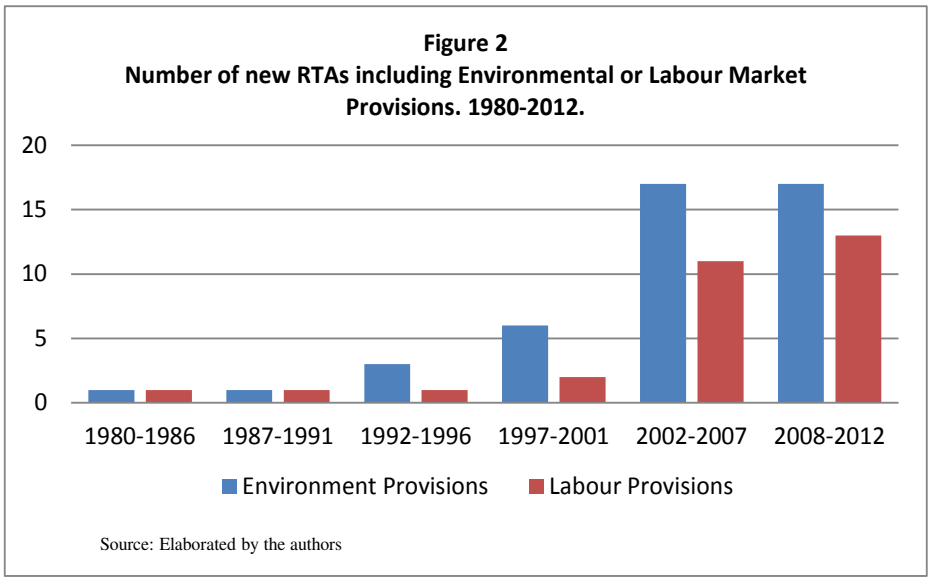
The main approach that we follow is given by (Shahid, 2011), (Orifice & Rocha, 2013) and (Dür et al., 2014). This literature put forward two different kinds of indicators in an attempt to capture deep integration from a set of related dummy variables accounting for the appearance of certain provisions that characterize RTAs texts. These indicators are first, additive indicators and second, distilled indicators extracted from PCA related methodologies. We also contribute to a better visualisation of the implication of these indices by presenting the additive indices as factor variables.

Figure 1 shows the evolution of the appearance of IPR, TRIM and GATSs provisions on new RTAs. On the same vein, Figure 2 presents the evolution of environmental and labour market provisions based on our 103 RTA sample classification of provisions.

The appearance of provisions dealing with investments and services topics under the traditional scope of the WTO+ shows an increasing trend over time. A comparable trend is found for intellectual property rights measures, although with loss of momentum on the period 2008-2012 compared to the 2002-2007 period, see (Figure 1). This trend goes in parallel with the rise in the number of RTAs over time. In percentages, the importance of these provisions also increases with time over the last two decades.



The surge of environmental and labour market regulation provisions, two of the most commonly WTO-X scope provisions negotiated in modern RTAs is clearly visible in (Figure 2). In percentages, labour market regulation provisions experience a more marked rise than the environmental clauses over the last two decades.



2.3.1. Additive indicators

The first step in building additive indicators is to establish a set of provisions likely to appear in a RTA, the second step consists of counting how many of these provisions are present in a particular agreement. The RTAs with the most provisions will be considered as the deepest. The advantage of this approach is that it is easy to compute; the weakness is that it assigns an equal weight to all the provisions embodied in an agreement. To solve this, additive

indicators can also be obtained by assigning different weights. In the absence of good reasons to assume that some provisions are more important than others, resorting to weighted indicators would be arbitrary, and might lead us to a biased researcher's opinion.

Additive indicators tested in our gravity model registers 0 if there is no agreement between both countries. Because (Dür et al., 2014) in DESTA data set assigned 0 to their shallowest agreements, and our count of WTO+ and WTO-X provisions is also 0 for the shallowest agreements, we recode these agreements with a 1 and raise the additive index measure of every RTA by one unit also. This can be considered as a common denominator clause for all agreements, namely, tariff reduction. We do this to avoid confusing the shallowest agreements with not having a free trade agreement at all. Thus, we will compare flows influenced by a RTA with all the flows without RTAs.

Table 3 presents information for WTO+, WTO-X and DESTA data sets. It shows the number of RTAs by the number of provisions and regrouped number of provisions they contain, as well as by the number of bilateral trade flows affected by these RTAs. The DESTA data set comprises the largest number of RTAs, 269 against 103 for WTO and WTO-X.

The first column for each database enumerates the number of provisions in a RTA, here each provision represent one range; the second column shows the number of RTAs with a maximum of provisions in each range. We considered RTAs for the period 1980-2012. For example; we find that WTO+, WTO-X and DESTA have 5, 11 and 25 RTAs in the shallowest range (1 provision). Also important to note is the fact that the number of RTAs is low for certain ranges, mainly for WTO-X registers. Thus, there are no RTAs with 23, 24 or 25 WTO-X provisions, but there are 3 with 28 WTO-X provisions.

Lack of sufficient observations may be a problem for econometric estimation. To deal with this inconvenient we regroup RTAs by their number of provision, which allows us to reduce the number of ranges which automatically increases the number of observations in each new regrouped range. This procedure makes possible to better capture the effect of deep integration after regression on a factor variables specification. We recognize that grouping can be contentious. In response to this in section 5 we perform sensitivity analysis testing for different groupings.

Taking this into account, we pass from 12 ranges to 4 grouped ranges for WTO+ framework provisions, see (Table 5). In the case of WTO-X provisions, we do not present the results for

the original 37 ranges, these being too large to be informative; we prefer to show results for 7 regrouped ranges on the left and for 4 regrouped ranges on the right side of (Table 6). DESTA provisions are computed for 9 ranges on the left and for 4 regrouped ranges on the right side of (Table 7). Our results are sensitive to this regrouping procedure, but their analysis proves to be clearer on the regrouped specification.

Table 3

Number of RTAs and its associated bilateral trade flows by number of provision and regrouped number of provisions for WTO+, WTO-X and WTI-DESTA data sets

WTO+						WTO-X									WTI-DESTA					
Number of provisions	Number of RTAs	Number of Flows	Regrouped ranges of provisions	Regrouped Number of RTAs	Regrouped Number of Flows	Number of provisions	Number of RTAs	Number of Flows	Regrouped ranges of provisions	Regrouped Number of RTAs	Regrouped Number of Flows	Regrouped ranges of provisions	Regrouped Number of RTAs	Regrouped Number of Flows	Number of provisions	Number of RTAs	Number of Flows	Regrouped ranges of provisions	Regrouped Number of RTAs	Regrouped Number of Flows
1	5	1,036	*1-3*	14	6,804	*1*	11	5,598	*1-5*	38	13,458	1-10	77	16,777	*1*	25	4,236	*1-3*	136	20,827
2	3	1,588	*4-7*	31	19.944	*2*	8	4,246	*6-10*	39	3,353	11-20	15	18.048	*2*	43	6,317	*4-6*	93	26,601
3	6	4,180	*8-11*	58	9.083	*3*	4	232	*11-15*	11	10,336	21-37	11	3.962	*3*	68	10,274	*7-8*	40	3,186
4	7	6,244				*4*	7	1,198	*16-20*	4	6,478				*4*	34	8,461			
5	7	902				*5*	8	2,184	*21-26*	5	2,268				*5*	33	4,962			
6	8	4,126				*6*	5	242	*27-37*	6	2,894				*6*	26	13,178			
7	9	8,672				*7*	8	2,133							*7*	26	1,233			
8	17	4,030				*8*	8	80							*8*	14	1,953			
9	11	694				*9*	14	864												
10	14	4,104				*10*	4	34												
11	16	258				*11*	2	58												
						12	4	4,715												
						13	2	282												
						14	2	3,615												
						15	1	1,666												
						16	1	810												
						17	1	1,800												
						18	0	-												
						19	0	-												
						20	2	3,868												
						21	3	1,200												
						22	1	594												
						23	0	-												
						24	0	-												
						25	0	-												
						26	1	474												
						27	1	594												
						28	3	1,442												
						29	0	-												
						30	1	534												
						31	0	-												
						32	1	324												
						33-37	0	-												
Totals						Totals									Totals					
	103	35.831		103	35.831		103	38.787		103	38.787		103	38.787		269	50.614		269	50.614

Source: Own calculations on data from WTO (2011) and WTI-DESTA (2014)

Some extra caveats may be presented; first, the number of provisions an agreement incorporates does not in itself ensure the enforceability of the agreement. We do not consider legal enforceability due to the subjectivity of its codification process. Second, neither does an additive indicator promise that what we think to be a very deep agreement, due to its institutional maturity or hype, would appear as such in the data.

For instance, (Claar and Nölke, 2010) consider that "Europe's single market is probably the best example globally of successful deep integration. EU members have not only eliminated all tariff barriers, they have also harmonised product and service standards in past decades".

Nevertheless, (Dur et al., 2014) additive indicator gives UE 1992 single market agreement a 5 while Colombia-USA is assigned with a 7. In parallel, (Orefice and Rocha, 2013) give 6 in WTO+ and 11 in WTO-X to EU_27 but 9 in WTO+ and 27 in WTO-X to EU-Chile.

This situation arises due to methodology consistency requirements that are needed to avoid a researcher vision bias.

2.3.2 Distilled Indicators

To deal with the problem of additive indicators, consisting of treating all characteristics as equals or being accused of arbitrariness, some statistical methods have been developed to produce indicators that distil or capture the inertia of a set of variables (characteristics) in a single dimension, a new variable that catalyses it all into one indicator. In our case, into what we claim is an indicator of the depth of RTAs.

The relative position of an RTA on the indicator, which is a continuous variable, is going to be given by the interactions of the correlations between all characteristics, namely, provisions in our analysis.

To obtain those kind of indicators, (Orefice and Rocha, 2013) develop a Principal Component Analysis (PCA) indicator. (Dür et al., 2014) compute a Rasch indicator, which has the advantage of previously assuming that only one dimension is defined by the observations of the dataset. It also presents some setbacks. Special software must be used to obtain a Rash indicator.

Given our purpose of finding an indicator of deep integration that stems from the first dimension of a component determination technique, we prefer an indicator obtained from a Multiple Correspondence Analysis (MCA) procedure. This procedure is equivalent to a principal component analysis PCA[4], but is more suitable for categorical variables, as PCA is

[4] "Principal component analysis is a statistical technique that linearly transforms an original set of variables into a substantially smaller set of uncorrelated variables that represents most of the information in the original set of variables. Its goal is to reduce the dimensionality of the original data set because a small set of uncorrelated variables is easier to use in further analysis than a larger set of correlated variables." Dunteman (1989, 7) "If the variables are highly correlated, then we

best prescribed for continuous variables (Cahuzac & Bontemps, 2008). MCA is designed to be used with categorical variables. Binomial variables, as the kind we face in our analysis, are a particular kind of categorical variables. MCA is used to detect and represent underlying structures in a data set and arranges data as points in a set of dimensions. (Le Roux and Rouanet, 2010).

The MCA we perform on the traditional provisions under the competence of the WTO (WTO+) shows that a great deal, equivalent to more than 85%, of the inertia is explained by the first dimension. We relate this dimension to a measure of deep integration. As a MCA procedure does not predefine the sense of the relationship, we review its coherence to be able to correctly introduce the data in the gravity model so that the shallowest agreements in the MCA indicator take on lowest valuations. Hence, an increase in the index means moving ahead to a higher depth of integration.

Likewise, to explore the impact of deeper agreements on the case of WTO non-traditional provisions we run a MCA for WTO-X and also for our restricted WTO-Xr provisions, namely, excluding agriculture, IPR and Investment. This time about 89% of the inertia is explained for the first dimension.

2.4 Gravity Model and Econometric Specifications

The international trade gravity theory Tinbergen (1962) claims that bilateral international trade flows from country i to country j, for a given year t, X_{ijt}, depend positively on the size of both economies y_{it} and y_{jt} respectively, and negatively on a set of trade cost variables t_{ijt}. Y^W is the world nominal income; θ_i and θ_j are shares of world income for country i and country j. Here σ is the elasticity of substitution between all goods.

Anderson and Van Wincoop (2003) provide us with a micro funded mathematical approach to better estimate the gravity equation. We keep here their main set of equations and then present the econometric model specification. A comprehensive discussion about the micro-foundation behind the gravity equation and its implications can be found in Head and Mayer (2014); Archanskaia and Daudin (2012) and Baldwin and Taglioni, (2006).

can linearly transform the p correlated variables into a smaller set of k uncorrelated variables, such that the k derived variables, if considered as independent variables, will maximize the prediction of the original p variables. The k derived variables which maximize the variance accounted for the original variables are called principal components". Dunteman (1989, 5).

$$(1)\ x_{ij} = \frac{y_i\, y_j}{y^w}\left(\frac{t_{ijt}}{P_i \Pi_j}\right)^{1-\sigma}$$

Where

$$(2)\ \Pi_i = \left(\sum_j \left(t_{ij}/P_j\right)^{1-\sigma} \theta_j\right)^{1/(1-\sigma)}$$

and

$$(3)\ P_j = \left(\sum_i \left(t_{ij}/\Pi_i\right)^{1-\sigma} \theta_i\right)^{1/(1-\sigma)}$$

Here, multilateral resistance for countries i and j (P_i and Π_j) are non-observable variables.

As we have no data for P_i and Π_j, the so-called multilateral resistance terms from equation (1), one solution would be to introduce remoteness controls like in Wei (1996) and Baldwin and Horrigan (2011) but the correct way to build these indicators and its effectiveness is controversial Anderson (2011). We prefer to introduce time invariant fixed effects for importers and exporters to first avoid endogeneity due to unobservable heterogeneity and then to partially control for omitted variable bias derived from multilateral resistance[5].

To disentangle the impact of the depth of RTAs, we regress bilateral export flows on a set of indicators of depth and covariates by the means of a Poisson specification. Poisson Pseudo Maximum Likelihood PPML has been positioned by (Santos Silva & Tenreyro, 2006; 2011) as the most suitable method for estimating the gravity equation. This method deals with bias caused by the presence of many zeros in bilateral international trade data, which are positively related to distance and negatively related to market size Baldwin and Harrigan (2011), and is also robust to heteroscedasticity. Martínez-Zarzoso (2013) and Head and Mayer (2014) provided additional evidence to support the use of the PPML estimator.

[5] Time-varying fixed effects can be introduced into the gravity equation to better account for multilateral resistance. Nevertheless, we do not control for country time-varying fixed effects in this paper due to computational limits that stem from the max likelihood process for PPML when too many fixed effects are to be computed. For robustness we will check out the OLS equivalent estimates, results it will be presented in Appendix F.

Our depth indicators, which are our variables of interest, are tested in three different main specifications: in levels as factor variables and in logarithms. Because the log of 0 is not defined, in order to compute logarithms for our depth indicators we add 1 to the variable.

Now, in the pursuit of our goal to estimate the effect of RTAs heterogeneity we resort to the following four specifications.

Our first specification eq. (4) allows us to include in levels our different kinds of depth indicators: additive, MCA or Rasch. We use the subscript $_m$ to indicate the kind of indicator we estimate (level, logarithmic or MCA) :

$$(4) \quad X_{ijt} = \exp(\beta_0 + \beta_1 \boldsymbol{dp_{indc_{ijtm}}} + \vartheta_l \boldsymbol{G_{ijt}} + \psi_h \boldsymbol{S_{it}} + \phi_h \boldsymbol{M_{jt}} + \alpha_t + \alpha_i + \alpha_j) u_{ijt}$$

Where the dependent variable X_{ijt} represents bilateral Fob exports in current dollars from country i to country j and $u_{ijt} = \exp((1-\sigma)\mathcal{E}_{ijt})$. $\boldsymbol{S}_{it}$ and $\boldsymbol{M_{jt}}$ are vectors of time varying monadic controls for exporters and importers respectively composed of h variables: $lnGDP_{it}$, $lnpop_{it}$, $OECD_{it}$ and $GATT_{it}$, as well as, $lnGDP_{jt}$, $lnpop_{jt}$, $OECE_{jt}$ and $GATT_{jt}$. ψ and ϕ are vectors of parameters to be estimated concerning the above control variables and the subscript h indicates variables.

Variables $lnGDP_{it}$ and $lnGDP_{jt}$ are the natural logarithm for current dollars GDPs from countries i and j; $lnpop_{it}$, $lnpop_{jt}$ are natural logarithm for the population in number of habitants of countries i and j. Respectively $GATT_{it}$ and $GATT_{jt}$ that take on 1 if countries i/j belong to the GATT/WTO. $OECD_{it}$ and $OECD_{jt}$ take on 1 if the countries i/j belong to the Organization of Economic Cooperation and Development OECD.

$\mathbf{G}_{ijt}$ is a vector dyadic variables consisting of $contg_{ijt}$, $comlang_{ijt}$, $col45_{ijt}$ *and* $lndist_{ijt}$; and ϑ_l is a vector of coefficients to be estimated for these variables where the subscript $_l$ is to indicate variables.

The error term is composed of year fixed effect α_t, time-invariant fixed effects for exporter and importer countries and α_i and α_j respectively and finally, u_{ijt} is the idiosyncratic error term.

Sources and definitions are available in appendices A-C. As we are accounting for time invariant country fixed effects, the inclusion of variable as country surface, insular or landlocked status are redundant.

The interpretation of the coefficient of indicator for deep integration in levels, as above, is not straightforward. What do we mean by saying that we increase a depth additive indicator by one unit? Which provision do we really change? Similarly, as our MCA and Rasch indicators ranges are low, an increase of one unit on these is also hard to evaluate. One solution is to introduce our indicator in logarithmic form; this way we can reason in terms of percentage variations. We chose to add 1 to the index before taking logarithm to deal with zeros, see eq. (5) specification:

$$(5) \quad X_{ijt} = \exp(\beta_0 + \beta_1 \boldsymbol{ln}[\boldsymbol{1} + \boldsymbol{dp_{Ind_{ijtm}}}] + \vartheta_l \boldsymbol{G_{ijt}} + \psi_h \boldsymbol{S_{it}} + \phi_h \boldsymbol{M_{jt}} + \alpha_t + \alpha_i + \alpha_j) u_{ijt}$$

Next, the econometric specification of Eq (6) introduces our additive indicators of depth for WTO+, WTO-X and DESTA as factor variables. To address this point we create a dummy variable for every range of RTAs by the number of provisions they possess. As we discussed before, some ranges of provisions present a limited number of RTAs, particularly for WTO-X, consequently, we also test this specification by regrouping RTAs in fewer ranges, where δ_{ijt} represent the coefficients for each of this ranges.

$$(6) \quad X_{ijt} = \exp(\beta_0 + +\vartheta_l \boldsymbol{G_{ijt}} + \psi_h \boldsymbol{S_{it}} + \phi_h \boldsymbol{M_{jt}} + \delta_{ijt\, n-1} \sum_{1}^{n-1} \boldsymbol{dp_{ind_{add_{nijt}}}} + \alpha_t + \alpha_i + \alpha_j) u_{ijt}$$

To try to identify possible nonlinearities such as diminishing or increasing returns we resort to eq (7) where we test our additive indicators on a quadratic form.

$$(7) \quad X_{ijt} = \exp(\beta_0 + \beta_1 \boldsymbol{dp_{Ind_{ijt}}} + \beta_2 \boldsymbol{dp_{Ind}}^{\boldsymbol{2}}{}_{\boldsymbol{ijt}} + \vartheta_l \boldsymbol{G_{ijt}} + \psi_h \boldsymbol{S_{it}} + \phi_h \boldsymbol{M_{jt}} + \alpha_t + \alpha_i + \alpha_j) u_{ijt}$$

2.5. Results

First, we discuss our findings for additive indicators and, second, for the factor variable specification. The right side of these tables presents results for regrouped ranges of provisions. Finally, we display our estimations for distilled depth indicators of the MCA and Rasch family.

2.5.1 Deep Integration Additive Indicators

Our interest variables here are (ad_WTO+) and (ad_WTO_X) consisting of additive index of provisions under the regular WTO framework and out of it respectively. We also test the variable (ad_DES) that is the additive index relying on Dür et al. (2014) DESTA database.

They take on the value 0 (no RTA), 1, simply for signing a free trade agreement without provision (ASEAN), 2 if the agreement presents one provision and so forth, up to the index of deepest RTAs, which is 11 for ad_WTO+, 32 for ad_WTO_X and 8 for ad_DES. Thus, ad^2_WTO+, ad^2_WTO_X and ad^2_DES are their quadratic form. Likewise, ln_ad_WTO, ln_ad_WTO_X and ln_ad_DES are their logarithmic expression. Variables in levels follow eq. 4 and in logarithms eq. 5 specification.

A positive and significant effect was found for every specification in (Table 4). An increase of 10% in the number of traditional WTO+ provisions increases bilateral trade around a 2.5% as well as for DESTA classification of provisions.

A slightly lower effect can be attributed to an increase in non-traditional WTO-X provision. When tested in their quadratic specification, additive indicators show the presence of decreasing returns on the process of integration.

Table 4

Deep Integration: Additive indicators in levels, logs and quadratic form for WTO+, WTO-X and DESTA. PPML estimator.									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}
ad_WTO+	0.058***	0.107***							
ad2_WTO+		-0.005***							
ln_ad_WTO+			0.231***						
ad_WTO_X				0.023***	0.071***				
ad2_WTO_X					-0.002***				
ln_ad_WTO_X						0.183***			
ad_DES							0.077***	0.127***	
ad2_DES								-0.007***	
ln_ad_DES									0.250***
$lnGDP_{it}$	0.764***	0.751***	0.747***	0.755***	0.758***	0.748***	0.740***	0.731***	0.730***
$lnGDP_{jt}$	0.678***	0.664***	0.661***	0.670***	0.670***	0.661***	0.655***	0.645***	0.644***
$lndist_{ijt}$	-0.785***	-0.768***	-0.762***	-0.819***	-0.766***	-0.770***	-0.764***	-0.751***	-0.751***
$lnpop_{it}$	-0.162**	-0.154**	-0.175**	-0.159**	-0.166**	-0.178**	-0.132*	-0.142*	-0.158**
$lnpop_{jt}$	-0.324***	-0.325***	-0.349***	-0.327***	-0.343***	-0.358***	-0.287***	-0.309***	-0.327***
$contig_{ijt}$	0.495***	0.502***	0.497***	0.530***	0.497***	0.506***	0.479***	0.483***	0.481***
$comlang_{ijt}$	0.245***	0.242***	0.239***	0.278***	0.267***	0.262***	0.265***	0.263***	0.261***
$col45_{ijt}$	0.144***	0.152***	0.157***	0.125***	0.182***	0.163***	0.236***	0.244***	0.245***
$ocde_{it}$	0.212***	0.220***	0.212***	0.253***	0.220***	0.214***	0.254***	0.248***	0.243***
$oecd_{jt}$	0.192***	0.197***	0.189***	0.223***	0.193***	0.187***	0.167***	0.161***	0.156***
$gatt_{it}$	0.351***	0.338***	0.334***	0.348***	0.337***	0.336***	0.326***	0.311***	0.305***
$gatt_{jt}$	0.219***	0.204***	0.200***	0.221***	0.211***	0.204***	0.223***	0.208***	0.200***
Observations	572,924	572,924	572,924	575,650	575,650	575,650	587,654	587,654	587,654
R-squared	0.900	0.902	0.902	0.894	0.902	0.901	0.900	0.901	0.901
Exporter time invariant FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Importer time invariant FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-pair FE	NO	NO	NO	NO	NO	NO	NO	NO	NO
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1; Source: Own calculations.

The results represented in Tables 5 and Table 6 come from the transformation of our additive indicators ad_WTO+ and ad_WTO-X into factor variable as in eq. (6). Thus, (Table 5) focus on the traditional WTO+ provisions and (Table 6) on WTO-X provisions. For WTO+ provisions, this procedure consists of generating 12 dummies including the no-agreement case (ad_WTO+1), the no-provision case[6] (ad_WTO+2) and the 10 different provisions (Table 1) under the WTO+ framework (ad_WTO+3 to ad_WTO+12). The results are presented in (Table 6). To avoid the dummy variable trap, the no-agreement case is considered as the excluded category in the following estimations.

[6] For example : ASEAN, PAFTA, Russian-Ukraine, Ukraine-Kazakhstan, and Ukraine-Turkmenistan

After regrouping in four ranges as can be seen in column 2, the effect of deeper integration on bilateral exports is increasing when more and more provisions are included in the RTAs, although the difference between *ad_WTO+3b* and *ad_WTO+4b* is just marginal. As explained before, regrouping is needed to ensure enough RTA representation in each range of our factor variables.

Table 5

Deep Integration: Additive indicator as factor variables from WTO+. Divided into 12 and 4

	(1)		(2)
VARIABLES	X_{ijt}		X_{ijt}
ad_WTO+2	0.202***	*ad_WTO+2b*	0.249***
ad_WTO+3	0.659***	*ad_WTO+3b*	0.486***
ad_WTO+4	0.252***	*ad_WTO+4b*	0.488***
ad_WTO+5	0.499***		
ad_WTO+6	-0.117***		
ad_WTO+7	0.604***		
ad_WTO+8	0.642***		
ad_WTO+9	0.407***		
ad_WTO+10	0.375***		
ad_WTO+11	0.394***		
ad_WTO+12	0.636***		
$lnGDP_{it}$	0.764***		0.732***
$lnGDP_{jt}$	0.679***		0.646***
$lndist_{ijt}$	-0.737***		-0.756***
$lnpop_{it}$	-0.136*		-0.172**
$lnpop_{jt}$	-0.296***		-0.344***
$contig_{ijt}$	0.458***		0.496***
$comlang_{ijt}$	0.269***		0.249***
$col45_{ijt}$	0.169***		0.161***
$oecd_{it}$	0.200***		0.222***
$oecd_{jt}$	0.177***		0.196***
$gatt_{it}$	0.345***		0.318***
$gatt_{jt}$	0.213***		0.183***
Observations	572,924		572,924
R-squared	0.906		0.902
Time-invariant exporter FE	YES		YES
Time-invariant importer FE	YES		YES
Country-pair FE	NO		NO
Time FE	YES		YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1 ; Source: Own calculations

Letter b at the end of variable's names means that ranges are grouped together, see table 3

Although we can see a predominantly positive result for RTAs, the grouping of 12 categories does not easily allow us to appreciate that more provisions gradually generate more trade. The reason could be that we do not have enough RTAs for each of the 12 categories; consequently a more aggregated grouping was needed to fully capture this behaviour.

Treating the WTO+ additive indicator as a factor variable regrouped in four successive ranges as in the right side of Table 5 shows us clearly that in so far as RTAs include more and more provisions, they tend to have a bigger impact on bilateral trade flows. Nevertheless, results are sensitive to the ranges we select, and they show more coherent results with smaller ranges as can be seen in section 2.6.1 where robustness checks are presented.

To analyse WTO-X additive indicator as factor variable we followed the same procedure described above. Because of the large number of provisions, we respectively generated dummy variables for 7 ranges and for 4 ranges.

The no-provision case is included in the lowest range. The results are presented in Table 6. The same choice is made for DESTA additive index, which is based on 8 general provisions. We test firstly for the 8 original ranges on left side, and then for 4 regrouped ranges on the right side of Table 7.

Although all our results are positive in Table 6 for WTO-X provisions, we do not achieve here the same conclusive result we obtained for WTO+.

The classification of the number RTAs available by the number of provisions it contains, presented in Table 3, allows us to identify that most of the RTAs are in the shallowest range of provisions, which could lead us to treat new grouping choices.

Table 6

Deep Integration: Additive indicator as factor variables for WTO-X

VARIABLES	(1) X_{ijt}		(2) X_{ijt}
ad_WTO_X2	0.410***	*ad_WTO_X2b*	0.449***
ad_WTO_X3	0.470***	*ad_WTO_X3b*	0.533***
ad_WTO_X4	0.582***	*ad_WTO_X4b*	0.344***
ad_WTO_X5	0.462***		
ad_WTO_X6	0.703***		
ad_WTO_X7	0.315***		
$lnGDP_{it}$	0.754***		0.740***
lnGDPjt	0.663***		0.649***
$lndist_{ijt}$	-0.740***		-0.740***
$lnpop_{it}$	-0.175**		-0.196**
$lnpop_{jt}$	-0.356***		-0.375***
$contig_{ijt}$	0.503***		0.502***
$comlang_{ijt}$	0.236***		0.233***
$col45_{ijt}$	0.187***		0.186***
$oecd_{it}$	0.223***		0.219***
$oecd_{jt}$	0.196***		0.192***
$gatt_{it}$	0.320***		0.318***
$gatt_{jt}$	0.186***		0.184***
Observations	575,650		575,650
R-squared	0.904		0.900
Time invariant exporter FE	YES		YES
Time invariant importer FE	YES		YES
Country-pair FE	NO		NO
Time FE	YES		YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1 ; Source: Own calculations.

Letter b at the end of variable's names means that ranges are grouped together; see table 3

Continuing with the additive approach, we proceed here to test the same phenomenon as in Table 5 and 6, but with data coming from DESTA of the World Trade Institute WTI.

Confirming our findings that deeper RTAs have a greater impact in bilateral trade than those which are shallow, (Table 7) allows us to see that by introducing DESTA depth additive indicators in our gravity equation as a factor variables, especially with a reduced grouping of RTAs, results in a pattern that is coherent with those obtained from WTO+ provisions when we tested them also as factor variable under the regrouped four ranges.

Table 7

Deep Integration: Additive indicator as factor variables from DESTA: divided into 9 and 4 ranges. PPML estimator.

	X_{ijt}		X_{ijt}
ad2_DES	0.193***	*ad2_DESb*	0.267***
ad3_DES	-0.188***	*ad3_DESb*	0.429***
ad4_DES	0.466***	*ad4_DESb*	0.532***
ad5_DES	0.386***		
ad6_DES	0.455***		
ad7_DES	0.528***		
ad8_DES	0.496***		
ad9_DES	0.561***		
$lnGDP_{it}$	0.734***		0.731***
$lnGDP_{jt}$	0.650***		0.646***
$lndist_{ijt}$	-0.753***		-0.763***
$lnpop_{it}$	-0.130*		-0.178**
$lnpop_{jt}$	-0.278***		-0.349***
$contig_{ijt}$	0.476***		0.486***
$comlang_{ijt}$	0.249***		0.264***
$col45_{ijt}$	0.193***		0.240***
$oecd_{it}$	0.267***		0.239***
$oecd_{jt}$	0.186***		0.153***
$gatt_{it}$	0.321***		0.306***
$gatt_{jt}$	0.214***		0.202***
Observations	587,654		587,654
R-squared	0.903		0.900
Time invariant Exporter Fixed Effects	YES		YES
Time invariant Importer Fixed Effects	YES		YES
Country-Pair Fixed Effects	NO		NO
Time Fixed Effects	YES		YES
Time Varying Exporter Fixed Effects	NO		NO
Time Varying Importer Fixed Effects	NO		NO

2.5.2 Deep Integration Distilled Indicator

This section presents the results for a set of distilled deep integration variables, obtained from the first dimension of a multiple correspondence analysis MCA[7] procedure, as well as a set of variables produced from the Rasch methodology computed by (Dür et al, 2014) with DESTA inputs. We also explore the possibility of nonlinearities in the process of trade integration by introducing quadratics terms on our MCA indicators for WTO and WTO-X provisions, as well as on Rasch indicators (Table 8). Concerning the MCA approach we have developed

[7] Regarding traditional WTO policy areas, the MCA indicator for the first dimension of the inertia captures 85.6%. It captures 88.8% of the inertial in the case of WTO-X provisions. We also compute an MCA for WTO-X excluding agriculture, investment and IPR, from the set of provisions presented in Table 2. The first dimensions of this restrained MCA accounts for 89.7% of the inertia.

two separate set of indicators, the first based on WTO traditional provisions and the second based on WTO-X provisions. We have tried specifications in levels, logarithms and quadratics to test the sensibility of these indicators.

We consider mca_WTO+ and mca_WTO_X, which are MCA indices obtained from their first dimension of inertia which captures the RTA degree of depth based on the number and combination of traditional WTO+ and WTO-X provisions they respectively embody; mca^2_WTO+ and mca^2_WTO_X are their squared forms and ln_mca_WTO+ and ln_mca_WTO_X are their natural logarithms. Rasch variable names follow these same conventions.

When we use the character *r* (as *restrained*) at the end of variables (mca_WTO_Xr, mca^2_WTO_Xr and ln_mca_WTO_Xr) we do not take into account agriculture, investment and IPR, because these provisions are, in a certain way, treated under the traditional WTO+ framework.

The exclusion of agriculture, investment and IPR from our MCA calculations does not change the sign or the significance of these indicators, but increases the value of the coefficients in all specifications, as can be observed in Table 8. This result could suggest a negative impact from some of these three provisions or their combination on trade.

The Rasch index in (Table 8) is positive and significant. When tested in their quadratic form it suggests the presence of diminishing returns as trade integration goes deeper. Because Rasch indicators are produced from a provisions database WTI-DESTA that is closer to the set of provisions embodied in the WTO+ framework of negotiation than to the WTO-X set of provision, this result is coherent with what we find for our MCA indicators on a quadratic specification.

Table 8

Deep Integration Distilled Indicators: MCA and Rasch indicators in levels quadratics and log. PPML estimator.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	Xij	Xij	Xij	Xij	Xij	Xij	Xij	Xij	Xij	Xij	Xij	Xij
mca_WTO+	0.147***	0.252***										
mca2_WTO+		-0.029***										
ln_mca_WTO+			0.351***									
mca_WTO_X				0.163***	0.450***							
mca2_WTO_X					-0.086***							
ln_mca_WTO_X						0.409***						
mca_WTO_Xr							0.162***	0.463***				
mca2_WTO_Xr								-0.091***				
ln_mca_WTO_Xr									0.412***			
rasch_DES										0.132***	0.268***	
rasch2_DES											-0.047***	
ln_raschs_DES												0.285***
$lnGDP_{it}$	0.767***	0.756***	0.755***	0.746***	0.740***	0.741***	0.746***	0.738***	0.739***	0.728***	0.720***	0.724***
$lnGDP_{jt}$	0.678***	0.666***	0.666***	0.661***	0.650***	0.653***	0.661***	0.649***	0.653***	0.645***	0.635***	0.640***
$lndist_{ijt}$	-0.780***	-0.765***	-0.763***	-0.800***	-0.736***	-0.766***	-0.804***	-0.735***	-0.768***	-0.800***	-0.791***	-0.793***
$lnpop_{it}$	-0.145*	-0.150**	-0.161**	-0.185**	-0.201***	-0.198***	-0.195**	-0.210***	-0.208***	-0.097	-0.108	-0.107
$lnpop_{jt}$	-0.306***	-0.319***	-0.330***	-0.362***	-0.384***	-0.381***	-0.371***	-0.394***	-0.391***	-0.269***	-0.287***	-0.284***
$contig_{ijt}$	0.496***	0.499***	0.497***	0.525***	0.494***	0.511***	0.526***	0.494***	0.512***	0.518***	0.517***	0.516***
$comlang_{ijt}$	0.236***	0.232***	0.231***	0.268***	0.244***	0.256***	0.267***	0.243***	0.255***	0.278***	0.278***	0.276***
$col45_{ijt}$	0.147***	0.156***	0.157***	0.137***	0.201***	0.165***	0.133***	0.200***	0.161***	0.217***	0.222***	0.222***
$oecde_{it}$	0.217***	0.221***	0.216***	0.237***	0.210***	0.215***	0.239***	0.209***	0.215***	0.324***	0.314***	0.317***
$oecd_{jt}$	0.198***	0.199***	0.194***	0.208***	0.184***	0.188***	0.209***	0.182***	0.187***	0.177***	0.179***	0.173***
$gatti_{t}$	0.344***	0.333***	0.333***	0.337***	0.319***	0.329***	0.336***	0.319***	0.328***	0.328***	0.312***	0.318***
$gatt_{jt}$	0.212***	0.198***	0.198***	0.206***	0.186***	0.195***	0.205***	0.186***	0.195***	0.215***	0.201***	0.205***
Observations	575,583	575,583	575,583	575,587	575,587	575,587	575,587	575,587	575,587	587,654	587,654	587,654
R2	0.901	0.902	0.902	0.897	0.904	0.901	0.897	0.904	0.901	0.891	0.891	0.891
Exporter TIFE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Importer TIFE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-pair FE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Time Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Own Calculations. Note: TIFE stands for time-invariant fixed effects.

2.6 Robustness Checks

In this section we check the sensitivity of our results to the grouping of provisions, the introduction of time-varying country fixed effects and the use of Principal Component Analysis.

2.6.1 Additive depth indicator factor variables grouping sensitivity analysis

Here we carry out a sensitivity analysis to WTO+ groupings. Column 2 in (Table 9) reproduces the breakdown presented in the right side of table 5 to make easier the analysis. Comparing (Table 9) results in column 2 to results in column 1, which presents 5 ranges, and in column 3, that presents 3 ranges; we find that WTO+ results are robust to an increase from 4 to 5 ranges as well as to a decrease from 4 to 3 ranges, as can be seen in (Table 9). This confirms that as we introduce more WTO+ provisions into RTAs we can expect them to produce a bigger impact on trade.

Table 9

Deep Integration: Additive indicator as factor variables from WTO+. Divided into 5, 4 and 3 ranges. PPML estimator

	(1)		(2)		(3)
	X_{ijt}		X_{ijt}		X_{ijt}
ad_WTO+2c	0.231***	*ad_WTO+2b*	0.249***	*ad_WTO+2d*	0.345***
ad_WTO+3c	0.411***	*ad_WTO+3b*	0.486***	*ad_WTO+3d*	0.543***
ad_WTO+4c	0.518***	*ad_WTO+4b*	0.488***		
ad_WTO+5c	0.565***				
$lnGDP_{it}$	0.752***		0.732***		0.751***
$lnGDP_{jt}$	0.664***		0.646***		0.663***
$lndist_{ijt}$	-0.759***		-0.756***		-0.752***
$lnpop_{it}$	-0.162**		-0.172**		-0.156**
$lnpop_{jt}$	(0.333***		-0.344***		-0.328***
$contig_{ijt}$	0.493***		0.496***		0.500***
$comlang_{ijt}$	0.249***		0.249***		0.243***
$col45_{ijt}$	0.165***		0.161***		0.158***
$oecde_{it}$	0.211***		0.222***		0.223***
$oecd_{jt}$	0.188***		0.196***		0.199***
$gatt_{it}$	0.330***		0.318***		0.349***
$gatt_{jt}$	0.196***		0.183***		0.215***
Observations	572924		572,924		572,924
R-squared	0.903		0.902		0.903
Taime invariant exporter FE	YES		YES		YES
Time invariant importer FE	YES		YES		YES
Country-pair FE	NO		NO		NO
Time FE	YES		YES		YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Own calculations.

Passing to review sensitivity for WTO-X provisions we reproduce in column 2 of (Table 10) the results presented in table 6. We can appreciate that a reduction in the number of ranges that group provisions from 4 to 3, see column 3 produce a result where deeper agreements increase trade more than shallow ones. Nevertheless, this finding is not confirmed when we pass from 4 to 5 ranges, see column 1 where as in column 2, deeper agreements seem to

increase trade more than shallow ones up to a certain point where more integration seems to increase trade but in a lesser proportion than before. This could be due to the fact that some WTO-X provisions like environmental laws which are present in RTAs with the highest number of provisions, are susceptible to mitigate the impact of other rather trade creating provisions.

Table 10

Deep Integration: Additive indicator as factor variables from WTO-X. Divided into 5, 4 and 3 ranges. PPML estimator

	(1)		(2)		(3)
	Xijt		Xijt		Xijt
ad_WTO_X2b	0.306***	*ad_WTO_X2b*	0.449***	*ad_WTO_X2d*	0.407***
ad_WTO_X3b	0.456***	*ad_WTO_X3b*	0.533***	*ad_WTO_X3d*	0.502***
ad_WTO_X4b	0.551***	*ad_WTO_X4b*	0.344***		
ad_WTO_X5b	0.426***				
$lnGDP_{it}$	0.757***		0.740***		0.744***
$lnGDP_{jt}$	0.669***		0.649***		0.655***
$lndist_{ijt}$	-0.750***		-0.740***		-0.747***
$lnpop_{it}$	-0.167**		-0.196**		-0.208***
$lnpop_{jt}$	-0.343***		-0.375***		-0.388***
$contig_{ijt}$	0.486***		0.502***		0.498***
$comlang_{ijt}$	0.236***		0.233***		0.234***
$col45_{ijt}$	0.181***		0.186***		0.174***
$oecde_{it}$	0.219***		0.219***		0.212***
$oecd_{jt}$	0.195***		0.192***		0.185***
$gatti_{t}$	0.323***		0.318***		0.324***
$gatt_{jt}$	0.190***		0.184***		0.190***
Observations	575,650		575,650		575,650
R-squared	0.903		0.900		0.903
Time invariant exporter fixed effects	YES		YES		YES
Time invariant importer fixed effects	YES		YES		YES
Country-pair fixed effects	NO		NO		NO
Time fixed effects	YES		YES		YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Own calculations.

As above, for sensitivity purposes, table 11 presents in column 2 the results for the four ranges breakdown shown on the right of table 7. We compare them with groupings including five and three ranges, see columns 1 and 3. A classification in 5 ranges as in column 1 suggests a positive and increasing impact in bilateral exports induced by the rise in the number of provision in a RTA. Reducing the number of ranges to three as in column 3 confirms the same pattern than columns 1 and 2 where RTAs with more provisions produce a

bigger increase in trade. Our results for DESTA additive classification of RTA are robust to changes in the groupings of their factor variables specification.

Table 11

Deep Integration: Additive indicator as factor variables from DESTA. Divided into 5, 4 and 3 ranges. PPML estimator

	(1)		(2)		(3)
	Xijt		Xijt		Xijt
ad2_DESc	0.189***	*ad2_DESb*	0.267***	*ad2_DESd*	0.277***
ad3_DESc	0.281***	*ad3_DESb*	0.429***	*ad3_DESd*	0.465***
ad4_DESc	0.398***	*ad4_DESb*	0.532***		
ad5_DESc	0.506***				
$lnGDP_{it}$	0.732***		0.731***		0.727***
$lnGDP_{jt}$	0.646***		0.646***		0.641***
$lndist_{ijt}$	-0.753***		-0.763***		-0.758***
$lnpop_{it}$	-0.125		-0.178**		-0.162**
$lnpop_{jt}$	-0.292***		-0.349***		-0.337***
$contig_{ijt}$	0.488***		0.486***		0.494***
$comlang_{ijt}$	0.266***		0.264***		0.266***
$col45_{ijt}$	0.251***		0.240***		0.242***
$oecde_{it}$	0.253***		0.239***		0.245***
$oecd_{jt}$	0.166***		0.153***		0.159***
$gatti_{t}$	0.309***		0.306***		0.302***
$gatt_{jt}$	0.206***		0.202***		0.198***
Observations	587,654		587,654		587,654
R-squared	0.901		0.900		0.900
Time invariant exporter Fixed Effects	YES		YES		YES
Time invariant importer Fixed Effects	YES		YES		YES
Country-pair Fixed Effects	NO		NO		NO
Time Fixed Effects	YES		YES		YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Own calculations.

2.6.2 Time-varying fixed effects OLS and PPML estimators

The estimation of the whole set of indicators using PPML and time-varying fixed effects for the complete 33 years period is for the movement out of the reach due to convergence difficulties for the PPML max likelihood when a big number of fixed effects are to be evaluated. To deal with this problem we worked with time-invariant county fixed effects.

Conversely, OLS procedure for time-varying fixed effects has become easily practicable thanks to the reg2hdfe Stata command developed by Guimaraes and Portugal (2010). Nevertheless its computation together with country-pair fixed effects continues to be very

hard to achieve. To solve this problem, we implement the Baier Bergstrand technique that allows the reduction of the number of fixed effects to be computed by working with four years intervals in the data.

Although with convergence problems, Baier and Bergstrand method is extensible for use with PPML and time-varying country fixed effects. Nevertheless, putting together time-varying fixed effects and country-pair fixed effects with PPML produces an aggravation of the convergence problems. This technical complication explains why the specification containing time-varying and country-pair fixed effects is only estimated with OLS.

The introduction of time-varying fixed effects on the analysis will give us elements to assess the robustness of the results presented until now as they reduce omitted variable bias, but a caveat about their inclusion is pertinent as (Angrist and Pischke, 2015, 199) warn that "if treatment effects emerge only gradually … estimates may fail to distinguish treatment effects from differential trends, with the end result being an imprecise and therefore inconclusive set of findings". To mitigate this setback we also apply the Baier and Bergstrand technique that impose intervals of four year in our database giving sufficient time for the treatment effect to emerge.

As can be seen in (Table 12) our set of depth additive indicators are estimated here using OLS and time-varying country fixed effects. Globally, additive indicators are robust to the change in the method of estimation to OLS and the introduction of time-varying fixed effects, provisions outside of the traditional competence of the WTO show lower coefficients than the main core of provisions associated with trade integration. This remains valid across specifications in levels, quadratic form or logarithms.

Table 12

Deep Integration: Additive indicators in levels, logs and quadratic form for WTO+, WTO-X and DESTA. OLS estimator with TVFE.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	lnXij	lnXij	lnXij	Lnxij	lnXij	lnXij	lnXij	lnXij	lnXij
ad_WTO+	0.063***	0.151***							
ad2_WTO+		-0.011***							
ln_ad_WTO+			0.223***						
ad_WTO_X				0.018***	0.032***				
ad2_WTO_X					-0.001**				
ln_ad_WTO_X						0.134***			
ad_DES							0.069***	0.355***	
ad2_DES								-0.051***	
ln_ad_DES									0.259***
$lndist_{ijt}$	-1.498***	-1.481***	-1.488***	-1.520***	-1.513***	-1.504***	-1.550***	-1.476***	-1.525***
$Contig_{ijt}$	0.774***	0.763***	0.767***	0.815***	0.809***	0.803***	0.742***	0.774***	0.728***
$Comlang_{ijt}$	0.589***	0.589***	0.588***	0.638***	0.637***	0.634***	0.659***	0.613***	0.653***
$col45_{ijt}$	1.534***	1.543***	1.540***	1.515***	1.518***	1.521***	1.532***	1.521***	1.535***
Observations	396,794	396,794	396,794	399,560	399,560	399,560	410,612	399,389	410,612
R-squared	0.734	0.734	0.734	0.733	0.733	0.733	0.733	0.734	0.733
Time-varying exporter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time-varying importer FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-pair FE	NO	NO	NO	NO	NO	NO	NO	NO	NO
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1 ; Source : Own calculations.

The following table presents estimates including time-varying fixed effects together with pair-country fixed effects on intervals of four years under the Baier and Bergstrand technique. Estimates are reviewed slightly downward in all three main specifications, levels, quadratics and logs, as well as across WTO domains and databases.

The inclusion of pair-country fixed effects usually reduces RTA related estimates. Nevertheless, estimates in (Table 4) remain robust to the Baier and Bergstrand technique and the inclusion of time-varying country fixed effects and pair-country fixed effects.

Table 13

Deep Integration: Additive indicators in levels, logs and quadratic form for WTO+, WTO-X and DESTA. OLS estimator with TVFE and county-pair FE.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	lnXij	lnXij	lnXij	lnXij	lnXij	lnXij	lnXij	lnXij	lnXij
ad_WTO+	0.044***	0.170***							
ad2_WTO+		-0.015***							
ln_ad_WTO+			0.167***						
ad_WTO_X				0.021***	0.058***				
ad2_WTO_X					-0.002***				
ln_ad_WTO_X						0.151***			
ad_DES							0.073***	0.145***	
ad2_DES								-0.012***	
ln_ad_DES									0.214***
Observations	107,373	107,373	107,373	108,109	108,109	108,109	110,917	110,917	110,917
R-squared	0.363	0.363	0.363	0.365	0.365	0.365	0.368	0.368	0.368
Time-invariant exporter FE	NO	NO	NO	NO	NO	NO	NO	NO	NO
Time-invarian importer FE	NO	NO	NO	NO	NO	NO	NO	NO	NO
Time varying exporter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time varying importer FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-pair FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	NO	NO	NO

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1; Source: Own calculations.

Table 14 provides a sensitivity analysis for our factor variables breakdown of WTO+ additive indicators based on the introduction of time-varying country fixed effects. We compare results with OLS and PPML.

Columns 1 and 4 are estimated with OLS and time-varying fixed effects. Columns 2 and 5 follow Baier and Bergstrand's technique and put pair-country fixed effects together in the same equation with time-varying fixed effects estimated with OLS over four year intervals. Columns 3 and 6 use PML and time-varying fixed effects over four year intervals as in columns 2 and 5.

At first sight estimates with time varying country fixed effects seem not to sustain results in (Table 5) computed with PPML time invariant fixed effects, but the introduction of time-varying fixed effects maintaining the PPML method suggest that sensitivity in results stems

from the method of estimation but not for the presence of time-varying country fixed effects. Therefore we can claim that results are robust to the introduction of time-varying fixed effects under the PPML method, which is accepted to be the method that better suited for gravity model equations.

In column 1 on the left, where WTO+ provisions are kept at their initial 12 ranges, a third of the ranges of provisions are non-significant and even a strong negative impact is present in the sixth range. We previously argued that a breakdown in 12 ranges is affected by computational pitfalls due to lack of sufficient RTAs present at each range.

For this reason we would rather focus on results presented in column 4, 5 and 6. It is important to highlight that OLS estimates suggest that further integration seem to increase trade in a lesser way than the previous range of provisions, which is an intriguing result because it would suggest that trading with a RTA that has between 10 and 11 provisions will increase trade in a slower motion than implementing an agreement with only between 4 and 6 provisions under the traditional competence of the WTO+, and apart from this, the first range of provision is non-significant.

Results in Table 5 showed a clear impact of deeper agreements on trade and these results are supported here by estimates in column 6 that introduce time-varying fixed effects in a PPML specification. Therefore, results in column 6 of table 14 support the finding that bilateral exports flows increase with the number of provisions that are present in a RTA.

Table 14

Deep Integration: Additive indicator as a factor variable from WTO+. Divided into 12 and 5 ranges. TVFE robustness test. OLS, PPML and Baier and Bergstrand Method

	(1) $\ln X_{ijt}$	(2) $\ln X_{ijt}$	(3) X_{ijt}		(4) $\ln X_{ijt}$	(5) $\ln X_{ijt}$	(6) X_{ijt}
ad_WTO+2	-0.275	-0.596***	0.138*	*ad_WTO+2b*	0.069	-0.019	0.182***
ad_WTO+3	0.400**	-0.253	0.545***	*ad_WTO+3b*	0.555***	0.207***	0.381***
ad_WTO+4	0.011	0.401***	0.176**	*ad_WTO+4b*	0.479***	0.590***	0.522***
ad_WTO+5	0.075	0.550***	0.437***	*ad_WTO+5b*	0.265***	0.056	0.586***
ad_WTO+6	-0.453***	-0.375***	-0.256***				
ad_WTO+7	1.430***	0.412***	0.771***				
ad_WTO+8	0.596***	0.974***	0.606***				
ad_WTO+9	0.240***	0.207***	0.460***				
ad_WTO+10	0.456***	0.394***	0.386***				
ad_WTO+11	0.283***	0.087	0.320***				
ad_WTO+12	0.232	0.136	0.696***				
$lndist_{ijt}$	-1.497***		-0.757***		-1.488***		-0.776***
$contig_{ijt}$	0.751***		0.449***		0.762***		0.485***
$comlang_{ijt}$	0.589***		0.249***		0.593***		0.234***
$col45_{ijt}$	1.471***		0.138*		1.539***		0.164**
Observations	396794	107,373	161,015		396794	102,931	161,015
R-squared	0.735	0.365	0.911		0.734	0.358	0.907
Time Varying Exporter FE	YES	YES	YES		YES	YES	YES
Time Varying Importer FE	YES	YES	YES		YES	YES	YES
Country-pair FE	NO	YES	NO		NO	YES	NO
Time FE	NO	NO	NO		NO	NO	NO

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Own calculations.

Letter b at the end of variable's names means that ranges are grouped together, see table 3

OLS estimates with time-varying fixed effects on columns 1 of (Table 15) are unstable and even suggest a negative impact at sixth range of depth. This anomaly is corrected in column 4 where provisions are regrouped and where a rather strong but flat effect of the integration process is depicted.

PPML with time-varying country fixed effects in columns 3 and 6 produce estimates that are very close to PPML time invariant country fixed effects estimates confirming that at an early stage of the integration process the impact of going deeper in the integration of non-traditional WTO-X provision produce a greater impact on bilateral exports than it does at the final stage where diminishing returns seem to be at play.

The Baier and Bergstrand technique with OLS estimates and time-varying fixed effects and country-pair fixed effects in column 5 seems to amplify the effects that appear with PPML and time-varying country fixed effects on the four year interval basis presented in column 6, but the main conclusion of positive and significant results remains, in spite of a decline of the advantages of WTO-X deepening of integration that seem to arise at the final stage.

The institutional changes that WTO-X integration can induce to impact trade could need time to fully unfold. Columns 2 and 3 where the Baier and Bergstrand technique of using four year intervals is implemented first with OLS in and then with PPML could be reflecting this with respect to results in Column 1, but a grouping of 7 ranges continues to be harder to estimate than the more compact grouping of 4 ranges.

Table 15

Deep Integration: Additive indicator as a factor variable for WTO-X provisions: divided into 7 and 4 ranges. TVFE robustness test. OLS, PPML and Baier and Bergstrand Method

	(1)	(2)	(3)		(4)	(5)	(6)
	$\ln X_{ijt}$	$\ln X_{ijt}$	X_{ijt}		$\ln X_{ijt}$	$\ln X_{ijt}$	X_{ijt}
ad_WTO_X2	0.522***	0.103**	0.385***	*ad_WTO_X2b*	0.466***	0.146***	0.428***
ad_WTO_X3	0.185**	0.242***	0.476***	*ad_WTO_X3b*	0.418***	0.590***	0.528***
ad_WTO_X4	0.530***	0.623***	0.531***	*ad_WTO_X4b*	0.425***	0.277***	0.363***
ad_WTO_X5	0.402***	0.617***	0.458***				
ad_WTO_X6	-0.247***	0.110	0.783***				
ad_WTO_X7	0.658***	0.478***	0.323***				
$lndist_{ijt}$	-1.482***		-0.758***		-1.479***		-0.756***
$contig_{ijt}$	0.772***		0.495***		0.782***		0.498***
$comlang_{ijt}$	0.608***		0.218***		0.615***		0.216***
$col45_{ijt}$	1.541***		0.173**		1.527***		0.177**
Observations	399560	108,109	161,791		399560	108,109	161,791
R-squared	0.734	0.365	0.908		0.733	0.365	0.908
Country-pair FE	NO	YES	NO		NO	YES	NO
Time FE	NO	NO	NO		NO	NO	NO
Time varying Exporter FE	YES	YES	YES		YES	YES	YES
Time varying Importer FE	YES	YES	YES		YES	YES	YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Own calculations.

Letter b at the end of variable's names means that ranges are grouped together; see table 3

As can be seen in column 6 of table 16, our results in table 7 for DESTA classification of provisions are robust to the introduction of time-varying fixed effects while maintaining the PPML estimator in the four ranges grouping of provisions. Changes in the estimation method to OLS with time-varying fixed effect produce sensitive variations. Results are instable on the left of (Table 16) in columns 1 to 3 where the original ranges do not offer sufficient RTAs in each range to produce reliable estimates.

Table 16

Deep Integration: Additive indicator as a factor variable from DESTA: divided into 9 and 4 ranges. TVFE robustness test. OLS, PPML and Baier and Bergstrand Method

	(1)	(2)	(3)		(4)	(5)	(6)
	lnXij	lnXij	Xij		lnXij	lnXij	Xij
ad2_DES	0.375***	-0.131	0.201**	ad2_DESb	0.781***	0.123***	0.169***
ad3_DES	1.155***	0.404***	-0.437***	ad3_DESb	0.275***	0.562***	0.395***
ad4_DES	0.736***	0.127**	0.513***	ad4_DESb	0.327***	-0.044	0.621***
ad5_DES	0.473***	0.387***	0.291***				
ad6_DES	0.296***	0.354***	0.511***				
ad7_DES	0.108*	0.907***	0.486***				
ad8_DES	1.338***	0.349***	0.701***				
ad9_DES	-0.501***	-0.287***	0.630***				
$lndist_{ijt}$	-1.506***		-0.775***		-1.510***		-0.783***
$contig_{ijt}$	0.689***		0.451***		0.683***		0.464***
$comlang_{ijt}$	0.593***		0.240***		0.621***		0.260***
$col45_{ijt}$	1.505***		0.185**		1.497***		0.251***
Observations	410612	110,917	164,869		410612	110,917	164,869
R-squared	0.734	0.370	0.908		0.734	0.369	0.901
Time invariant Exporter FE	NO	NO	NO		NO	NO	NO
Time invariant Importer FE	NO	NO	NO		NO	NO	NO
Country-pair FE	NO	YES	NO		NO	YES	NO
Time FE	NO	NO	NO		NO	NO	NO
Time Varying Exporter FE	YES	YES	YES		YES	YES	YES
Time Varying Importer FE	YES	YES	YES		YES	YES	YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Own calculations.

Letter b at the end of variable's names means that ranges are grouped together; see table 3

Distilled indicators of depth are robust to the introduction of exporter and importer time varying fixed effects under the OLS estimator. The same general conclusions that point to a positive and significant impact of the depth of the agreements on bilateral exports stand valid. Specifications in level show a slightly upward shift for the WTO+ and the Rashc indicator, the latter being more pronounced. The log specification for the WTO+ MCA remains practically unchanged, while the log specification of the Rasch depth indicator presents an upward increase. The WTO-X provisions swing slightly downward in levels. It also shows a

more pronounced downward change in the logarithmic specification. The quadratics specification also reacts to this sensitivity analysis without changing their basic interpretation.

Table 17

Deep Integration Distilled Indicators : MCA and Rasch indicators in levels quadratics and log. OLS estimator with TVFE.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	lnXij	lnXij	lnXij	lnXij	lnXij	lnXij	lnXij	lnXij	lnXij	lnXij	lnXij	lnXij
mca_WTO+	0.159***	0.408***										
mca2_WTO+		-0.079***										
ln_mca_WTO+			0.357***									
mca_WTO_X				0.137***	0.311***							
mca2_WTO_X					-0.050***							
ln_mca_WTO_X						0.334***						
mca_WTO_Xr							0.140***	0.318***				
mca2_WTO_Xr								-0.051***				
ln_mca_WTO_Xr									0.341***			
rasch_DES										0.151***	0.996***	
rasch2_DES											-0.335***	
ln_raschs_DES												0.360***
$lndist_{ijt}$	-1.493***	-1.476***	-1.485***	-1.506***	-1.489***	-1.493***	-1.506***	1.489***	-1.493***	-1.555***	-1.517***	-1.540***
$contig_{ijt}$	0.794***	0.781***	0.788***	0.807***	0.790***	0.796***	0.806***	0.789***	0.796***	0.749***	0.707***	0.742***
$comlang_{ijt}$	0.633***	0.626***	0.629***	0.634***	0.627***	0.629***	0.634***	0.627***	0.629***	0.661***	0.652***	0.659***
$col45_{ijt}$	1.507***	1.522***	1.514***	1.520***	1.528***	1.525***	1.520***	1.528***	1.525***	1.534***	1.515***	1.536***
Observations	399,560	399,561	399,562	399,563	399,564	399,565	399,566	399,567	399,568	410,612	410,613	410,614
R-squared	0.733	0.733	0.733	0.733	0.734	0.735	0.736	0.737	0.738	0.739	0.734	0.739
Country-pair FE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Time FE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Time-varying exporter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time-varying importer FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 ; Source: Own calculations.

The Baier and Bergstrand technique facilitates the introduction of country-pair fixed effects together with time-varying country fixed effects. Here again, results in table 8 for distilled indicators remain robust. Rasch indicators bounce slightly upward in their level and log specification with little variation on quadratic. WTO+ and WTOx MCA depth indicator shift slightly downward in levels and present a more pronounced variation in their logarithmic specifications.

The downward shift induced on MCA depth indicators by the Bair and Bergstrand technique is more marked than without the inclusion of country-pair fixed effects. Quadratic forms also

shift downward without changing their main implications that point to the presence of diminishing returns in the integration process.

Table 18

Deep Integration Distilled Indicators: MCA and Rasch indicators in levels quadratics and log. OLS estimator with TVFE and pair-country FE using Baier and Bergstrand method.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Lnxij	lnxij	lnxij	lnxij	lnxij	lnxij	lnxij	Lnxij	lnxij	lnxij	lnxij	lnxij
mca_WTO+	0.111***	0.414***										
mca2_WTO+		-0.090***										
ln_mca_WTO+			0.262***									
mca_WTO_X				0.127***	0.308***							
mca2_WTO_X					-0.051***							
ln_mca_WTO_X						0.303***						
mca_WTO_Xr							0.126***	0.313***				
mca2_WTO_Xr								-0.053***				
ln_mca_WTO_Xr									0.301***			
rasch_DES										0.161***	0.267***	
rasch2_DES											-0.040**	
ln_raschs_DES												0.324***
Observations	108,109	108,109	108,109	108,109	108,109	108,109	108,109	108,109	108,109	110,917	110,917	110,917
R-squared	0.365	0.365	0.365	0.365	0.365	0.365	0.365	19,416	0.365	0.368	0.368	0.368
Time invariant exporter FE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Time invariant importer FE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Country-pair FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Time varying exporter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time varying importer FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Source: Own calculations.

2.6.3 Principal Components Analysis PCA robustness check

We perform a PCA to the WTO (2011) database to obtain a depth indicator of the RTAs. This indicator is based on the first dimension predicted by the procedure, which is that which captures most of the variability in the provisions distribution of the RTAs. The first dimension of the PCA explains 39.9% of the variability in the data for the WTO+ provisions, 34.2% for WTO-X and 35.7% for WTO-Xr. We test the PCA depth indicator in our gravity model using specifications in levels, quadratic forms and logarithm.

The first dimension of PCA depth indicators is strongly correlated with the first dimensions of MCA depth indicators. Some distinctions between MCA and PCA results are that PCA gives estimates for WTO+ and WTO-X provisions that are substantially reviewed downward.

In the case of WTO-X provisions tested in levels the PCA results are positive and statistically significant, but their economic significance is strongly reduced. The general conclusions drawn from MCA can be sustained under the PCA results presented in table 19, pointing to an increase in bilateral exports of around 2.3% after an increase in 10% on a PCA indicator of the depth of the agreements.

Table 19

Deep Integration Distilled Indicators: PCA indicators in levels quadratics and log. PPML estimator.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Xij	Xij	Xij	Xij	Xij	Xij	Xij	Xij	Xij
pca_WTO+	0.073***	0.124***							
pca2_WTO+		-0.008***							
Ln_pca_WTO+			0.235***						
pca_WTO_X				0.043***	0.147***				
pca2_WTO_X					-0.010***				
ln_pca_WTO_X						0.225***			
pca_WTO_Xr							0.042***	0.156***	
pca2_WTO_Xr								-0.011***	
ln_pca_WTO_Xr									0.229***
$lnGDP_{it}$	0.765***	0.755***	0.750***	0.745***	0.742***	0.740***	0.745***	0.740***	0.739***
$lnGDP_{jt}$	0.677***	0.666***	0.661***	0.662***	0.654***	0.653***	0.662***	0.651***	0.652***
$lndist_{ijt}$	-0.803***	-0.792***	-0.788***	-0.840***	-0.783***	-0.798***	-0.844***	-0.784***	-0.800***
$lnpop_{it}$	-0.115	-0.111	-0.128*	-0.142*	-0.140*	-0.148*	-0.152**	-0.156**	-0.159**
$lnpop_{jt}$	-0.275***	-0.277***	-0.296***	-0.318***	-0.321***	-0.331***	-0.327***	-0.338***	-0.343***
$contig_{ijt}$	0.483***	0.487***	0.486***	0.519***	0.489***	0.499***	0.520***	0.490***	0.500***
$comlang_{ijt}$	0.252***	0.246***	0.243***	0.288***	0.279***	0.276***	0.287***	0.279***	0.277***
$col45_{ijt}$	0.178***	0.183***	0.186***	0.164***	0.223***	0.196***	0.160***	0.220***	0.193***
$oecd_{it}$	0.262***	0.267***	0.263***	0.292***	0.262***	0.261***	0.294***	0.260***	0.260***
$oecd_{jt}$	0.184***	0.187***	0.182***	0.207***	0.177***	0.176***	0.209***	0.175***	0.175***
$gatti_{t}$	0.333***	0.325***	0.321***	0.323***	0.321***	0.322***	0.321***	0.321***	0.321***
$gatt_{jt}$	0.230***	0.221***	0.217***	0.224***	0.223***	0.220***	0.223***	0.223***	0.220***
Constant	-2.955*	-2.416	-1.471	-0.265	-0.336	0.262	0.117	0.441	0.770
Observations	588,262	588,262	588,262	588,262	588,262	588,262	588,262	588,262	588,262
R2	0.900	0.901	0.901	0.892	0.901	0.899	0.892	0.900	0.899
Time-invariant exporter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time-invariant importer FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-pair FE	NO	NO	NO	NO	NO	NO	NO	NO	NO
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Own calculations.

2.7 Discussion and Conclusion

This article investigates the hypothesis that deeper RTAs contribute more to increasing bilateral trade those that are shallow. After having tested different indicators for the depth of the agreements we found no evidence to refute this hypothesis. Deep integration indicators were computed from two different data sets and tested in different specifications. They were plugged respectively into the gravity equations in levels, quadratic and logarithmic form. For the additive indicators they were also tested as factor variable.

In the end, our research results for different indicators of the depth of RTAs have allowed us to confirm that deeper, rather that shallow, RTAs promote trade. A 10% increase on a measure of the depth of the integration increases bilateral international trade flows around a 4.0%.

We are now more aware that not all RTAs are equal, and that their heterogeneity plays an important role in explaining bilateral trade flows. This could imply that estimations of the average effect of PTA on trade interpretation should be nuanced as its effect will depend on the dose of the treatment. The average treatment effect of an RTA is around 0.4. This means the average effect for the whole number of observations of bilateral trade flows; not the effect of an average RTA because we do not really know for sure what an average RTA should be.

Consequently, our findings indicate that a larger dose of integration bears a more positive impact on trade than just the application of a shallow agreement. Additive indicators presented as factor variable contribute greatly to clearly capturing this behaviour. Hence, if the intention of signing a RTA is to increase trade, we now know that a deeper agreement will work better, at least, up to a certain limit. This study also contributes to clarifying the question of the importance of other provisions related to trade, but outside the traditional WTO framework of negotiation to expand trade. It shows that to introduce more provisions is profitable, in terms of trade creation.

However, the quadratic specification of the MCA and Rasch indicators suggests that as we advance in the process of integration, within or outside of the WTO traditional framework of provisions, the return of further liberalization on trade is decreasing. This could mean that the persistence in some developing countries of certain low standards, for instance, in environment protection, labour market regulation or IPR should be generating more international trade, but at the expense of other laudable objectives.

Our additive and MCA depth indicators results are robust to changes in the method of estimation to OLS, the Baier and Bergstrand technique and the introduction of time-varying country fixed effects. Additive indicators when treated as factor variables are sensitive to computations using the OLS method and time varying fixed effects. Nevertheless, they are robust to the introduction of time-varying country fixed effects preserving PPML as the method of estimation.

A sensitivity analysis of the additive depth indicators presented as factor variables confirm the finding that deeper agreements increase trade more than those which are shallow for WTO+ and DESTA classification of provisions in RTAs. A breakdown in three provisions confirms this pattern for WTO-X classification of RTAs too, but a positive and decreasing impact of non-traditional WTO-X provisions on trade at the latest stage of the integration for groupings of 4 and 5 ranges.

Finally, Principal Components Analysis depth indicators when tested in the gravity model produce estimates that are substantially below the estimates obtained with Multiple Correspondence Analysis MCA, but still suggest a positive and significant effect of deeper agreements on bilateral exports.

Defining the meaning of *deeper*, continues to represent a challenge, as well as, establishing which agreements are really enforceable. A more reliable deep integration indicator should present the European Union integration model as the deepest, or very close to being the deepest. Meanwhile, although not completely accurate, the depth indicators presented in this research provide sufficient elements to give us reliable clues regarding the direction of the impact of the heterogeneity of the agreements on trade.

More research on this field is still needed, in particular to identify the impact on trade creation of particular provisions or combinations of provisions.

Appendix 2A

Variable Sources for the Gravity Model

Bilateral Exports: International Monetary Fund (IMF), Direction of Trade Statistics Database DOTS (2013).

Current GDP and population: World Development Indicators (WDI) database, World Bank, (2013).

Area, Island and Landlocked, constructed by the author based on the World Factbook from the Central Intelligence Agency of the United States of America (CIA)

Weighted distance, contiguity, col45 and comlang_eth9: CEPII (2013): Head, K., Mayer, T. & Ries, J. (2010), Gravity dataset, obs. till 2006.

Regional Trade Agreements: constructed by the authors, based on the Regional Trade Agreements Information System (RTA-IS), World Trade Organization WTO (2013)

CEPII: Head, K., Mayer, T. & Ries, J. (2010), Gravity dataset, obs. Till 2006.
Rose, A. (2005) data set on The Multilateral (GATT/WTO) System and Trade obs. Till 1999

GATT membership: constructed by the authors based on the World Trade Organization WTO information (2013).

OCDE membership: constructed by the authors based on the Organisation de coopération et de développement économiques OCDE (2013) information.

Provisions analysis: WTO (2011) Research division for the World Trade Report and Design of Trade Agreements DESTA-WTI (2014).

https://www.wto.org/english/res_e/booksp_e/.../wtr11-anatomy_ptas_e.xls
http://www.designoftradeagreements.org/?page_id=884

Appendix 2B

Variable Definitions of Depth Indicators

ad_WTO: additive index of provisions under the regular WTO framework

ad2_WTO: ad_WTO squared

ln_ad_WTO: natural logarithm of (1+ ad_WTO).

ad_WTO_X: additive index of provisions out of the regular WTO framework.

ad2_WTO_X: ad_WTO_X squared

ln_ad_WTO_X: is the natural logarithm of (1+ ad_WTO_X) .

mca_WTO+: is a multiple component analysis index that captures the degree of depth of free trade agreements based on the number and combination of traditional WTO+ provisions.

mca2_WTO+: is mca_WTO+ squared.

ln_mca_WTO+: the natural logarithm of (1+ mca_WTO+).

mca_WTO_X: a multiple component analysis index from its first dimension of inertia that captures the degree of depth of free trade agreements based on the number and combination of provisions it presents out of the traditional WTO framework.

mca2_WTO_X: mca_WTO_X squared.

ln_mca_WTO_X: the natural logarithm of (1+ mca_WTO_X).

mca_WTO_Xr: a multiple component analysis index from its first dimension of inertia that captures the degree of depth of free trade agreements based on the number and combination of provisions it presents out of the traditional WTO framework, it doesn't include agro, ipr and investment as they are commonly negotiated under the WTO framework.

mca2_WTO_Xr: depth_mca_WTO_Xr squared.

ln_mca_WTO_Xr: the natural logarithm of (1 + mca_WTO_Xr).

ad_DES: additive indicator based on DESTA classification of the provisions that are present in the agreements

ad2_DES: ad_DES squared.

ln_ad_DES: the natural logarithm of (1 + ad_DES)

rasch_DES: index based on the Rash latent trade analysis from DESTA team that captures the depth of the integration.

rasch2_DES: rasch_DES squared.

ln_rasch_DES: the natural logarithm of (1 + rasch_DES).

pca_WTO+ : is a principal component analysis index that captures the degree of depth of free trade agreements based on the number and combination of traditional WTO+ provisions.

pca2_WTO+ : is pca_WTO+ squared.

Ln_pca_WTO+ : the natural logarithm of (1 + pca_WTO+)

pca_WTO_X : a principal component analysis index from its first dimension of inertia that captures the degree of depth of free trade agreements based on the number and combination of provisions it presents out of the traditional WTO framework.

pca2_WTO_X : is pca_WTO_X squared

ln_pca_WTO_X :is the natural logarithm of (1 + pca_WTO_X).

pca_WTO_Xr : is a principal component analysis index from its first dimension of inertia that captures the degree of depth of free trade agreements based on the number and combination of provisions it presents out of the traditional WTO framework, it doesn't include agro, ipr and investment as they are commonly negotiated under the WTO framework.

pca2_WTO_Xr : is pca_WTO_Xr squared

ln_pca_WTO_Xr : is the natural logarithm of (1 + pca_WTO_Xr).

Appendix 2C

Gravity Model List of Variables

X_{ijt} : value of the fob merchandise exports from country i to country j in millions of dollars

$lnGDP_{it}$, $lnGDP_{jt}$: natural logarithm for usd current gdp from countries i and j.

$lnpop_{it}$, $lnpop_{jt}$: natural logarithm for the population of countries i and j.

$lndist_{ijt}$: natural logarithm for distance between I and j

$contig_{ijt}$: 1 if there is a common land frontier between i and j

$comlang_{ijt}$: 1 if at least 9% of the pair population share the same language

$col45_{ijt}$: 1 if both countries were under a colonial relationship before 1945.

$gatt_i$, $gatt_j$: 1 if countries i/j. belong to the GATT/WTO

RTA_{ijt} : 1 If both countries share a free trade agreement.

$OECD_{it}$, $OECD_{jt}$: 1 if the countries i/j. belong to the OECD

G_{ijt} : Vector of dyadic variables

$\boldsymbol{S_{it}}$ **:** Vector of nomadic variables concerning the exporter country

$\boldsymbol{M_{jt}}$ **:** Vector of nomadic variables concerning the importer country

ϑ_g : Vector of coefficients related to the vector of dyadic variables

ψ_h : Vector of coefficients related nomadic variables concerning the exporter country

ϕ_h : Vector of coefficients related nomadic variables concerning the importer country

α_t, fixed effect for years

α_i and α_j : respectively time-invariant fixed effect for exporter and importer countries.

u_{ijt} idiosyncratic error term.

Appendix 2D:

Gravity Model Data Set: List of Countries

Albania	Djibouti	Korea, South	Russia

Algeria	Dominican Republic	Kuwait	Rwanda
Angola	Ecuador	Kyrgyzstan	Samoa
Argentina	Egypt	Latvia	Saudi Arabia
Australia	El Salvador	Lebanon	Senegal
Austria	Equatorial Guinea	Liberia	Sierra Leone
Azerbaijan	Estonia	Libya	Singapore
Bahrain	Ethiopia	Lithuania	Slovakia
Bangladesh	Fiji	Luxembourg	Slovenia
Barbados	Finland	Madagascar	South Africa
Belarus	France	Malawi	Spain
Belgium	Gabon	Malaysia	Sri Lanka
Belize	Gambia, The	Mali	Sweden
Benin	Georgia	Malta	Switzerland
Bermuda	Germany	Mauritania	Syria
Bolivia	Ghana	Mauritius	Tajikistan
Brazil	Greece	Mexico	Tanzania
Brunei	Grenada	Moldova	Thailand
Bulgaria	Guatemala	Mongolia	Togo
Burkina Faso	Guinea	Morocco	Tonga
Burundi	Guinea-Bissau	Mozambique	Trinidad and Tobago
Cambodia	Guyana	Nepal	Tunisia
Cameroon	Haiti	Netherlands	Turkey
Canada	Honduras	New Zealand	Turkmenistan
Cape Verde	Hong Kong	Nicaragua	Uganda
Central African Republic	Hungary	Niger	Ukraine
Chad	Iceland	Nigeria	United Arab Emirates
Chile	India	Norway	United Kingdom
China	Indonesia	Oman	United States
Colombia	Iran	Pakistan	Uruguay
Congo, Deomocratic	Iraq	Panama	Uzbekistan
Congo, Republic of the	Ireland	Papua New Guinea	Venezuela
Costa Rica	Israel	Paraguay	Vietnam
Cote d'Ivoire	Italy	Peru	Yemen
Croatia	Jamaica	Philippines	Zambia
Cuba	Japan	Poland	Zimbabwe
Cyprus	Jordan	Portugal	
Czech Republic	Kazakhstan	Qatar	
Denmark	Kenya	Romania	

Appendix 2E : Classification of Regional Trade Agreements by Traditional (WTO+) Provisions

Agreement	Year	SPS	TB	STE	AD	CVM	SA	PP	TRIM	GATS	TIPR

ASEAN free trade area	1992	0	0	0	0	0	0	0	0	0	0
ASEAN-Australia	2010	1	1	0	1	1	0	0	1	1	1
ASEAN-India	2010	1	1	0	0	0	0	0	1	1	1
ASEAN-Korea	2010	1	1	1	1	1	1	0	1	1	1
ASEAN-New Zealand	2010	1	1	0	1	1	0	0	1	1	1
Australia-New Zealand	1983	0	1	0	1	1	1	0	0	1	0
Australia-Singapore	2003	1	1	1	1	1	1	1	1	1	1
Australia-Thailand	2005	1	1	1	1	1	1	1	1	1	1
CAFTA-DR	2006	1	1	0	1	1	1	1	1	1	1
CAN	1988	0	0	0	0	0	0	0	0	1	0
Canada Colombia	2012	1	1	1	1	1	1	1	1	1	1
Canada-EFTA	2009	1	1	1	1	1	1	1	0	1	0
Canada-Peru	2009	1	1	1	1	1	1	1	1	1	0
CEFTA	2007	1	1	1	1	1	1	1	0	1	1
Chile Colombia1	1994	1	1	0	0	0	1	1	0	0	0
Chile Colombia2	2009	1	1	0	0	0	0	1	0	1	0
Chile-Australia	2009	1	1	1	1	1	0	1	1	1	1
Chile-China	2006	0	1	1	1	1	1	0	1	0	1
Chile-Japan	2007	1	1	1	1	1	1	1	1	1	1
Chile-Korea	2004	1	1	1	1	1	1	1	1	1	1
Chile-Peru1	1999	1	1	0	0	0	0	0	0	0	0
Chile-Peru2	2009	1	1	0	1	1	0	0	1	1	0
China-ASEAN	2005	0	0	0	1	1	0	0	1	1	0
China-Hong Kong	2004	0	0	0	1	1	0	0	0	1	0
China-New Zealand	2008	1	1	1	1	1	1	0	1	1	1
China-Pakistan	2007	1	1	0	1	1	1	0	0	0	0
China-Peru	2010	1	1	1	1	1	0	0	1	1	1
China-Singapore	2009	1	1	1	1	1	0	0	1	1	0
CIS	1994	0	1	0	1	1	1	0	1	0	0

Note: (SPS) Sanitary and phytosanitary measures, (TB) Technical barriers, (STE) State trading enterprises, (AD) Antidumping, (CVM) Countervailing measures
(SA) State aid, (PP) Public procurement, (TRIM) Trade-related investment measures, (GATS) Trade in services agreement, (TIPR) Trade-related intellectual property rights

Appendix 2E : Classification of Regional Trade Agreements by Traditional (WTO+) Provisions, Continuation …

Agreement	Year	SPS	TB	STE	AD	CVM	SA	PP	TRIM	GATS	TIPR

Colombia-MERCOSUR	2005	0	0	0	0	0	1	0	0	1	0
Colombia Cuba	2002	1	1	0	0	0	1	0	0	1	0
Colombia EFTA	2011	1	1	1	1	1	1	1	1	1	1
Colombia Northern Triangle	2009	1	1	1	1	1	1	1	1	1	1
COMESA	1994	1	1	0	1	1	1	0	0	1	0
EAEC	1997	0	0	0	1	0	1	0	0	1	0
EC Enlargement (10)	1958	0	0	1	1	0	1	0	1	1	1
EC Enlargement (12)	1986	0	0	0	0	0	1	0	1	1	0
EC Enlargement (15)	1995	0	0	0	0	0	1	0	1	1	0
EC Enlargement (25)	2004	1	1	1	0	0	1	1	0	0	0
EC Enlargement (27)	2007	1	1	0	1	1	1	1	0	0	0
EC-Albania	2006	0	1	1	1	1	1	1	0	0	1
EC-Algeria	2005	0	0	1	1	1	0	1	0	1	0
EC-Cameroon	2009	1	1	0	1	1	0	1	0	1	1
EC-CARIFORUM	2008	1	1	1	1	1	1	1	0	1	1
EC-Chile	2003	1	1	1	1	1	1	1	0	1	1
EC-Côte d'Ivoire	2009	1	1	0	1	1	0	0	0	0	0
EC-Croatia	2002	1	1	1	1	1	1	1	0	0	1
EC-Efta	1973	0	0	0	1	0	1	0	0	0	0
EC-Egypt	2004	0	1	1	1	1	1	1	0	0	1
EC-Israel	2000	1	1	1	1	1	1	1	0	1	1
EC-Jordan	2002	1	1	1	1	1	1	1	0	1	1
EC-Lebanon	2003	0	0	1	1	1	0	0	0	0	1
EC-Mexico	2000	1	1	0	1	1	0	1	0	1	1
EC-Morocco	2000	0	1	1	1	1	1	1	0	0	1
ECOWAS	1993	0	1	0	1	0	0	0	0	1	0
EC-South Africa	2000	0	1	0	1	1	1	1	0	0	1
EC-Syria	1977	0	0	0	1	0	0	0	0	0	0
EC-Tunisia	1998	0	1	1	1	1	1	1	0	0	1

Note: (SPS) Sanitary and phytosanitary measures, (TB) Technical barriers, (STE) State trading enterprises, (AD) Antidumping, (CVM) Countervailing measures
(SA) State aid, (PP) Public procurement, (TRIM) Trade-related investment measures, (GATS) Trade in services agreement, (TIPR) Trade-related intellectual property rights

Appendix 2E : Classification of Regional Trade Agreements by Traditional (WTO+) Provisions. Continuation …

Agreement	Year	SPS	TB	STE	AD	CVM	SA	PP	TRIM	GATS	TIPR
EC-Turkey	1996	0	1	1	1	1	1	1	0	0	1
EFTA-Israel	1993	0	1	1	1	0	1	1	0	0	0
EFTA-Korea	2006	1	1	1	1	1	1	1	0	1	1

EFTA-Peru	2012	0	0	0	0	0	0	1	1	1	0
GCC	2003	0	0	0	1	0	0	0	1	0	0
Group of Three	1995	1	1	0	1	1	0	0	1	1	1
India-Japan	2011	1	1	0	1	1	1	1	1	1	1
India-Malaysia	2011	1	1	0	1	0	0	0	0	1	0
India-Singapore	2005	1	1	1	1	1	1	0	1	1	0
India-Sri Lanka	2001	0	0	1	1	0	0	0	0	0	0
Japan-ASEAN	2008	1	1	0	1	1	0	0	1	1	0
Japan-Indonesia	2008	0	0	0	1	1	0	1	1	1	1
Japan-Malaysia	2006	1	1	0	1	1	0	0	1	1	1
Japan-Mexico	2005	1	1	0	1	1	0	1	1	1	1
Japan-Peru	2012	1	1	1	1	1	1	1	1	1	1
Japan-Philippines	2008	0	0	1	1	1	0	1	1	1	1
Japan-Singapore	2002	0	1	1	1	1	0	1	1	1	1
Japan-Switzerland	2009	1	1	1	0	0	1	1	1	1	1
Japan-Thailand	2007	0	0	0	1	1	0	1	1	1	1
Japan-Viet Nam	2009	1	1	1	1	1	1	1	0	1	1
Korea, Republic of-India	2010	1	1	1	1	1	1	1	1	1	1
Korea, Republic of-Singapore	2006	1	1	0	1	1	0	1	1	1	1
Korea-Peru	2012	1	1	1	1	1	1	1	1	1	1
MERCOSUR	1991	0	0	1	1	0	0	1	1	1	1
MERCOSUR-India	2009	1	1	1	1	1	0	0	0	0	0
Mercosur-Peru	2006	1	1	0	1	1	0	0	1	1	1
NAFTA	1991	1	1	1	1	1	1	1	1	1	1
PAFTA	1998	0	0	0	0	0	0	0	0	0	0
Russian Federation-Ukraina	1994	0	0	0	0	0	0	0	0	0	0
SAFTA	2006	0	1	0	0	0	0	0	0	0	0
Southern African Dev. Comm.	2000	1	1	0	1	1	0	0	1	1	1
Turkey-EFTA	1992	0	1	1	1	1	1	1	0	0	1
Ukraine-Belarus	2006	0	0	0	1	1	0	0	0	0	0
Ukraine-Kazakhstan	1998	0	0	0	0	0	0	0	0	0	0
Ukraine-Turkmenistan	1995	0	0	0	0	0	0	0	0	0	0
US-Australia	2005	1	1	1	1	1	1	1	1	1	1
US-Bahrain	2006	1	1	0	1	1	1	1	0	1	1
US-Chile	2004	1	1	1	1	1	1	1	1	1	1
US-Colombia	2012	1	1	1	1	1	1	1	1	1	1
US-Israel	1985	1	0	0	1	1	1	1	1	1	1
US-Jordan	2001	0	0	0	0	0	0	1	0	1	1
US-Morocco	2006	1	1	1	1	1	1	1	1	1	1
US-Oman	2009	1	1	0	1	1	1	1	1	1	1
US-Peru	2009	1	1	1	1	1	1	1	1	1	1
US-Singapore	2004	0	1	1	1	1	0	1	1	1	1

Note: (SPS) Sanitary and phytosanitary measures, (TB) Technical barriers, (STE) State trading enterprises, (AD) Antidumping, (CVM) Countervailing measures

(SA) State aid, (PP) Public procurement, (TRIM) Trade-related investment measures, (GATS) Trade in services agreement, (TIPR) Trade-related intellectual property rights

Appendix 2F : Classification of Regional Trade Agreements by Non-Traditional (WTO-X) Provisions

Agreement	Year	AC	CP	EN	IPR	IN	LB	MC	CP	DP	AG	AL	AU	IP	CC	EP	ET	EG	FA	HL	HR	II	ID	IC	IS	MI	ML	NS	PD	PA	RC	RT	SM	SO	ST	TX	TE	VA
ASEAN free trade area	1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ASEAN-Australia	2010	0	1	0	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
ASEAN-India	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ASEAN-Korea	2010	0	0	1	1	1	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0
ASEAN-New Zeland	2010	0	1	0	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Australia-New Zealand	1983	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Australia-Singapore	2003	0	1	0	1	1	0	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Australia-Thailand	2005	0	1	0	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
CAFTA-DR	2006	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAN	1988	0	1	0	0	0	0	1	0	0	1	1	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0
Canada Colombia	2012	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Canada-EFTA	2009	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Canada-Peru	2009	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CEFTA	2007	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chile Colombia1	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chile Colombia2	2009	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chile-Australia	2009	0	1	1	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Chile-China	2006	0	0	1	1	1	1	0	0	0	0	0	0	0	1	1	1	0	1	1	1	0	0	1	0	1	0	1	0	1	0	1	1	1	0	1	1	1
Chile-Japan	2007	0	1	0	0	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chile-Korea	2004	0	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Chile-Peru1	1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chile-Peru2	2009	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
China-ASEAN	2005	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
China-Hong Kong	2004	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
China-New Zealand	2008	0	0	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1
China-Pakistan	2007	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
China-Peru	2010	0	1	1	0	0	1	1	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	1	0	0	0	0	1
China-Singapore	2009	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1
CIS	1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Colombia (CAN)-MERCOSUR	2005	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Colombia-Cuba	2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Colombia-EFTA	2011	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Colombia-Northern Triangle	2009	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
COMESA	1994	0	1	1	0	1	1	1	0	0	1	0	0	0	1	1	1	1	1	1	0	0	1	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0
EAEC	1997	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1
EC Enlargement (10)	1958	0	1	1	0	0	1	1	1	0	0	1	0	0	0	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
EC Enlargement (12)	1986	0	1	1	0	1	1	1	1	0	1	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0
EC Enlargement (15)	1995	0	1	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EC Enlargement (25)	2004	0	1	1	1	0	1	1	1	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	0	1
EC Enlargement (27)	2007	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
EC-Albania	2006	0	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1
EC-Algeria	2005	1	1	1	1	1	0	1	1	1	1	1	0	0	1	0	1	1	1	0	1	1	1	1	1	1	1	0	1	0	1	1	0	1	1	0	1	0
EC-Cameroon	2009	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
EC-CARIFORUM	2008	0	1	1	1	1	1	1	0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0
EC-Chile	2003	0	1	1	1	1	0	1	1	1	1	0	1	0	1	1	1	1	0	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0	1	0
EC-Côte d'Ivoire	2009	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0

Note: (AC) Anticorruption, (CP) Competition policy, (EN) Environmental laws, (IPR) Itellectual property laws, (IN) Investment, (LB) Labour market regulation, (MC) Movement of capital, (CP) Consumer protection, (AG) Agriculture, (AL) Approximation of legislation, (AU) Audiovisual, (IP) Innovation policies, (CC) Cultural cooperation, (EP) Economic policy dialogue, (ET) Education and training, (EG) Energy, (FA) Financial assistance, (HE) Health, (HR) Human rights, (II) Illegal immigration, (ID) Illicit drugs, (IC), (IS) Information society, (MI) Mining, (ML) Money laundering, (NS) Nuclear safety, (PD) Political dialogue, (PA) Public administration, (DP) Data protection, (RC) Regional cooperation, (RT) Research and technology, (SM) Samall and medium entreprises, (SO) Social matters, (ST) Statistics, (TX) Taxation, (TE) Terrorism, (VA) Visa and asylum.

Appendix 2F : Classification of Regional Trade Agreements by Non-Traditional (WTO-X) Provisions. Continuation …

Agreement	Year	AC	CP	EN	IPR	IN	LB	MC	CP	DP	AG	AL	AU	IP	CC	EP	ET	EG	FA	HL	HR	II	ID	IC	IS	MI	ML	NS	PD	PA	RC	RT	SM	SO	ST	TX	TE	VA
EC-Croatia	2002	0	1	1	1	1	0	1	1	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1
EC-Efta	1973	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EC-Egypt	2004	0	1	1	1	1	0	1	1	0	1	1	1	0	1	0	1	1	1	0	1	1	1	1	1	0	1	0	1	0	1	1	0	1	1	0	1	0
EC-Israel	2000	0	1	1	1	0	0	1	0	0	1	1	1	0	1	0	0	1	0	0	1	1	1	1	0	0	1	0	1	0	1	1	0	1	0	0	0	1
EC-Jordan	2002	0	1	1	1	1	0	1	0	0	1	1	0	0	1	0	1	1	1	0	1	0	1	1	0	0	1	0	1	0	1	1	0	1	1	0	0	0
EC-Lebanon	2003	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EC-Mexico	2000	0	1	1	1	1	0	1	1	1	1	0	1	0	1	1	1	1	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	0
EC-Morocco	2000	0	1	1	1	1	0	1	0	0	1	1	0	0	1	0	1	1	1	0	1	0	1	1	1	0	1	0	1	0	1	1	0	1	1	0	0	0
ECOWAS	1993	0	0	1	0	1	0	1	0	0	1	0	0	0	1	0	1	1	0	0	0	0	0	1	1	0	0	0	1	0	1	1	0	1	0	0	0	0
EC-South Africa	2000	0	1	1	1	1	0	1	1	1	1	0	1	0	1	0	0	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	0
EC-Syria	1977	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EC-Tunisia	1998	0	1	1	1	1	0	1	0	0	1	1	0	0	1	0	1	1	1	0	1	0	1	1	0	0	1	0	1	0	1	1	0	1	1	0	0	0
EC-Turkey	1996	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EFTA-Israel	1993	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EFTA-Korea	2006	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EFTA-Peru	2012	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
GCC	2003	0	0	1	0	0	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Group of Three	1995	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
India-Japan	2011	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	1	0	1	1	0	0	0	1
India-Malaysia	2011	1	1	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1
India-Singapore	2005	0	1	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
India-Sri Lanka	2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Japan-ASEAN	2008	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0
Japan-Indonesia	2008	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1
Japan-Malaysia	2006	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Japan-Mexico	2005	0	1	1	1	1	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Japan-Peru	2012	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Japan-Philippines	2008	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Japan-Singapore	2002	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Japan-Switzerland	2009	0	1	0	1	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Japan-Thailand	2007	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1
Japan-Viet Nam	2009	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Korea, Republic of-India	2010	0	1	0	1	1	0	1	0	0	0	0	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1
Korea, Republic of-Singapore	2006	0	1	0	1	1	0	1	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Korea-Peru	2012	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MERCOSUR	1991	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MERCOSUR-India	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mercosur-Peru	2006	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
NAFTA	1991	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
PAFTA	1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Russian Federation-Ukraina	1994	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SAFTA	2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Southern African Dev. Comm.	2000	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Turkey-EFTA	1992	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ukraine-Belarus	2006	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ukraine-Kazakhstan	1998	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ukraine-Turkmenistan	1995	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
US-Australia	2005	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
US-Bahrain	2006	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
US-Chile	2004	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
US-Colombia	2012	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
US-Israel	1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
US-Jordan	2001	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
US-Morocco	2006	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
US-Oman	2009	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
US-Peru	2009	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
US-Singapore	2004	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: (AC) Anticorruption, (CP) Competition policy, (EN) Environmental laws, (IPR) Itellectual property laws, (IN) Investment, (LB) Labour market regulation, (MC) Movement of capital, (CP) Consumer protection, (AG) Agriculture, (AL) Approximation of legislation, (AU) Audiovisual, (IP) Innovation policies, (CC) Cultural cooperation, (EP) Economic policy dialogue, (ET) Education and training, (EG) Energy, (FA) Financial assistance, (HE) Health, (HR) Human rights, (II) Illegal immigration, (ID) Illicit drugs, (IC), (IS) Information society, (MI) Mining, (ML) Money laundering, (NS) Nuclear safety, (PD) Political dialogue, (PA) Public administration, (DP) Data protection, (RC) Regional cooperation, (RT) Research and technology, (SM) Samall and medium entreprises, (SO) Social matters, (ST) Statistics, (TX) Taxation, (TE) Terrorism, (VA) Visa and asylum.

Chapter 3
Trade Potentials between Colombia and the European Union

3.1 Introduction

Left behind by Chile and Mexico prolific trade policy of the last thirty years, Colombia faced a competitive disadvantage in the Latin American and the Caribbean region. This fact, added to a relative weak opposition to the liberal ideas promoted by the incumbent administrations, gave birth to a wave of trade liberalization negotiations that closed important trade agreements with USA, Canada, Central American and EFTA countries. On March 2010, Colombia and Peru formally culminated negotiations to liberalize trade and investments with the European Union. This agreement (OJEU, 2012) entered into force on 1 March 2013 (WTO, 2015) for Peru and on 1 August with Colombia.

Free trade agreements are supposed to increase trade among their members, Kohl (2014). But, is there really a gap to close between observed and potential trade between Colombia and EU? Or to the contrary, is Colombia already trading more than what should be considered normal with EU countries. In this paper, we will try to answer the question about the existence of untapped trade potentials between Colombia and EU countries in both directions: exports from Colombia to EU countries and exports from EU countries to Colombia.

To identify if trade potentials exist between EU countries and Colombia we require to have a view on what would constitute a "normal" trade relationship for these bilateral trade flows. The gravity model sets up a theoretical framework to tackle this question empirically. We then estimate it using up-to-date estimation methodologies, mainly the Poisson Pseudo Maximum Likelihood estimator.

This chapter will provide evidence of the presence of overtrading or undertrading for Colombia's bilateral trade flows with EU countries and a set of interesting markets, as well as from these markets towards Colombia.

Predictions indicating a trade pattern less than the observed can be interpreted in many ways: they could stem from short-term deviations, structural restrictions or even as a problem of model specification. Yet a combined analysis of trade potentials with the study of the evolution and particularities of the bilateral relationship, can lead us to interpret *undertading* as a potential gap that the exporter country could realize.

Trade potential identification could be a valuable input to focus trade policy where it could be more effective and help define sells expansion plans in the international markets at the firm level. We also hope to open up the way to future research on the ex post impact on the agreement.

Following this introduction, this manuscript will put forward a literature review on trade potentials; then, a data and methodology section; after which, another section will present results and make a sensitivity analysis. Finally, a discussion and conclusion section will take place.

3.2 Literature Review

Some of the pioneer articles in trade potentials were interested in Central Eastern Europe CEEC countries. These countries presented a distorted pattern of trade that was supposed to find its natural equilibrium in a more open environment. (Wang and Winters, 1992) working with data for 76 countries from 1984-1986 predicted a reconfiguration of cross-border transactions concerning these economies. They found a relative overtrading pattern with West Europe and projected a rise on exports to the USA and Japan. Keeping the same sample (Hamilton and Winters, 1992) estimated that former Soviet Union and Eastern Europe countries trade with market economies was dramatically short of its trade potential and that trade had to rise mainly with USA, Germany and UK.

Baldwin (1994) found that "even at 1989 CEEC income levels, EFTA-CEEC trade should have been four times greater". Variations across countries were found. For example, Bulgaria

observed trade with the EU was five times smaller than its potential while Hungary's was closer to equilibrium due to anticipated trade liberalization programs.

Grosa and Andrzej (1996) took Baldwin (1994) as a benchmark and focused their attention on the most advanced transition economies the Czech Republic, Slovakia, Hungary and Poland, considering data for 1992 found relatively exhausted trade potentials for CEEC towards EU markets, meaning that the reorientation of trade flows was already accomplished. (Bullhart and Kelly, 1999) focused on Ireland's Trading Potential with CEEC. Applying out-of-sample OLS estimates to a 1994 data cross-section for 24 countries, determined that the main five CEEC were trading below half their potential with Ireland, while Ireland's bilateral flows were around their normal level with all other countries in the sample.

Another gravity model application to trade potentials for South Eastern European Countries is (Christie, 2002) who estimated pooled cross sections with OLS for years 1996-1999. Large deviations between observed and predicted bilateral flows were found particularly among Balkans countries in what could be considered unnatural trade relationships derived from the war.

Reviewing Central and South Eastern Europe countries integration with the euro area (Bussière, Fidrmuc and Schnatz, 2008) on a panel of 61 countries for 1980-2003 estimated with OLS fixed effects found that potentials with the euro area for the new EU members were relatively of little scope, while considerable potentials were still available for Albania, Bosnia-Herzegovina, Macedonia and Croatia according to the out-of-sample trade potential indicator.

(Martínez and Nowak, 2003) performed an application on EU-Mercosur trade potentials using panel data. They estimated an OLS fixed effect gravity model on a sample of 20 countries with a 1988-1996 time span. They found that in 1996 Mercosur traded below its potential with every single country of the EU.

Based on a 1967–2001 panel for 45 countries (Antonucci and Manzocchi, 2006) explored Turkey trade potentials with EU countries, finding that bilateral trade flows between Turkey and EU countries was around the normal rule prediction of their OLS fixed effects gravity model estimations.

In one of the most recent studies, Péridy (2012, 9), following an out-of-sample methodology, found that Mediterranean partners have exhausted their trade potentials with the European

Union. He opted for the Hausman and Taylor estimator, which is a 2SLS random effect model to estimate a gravity equation on 67 countries for the years 2000-2009. In (Péridy, 2006) it was found that even though much of the old members of the EU neighbourhood policy or early liberalisers had exhausted their potentials, new members like South Caucasus and Balkans countries still had trade potentials to fulfil. (Péridy, 2005) revealed limited trade potentials among the Agadir Agreement member states based on a dynamic ABB gravity model, this in spite of the fact that only a tiny fraction of total trade was completed among this free trade area.

Pointing to evaluate African regional integration schemes, (Rojid, 2006) estimated a gravity model using a Tobit specification on a 1980–2001 panel data set for 147 countries. According to his results, COMESA countries were overtrading within them and trade potentials only remained available for the Angola and Uganda cases.

China trade integration in the world is more than accomplished, that is what (Bussière and Schnatz, 2007) confirmed through their OLS fixed effects estimations of a gravity model across 61 countries for the span from 1980 to 2003. To avoid omitted variable bias, they adjust residuals with a new empirical indicator of trade integration that takes into account country average trade links or trade intensity. Possible trade potentials for China were found with India, Portugal and Luxembourg.

Pakistan presents considerable trade potentials with Japan, Sri Lanka, Bangladesh, Malaysia, the Philippines, New Zealand and Norway. That is what (Gul and Yasin, 2011) found through an out-of-sample technique based on a gravity model with fixed effects across 42 countries for the 1981-2005 time span.

India's global trade potentials were documented in Batra (2006). He applied OLS to a gravity equation for 146 countries on a year 2000 cross section. Trade Potentials were found mainly in the Asia-Pacific, Western Europe and CIS region. Georgia, Turkmenistan and Uzbekistan were found trading more than ten times below its potential level. Much of the predicted trade expansion was to be attained with China, United Kingdom, Italy and France.

(Masudur Rahman and Arjuman Ara, 2010) using OLS random and fixed estimated a gravity equation on a panel 1995-2007 for 81 countries. Their results point out "that a large part of Bangladesh's potential trade has remained unrealized". Based on these findings they claim that Bangladesh trade policy should focus on partner diversification strategies. (Masudur

Rahman, 2010) explored global trade potentials for Australia. He estimated with OLS a regression for a 50 countries cross-section gravity equation on 2001 and 2005 data. His results for 2005 data revealed substantial trade potential with Argentina, Portugal, Greece, Chile, Philippines and the Russian Federation. Trade with these countries presented the possibility of a rise of at least three times their actual level to attain the gravity model predicted values.

Boughanmi, H. (2008) on a 1990-2004 pooled cross-section OLS estimation of a gravity model for 88 countries concludes that Gulf Cooperation Council GCC intra block trade had already attained their potential. Unexpectedly, they were below their potential with Maghreb countries after ten years of the GAFTA agreement.

In 2012 Russia became an official WTO member state. The perspective of its forthcoming commitment with international trade rules generated big expectations. To explore this subject (Babetskaia-Kukharchuk and Maurel, 2004) estimated a gravity equation by the Hausman-Taylor estimator controlling for individual effects on a 1994-2001 data panel for 42 countries. They found that CIS trade with non-CIS countries in the sample offered a considerable trade potential. An important rise in trade was expected after the Russian accession to the WTO due to institutional improvements.

In an application on South Korea (Sohn, 2005) determined that unrealized trade potentials were present with Japan and China and suggested further negotiations to close a free trade agreement to facilitate trade across these nations. He worked with 1995 data on a sample of bilateral exports for 31 countries and 23 desegregated sectors.

We find critics to out-of sample and in-sample computation of trade potentials in Egger (2002) who estimates a gravity model with OLS for a sample of OECD countries and 10 Central and Eastern European Countries over the period 1986-1997. He considered that much of the biggest gaps between predicted and observed flows derived for a misspecification of the model. In a previous work (Breuss and Egger, 1999) Egger had also analysed the reliability of CEEC trade potentials estimations and had concluded that large forecast interval spans around the predicted values for cross-sectional estimations were common, therefore predictions of a rise in exports in absolute terms were questionable based on predicted vs. observed bilateral export ratios.

Other alarms concerning the choice of the sample and multilateral resistance bias go off from (Fontagné, Pajot, and Pasteels, 2002) who worked with a sample of 74 countries for averaged data on years 1995-1996. They also suggest that some corrections to obtain a closer adjustment between fitted and observed trade could be needed to achieve a better interpretation of trade potentials.

In the same vein, Luca De Benedictis & Claudio Vicarelli (2005) who working with a panel of 11 European and 31 OECD countries estimated a gravity model with OLS and found that results were sensible to dynamics and country heterogeneity. These authors suggested that the sign of a country potential yearly average had to be considered with caution to declare the existence or inexistence of unrealized trade potentials.

On one of the most influential papers applying quantitative methods to understand Colombia's international trade relationships is (Cárdenas & García, 2004). They estimated a 178 countries gravity equation with OLS for the period 1948-1999. They found a negative fixed effect for Colombia that they interpreted as a general undertrading position relative to all other countries. As their objective was to nail down the expected impact of a free trade agreement between Colombia and USA they didn't delve into which particular countries offered to Colombia an untapped potential to increase exports or imports. They predicted a 40% increase in trade between Colombia and the USA, after discounting the GSP effect from the RTA effect they found.

In an analysis of the impact of the European GSP in Colombia's Exports (Correia, 2008) found little success for this scheme of preferences to promote Colombia's exports. Results were derived from OLS gravity model estimations including country fixed effects for 167 countries from 1991 to 2005.

(Umaña, 2011) revived the need to better explore Colombia's international trade. He predicted a positive expected impact for the Colombia – USA and the Colombia –EU free trade agreements. This, by combining a Computable General Equilibrium model for 45 countries with data for the year 2009 based on results from a gravity equation on 208 countries and data for 1948-2006 estimated with Poisson Pseudo Maximum Likelihood and fixed effects. Nevertheless, no information about trade potentials for Colombia is retrievable from this study.

We are confident that the application of a Poisson Pseudo Maximum Likelihood estimator and the possibility that panel data offers to control for country heterogeneity and multilateral resistance on a reasonably large group of countries over many years will produce reliable trade potential results.

3.3. Data and Methodology

3.3.1 Model Specification

The gravity model explains bilateral international trade flows X_{ijt} from country i to country j, for a given year t, as a function of on the size of both economies y_{it} and y_{jt} and transaction cost t_{ijt}. The world nominal income is represented by Y^W and θ_i and θ_j are shares of world income. The term σ is the elasticity of substitution between all goods. Distance has been considered one the most important transaction cost. Alongside it we find other geographical, cultural and institutional factors like the presence of a common border, the use of a common language, the sharing of historic colonial links, legal systems and free trade agreements. We present the variable definitions for our gravity model application in appendix A.

The following is theoretical gravity model proposed by (Anderson and Van Wincoop, 2003):

$$Eq(1)\ \ x_{ij} = \frac{y_i\, y_j}{y^w}\left(\frac{t_{ijt}}{P_i \Pi_j}\right)^{1-\sigma}$$

Where

$$Eq(2)\ \ \Pi_i = \left(\sum_j \left({t_{ij}}/{P_j}\right)^{1-\sigma} \theta_j\right)^{1/(1-\sigma)}$$

and

$$Eq(3)\ \ P_j = \left(\sum_i \left({t_{ij}}/{\Pi_i}\right)^{1-\sigma} \theta_i\right)^{1/(1-\sigma)}$$

The terms (P_i and Π_j) are non-observable variables representing multilateral resistance. To avoid endogeneity problems due to unobservable heterogeneity the introduction of time invariant fixed effects from importer and exporter countries has become customary. In this paper we also introduce exporter and importer time varying fixed effects to control for omitted variable derived from multilateral resistance and any other source of non-constant unobserved variation across countries over time.

We estimate our models with the (Santos Silva and Tenreyro 2006, 2011) Poisson Pseudo Maximum Likelihood (PPML) estimator. Another estimator we use is the (Simcoe, 2008) Fixed-Effect Poisson Pseudo Maximum Likelihood estimator (XTPQML). This estimator permits to control for observed and unobserved heterogeneity at the country-pair level that is constant over time.

Our first model consist of a Poisson Pseudo Maximum Likelihood specification controlling for a set of dyadic variables, time varying fixed effects for exporters and importers, time invariant fixed effects for exporters and importers and year fixed effects.

$$Eq(4) \quad X_{ijt} = \exp(\beta_0 + \varphi_g Z_{ijt} + \alpha_t + \alpha_i + \alpha_j + \alpha_{it} + \alpha_{jt})\, u_{ijt}$$

Where our dependent variable X_{ijt} represents bilateral fob exports values in millions current dollars from country i to country j; α_t stands for time fixed effects, α_i and α_j are exporter and importer time invariant fixed effects; α_{it} and α_{jt} are time varying exporter fixed effects and time varying importer fixed effects respectively; u_{ijt} is an idiosyncratic error term. Likewise, $\boldsymbol{Z_{ijt}}$ is a vector dyadic variables that help minimizing possible bias that consist of RTA_{ijt}, $contg_{ijt}$, $comlang_{ijt}$, $col45_{ijt}$ *and* $lndist_{ijt}$; and φ_h is a vector of coefficients to be estimated concerning these dyadic variables where the subscript g indicate the variables. The idyosincratic error term $u_{ijt} = \exp((1-\sigma)\mathcal{E}_{ijt})$.

More precisely, $lndist_{ijt}$ represent the natural logarithm of the weighted distance between countries i and j; $contig_{ijt}$ takes on 1 if there is a common land frontier between i and j, 0 otherwise; $comlang_{ijt}$ takes on 1 if at least 9% of the pair population share the same language,

0 otherwise, $col45_{ijt}$ takes on 1 if both countries were under a colonial relationship before 1945 and 0 otherwise, and RTA_{ijt} takes on 1 if both countries share a free trade agreement and 0 otherwise.

Our second model in Eq(5) is a Poisson Pseudo Maximum Likelihood specification controlling for a set of dyadic and non-dyadic variables, here we do not include time varying fixed effects while maintaining time invariant country fixed effects for exporters and importers and year fixed effects.

$$Eq(5) \quad X_{ijt} = \beta_0 + \varphi_g \boldsymbol{Z_{ijt}} + \psi_h \boldsymbol{S_{it}} + \phi_h \boldsymbol{M_{jt}} + \alpha_t + \alpha_i + \alpha_j + u_{ijt}$$

Where $\boldsymbol{S}_{it}$ and $\boldsymbol{M_{jt}}$ are vectors of time varying monadic controls for exporters and importers respectively composed of h variables: $lnGDP_{it}$, $lnpop_{it}$, $OECD_{it}$ and $GATT_{it}$, as well as, $lnGDP_{jt}$, $lnpop_{jt}$, $OECE_{jt}$ and $GATT_{jt}$.

Here, ψ and ϕ are vectors of coefficients to be estimated concerning the above control variables and the subscript h indicates variables.

Variables $lnGDP_{it}$ and $lnGDP_{jt}$ are the natural logarithm for current dollars GDPs from countries i and j; $lnpop_{it}$, $lnpop_{jt}$ are natural logarithm for the population in number of habitants of countries i and j. Respectively $GATT_{it}$ and $GATT_{jt}$ that take on 1 if countries i/j belong to the GATT/WTO. $OECD_{it}$ and $OECD_{jt}$ take on 1 if the countries i/j belong to the Organization of Economic Cooperation and Development OECD.

Our third model is a Fixed Effect Poisson Pseudo Maximum Likelihood specification controlling for a set of time varying non-dyadic variables, country-pair fixed effects and year fixed effects

$$Eq(6) \quad X_{ijt} = \beta_0 + \psi_h \boldsymbol{S_{it}} + \phi_h \boldsymbol{M_{it}} + \alpha_{ij} + \alpha_t + u_{ijt}$$

In Eq(6) α_{ij} defines pair-country fixed effects. All time invariant variables are drop from the equation due to multicollinearity.

3.3.2 Variable Sources for the Gravity Model

- Bilateral Exports Fob values in millions current dollars. (X_{ijt}). International Monetary Fund (IMF), Direction of Trade *Statistics* Database DOTS (2013).

- GDP in millions current dollars, population in number of habitants and urban participation in percentages ($lnGDP_{it}$; $lnGDP_{jt}$; $lnpop_{it}$; $lnpop_{jt}$): World Development Indicators (WDI) database, World Bank, (2013).

- Weighted distance in Km, Common land border and Colonial Links ($lndist_{ijt}$; $contig_{ijt}$; $comlang_eth9_{ijt}$; $col45_{ijt}$) : CEPII (2013): Head, K., Mayer, T. & Ries, J. (2010), Gravity dataset.

- Regional Trade Agreements (rta_{ijt}): constructed by the author, based on the Regional Trade Agreements Information System (RTA-IS), World Trade Organization WTO (2013). Also de Sousa, J. (2012), "The currency union effect on trade is decreasing over time", Economics Letters, 117(3), 917-920. http://jdesousa.univ.free.fr/data.htm

- GATT membership ($gatt_{it}$; $gatt_{jt}$): constructed by the author based on the World Trade Organization WTO information (2013).

- OECD membership ($oecd_{it}$; $oecd_{jt}$) : constructed by the author based on information from the Organisation the Organization for Economic Co-operation and development OECD (2013).

3.3.3 Trade Potentials methodological issues

An out-of sample approach was needed to estimate trade potential for transition economies because no suitable counterfactual was discernible from the available data at the time. A sample of 153 countries over 33 years makes it possible a within-sample approach for Colombia as this country has remained relatively well inserted in cross-border exchanges, similar countries are also present in the sample while enough country heterogeneity guarantee a good counterfactual in a gravity model.

An intuitive and direct form to present trade potentials is by the means of the ratio between bilateral exports fitted values and its respective observed values.

$$Eq(7)\ Trade\ Potential\ indicator = \left[\frac{\hat{x}_{ijt}}{x_{ijt}}\right]$$

Where x_{ijt} are the observed bilateral exports from country i to country j for each year t, and $\hat{x}_{ijt}$ are bilateral exports fitted values.

Results above one define an overtrading condition and results below one an undertrading relationship. Nevertheless, comparisons of this indicator are a little difficult to the eye. For example, a couple of countries that are 40% above the normal trade pattern will be read 1.400 while when 40% bellow it will be read 0.714.

Another way to present trade potentials is calculating a Relative Residuals ratio, and then multiplying it by 100. The following formula proposed by (Pasteels, 2006) resumes this indicator:

$$Eq\ (8)\ \ Trade\ Potential\ Relative\ Residuals\ Indicator = \left[\frac{\hat{x}_{ijt} - x_{ijt}}{x_{ijt} + \hat{x}_{ijt}}\right] * 100$$

The within-sample trade potential indicator based on gravity equation residuals, expressed in relative terms, swings between -100% and +100%. Positive (negative) values of this ratio indicate that country i exports to country j are below (above) the reasonable level predicted by the model.

If the indicator is near 0% then predicted trade is close to current trade. Negative values imply an overtrading position and positive values indicate undertrading. Some kind of threshold could be useful to better declare bilateral trade positions. Consequently, (Pasteels, 2006) suggest that if the indicator is above 30%, then untapped trade potential clearly exists and if below 30% strong current trade is already happening

Noteworthy, (Pasteels, 2006) suggestion of a threshold for Relative Residuals at the 30% level is preferable than just the sign of the trade potential statistic as criteria to define its existence, because values near zero should not be easily taken as overtrading or overtrading flows. However, we would relax the 30% threshold because it could be too conservative, in particular when the three years average and the 2012 relative residuals indicate the same conclusion.

Periods and panel balance

Our 1980-2012 panel based on DOTs statistics is unbalanced, mainly due to country appearances and disappearances, but also because of statistical collection restrictions, e.g. Belgium, Luxembourg and South Africa. With the pass of time more countries report a larger number of trading partners, this means a more balanced panel data structure. At the same time the proportion of flows declared with zero diminish.

Given that a balanced panel configuration would be a preferable approach to make predictions, we also compute statistics for a 2000-2012 panel, this shorter framework although not yet completely balanced, guarantee the inclusion of observations for all the countries in the sample at the same time and a more balanced structure of country pairs relationships. Thus, relative residuals trade potential statistics for a 2000-2012 panel will be presented in tables next to the 1980-2012 trade potentials. A trade-off is then at play, as switching from the larger to the shorter panel to win a more balance structure make us loose historic data.

Averaged vs. snapshot prediction

Other issue to consider is related with the fact that providing relative residuals comparisons only for a single year snapshot, 2012, which is the last year in our sample, could be affected by exogenous transitory shocks. Developing countries could be prone to this kind of events as their exporting base is less diversified, then vulnerable to shocks. Hence, we compute an average of relative residuals trade potentials for the last three years of our sample (2010, 2011 and 2012) to account for the sensibility to this kind of punctual fluctuations. The assumption here is that if a trade potential appears in a three-year average measure, as well as in the snapshot for 2012, its appearance would be less attributable to transitory short-term shocks or measurement errors. We present these results for both period of analysis 1980-2012 and 2000-2012.

Econometrics methods

Equation 4 to 6 summarizes the three main models we use to compute relative residuals in the pursuit of trade potentials. Given that Eq (6) or the pair-country fixed effect specification estimated by the XTPQML command in Stata also known as the (Simcoe, 2008) Poisson pair

fixed effects method generates fitted values that are not suitable to compute trade potentials, Santos-Silva & Tenreyro (2015)[8] suggest a parameter of adjustment to obtain zero mean residuals. This parameter θ_{ij} is the ratio between the mean of observed exports by cluster of bilateral exports or pairs and the mean of its respective fitted values. Each fitted value is then adjusted by the respective θ which is a constant for all observations within its cluster. This is comparable to a pair fixed effect.

Adjustment factor: $\theta_{ijt} = \frac{\frac{1}{t}\sum_{t=1}^{t} X_{ijt}}{\frac{1}{t}\sum_{t=1}^{t} \hat{X}_{ijt}}$ for each cluster of bilateral exports.

We also apply this adjustment factor to PPML fitted values to review its sensibility. Nevertheless, PPML adjusted models not necessarily need to be taken as the correct specification to follow. One of the noteworthy consequences of these adjustments concerns zero flows. PPML non-transformed models will predict a positive flow in a historical zero flow bilateral relationships that will generate a 100% relative residual or an absolute trade potential. Conversely, adjusted PPML models will predict a zero when the historical bilateral relationship is a zero flow series, and then no trade potential at all.

We think that PPML with time varying fixed effects without adjustment is a better benchmark to consider because this specification fully controls for unobserved variable bias and its residuals are zero mean, but is useful to know its adjusted transformation for comparisons.

Putting Colombia – EU trade potential in context

To put Colombia and EU countries trade potential in context we also present results for other 12 interesting markets. These countries are USA, China, Japan, Brazil, India, Russia, Canada, Australia, Korea Republic, Turkey and Switzerland. Their selection was made mainly based on the size of their economies.

To make easier the comprehension of our tables we prefer only to display statistics for bigger markets, as the economic value of their possible potentials is of greater interest. Yet, small

[8] http://privatewww.essex.ac.uk/~jmcss/LGW.html

size EU markets: Cyprus, Bulgaria, Estonia, Latvia, Lithuania, Luxemburg, Malta, Slovenia and Slovakia are considered to calculate the EU average relative residuals. Croatia was not an official member of EU in 2012.

Five specifications are then calculated to evaluate trade potentials Relative Residuals: The first one comes stems from Eq(4) and is estimated with PPML and country time-varying fixed effects TVFE; the second, is the specification in Eq(5) which contains country time invariant fixed effects TIFE, but not TVFE. Specifications 3 and 4 are their adjusted with θ_{ijt} versions of Relative Residuals. Finally, specification 5 is derived from Eq(6) that is estimated with XTPQML country-pair fixed effects and is adjusted with θ_{ijt} .

3.4. Results

We begin to present regression results for the three different specifications that we selected to compute trade potentials, see table 1. After that, four figures that resume the trade position of bilateral relationships in five categories that order the intensity of the gap between predicted and observed bilateral exports will be exposed.

Because combined analysis of trade potential and export evolution can give a better insight to the strength of these potentials, a graphic analysis displaying the evolution of bilateral trade and their projected flows will complement the relative residuals or trade potential analysis.

Results from the gravity model estimations resumed in table 1 are theoretically sound for columns (1) and (2) corresponding to the PPML estimator and the longer period of analysis. Some important differences appear between the PPML and XTPQML estimations: RTA estimates are underestimated in columns (3) and (6). The impact of the population size and OECD membership are non-significant in columns (5) and (6) corresponding to models computed on the 2000-2012 sample. Dyadic variables estimates from PPML are robust to the change in the time span. PPML deals better than XTPQML with zero registered flows including more observations in the analysis. Fitted values from the regressions resumed in table 1 will be used to compute trade potentials. These can be seen in figures 1 to 4.

Table 1

PPLM and XTPQML Regressions on 153 countries from 1980 to 2012 and 2000 - 2012

	1980-2012	2000-2012

	PPML	PPML	XTPQML	PPML	PPML	XTPQML
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}
rta_{ijt}	0.397***	0.407***	0.140***	0.365***	0.371***	0.078***
	(0.018)	(0.017)	(0.037)	(0.021)	(0.021)	(0.029)
$gatt_{it}$		0.280***	0.307***		0.188***	0.224***
		(0.039)	(0.051)		(0.069)	(0.040)
$gatt_{jt}$		0.175***	0.196***		0.116*	0.158***
		(0.033)	(0.054)		(0.060)	(0.043)
$lnGDP_{it}$		0.729***	0.744***		0.624***	0.632***
		(0.024)	(0.034)		(0.040)	(0.027)
$lnGDP_{jt}$		0.644***	0.670***		0.641***	0.653***
		(0.022)	(0.035)		(0.037)	(0.041)
$lndist_{ijt}$	-0.770***	-0.761***		-0.792***	-0.789***	
	(0.009)	(0.009)		(0.012)	(0.012)	
$contig_{ijt}$	0.471***	0.488***		0.452***	0.459***	
	(0.016)	(0.016)		(0.021)	(0.020)	
$comlang_{ijt}$	0.261***	0.258***		0.228***	0.226***	
	(0.016)	(0.016)		(0.021)	(0.021)	
$col45_{ijt}$	0.251***	0.244***		0.243***	0.246***	
	(0.039)	(0.041)		(0.054)	(0.054)	
$oecd_{it}$		0.240***	0.258***		0.026	0.014
		(0.043)	(0.096)		(0.106)	0.035
$oecd_{jt}$		0.157***	0.209***		0.064	0.064
		(0.039)	(0.057)		(0.050)	0.056
$lnpop_{it}$		-0.193**	-0.082		0.113	0.213*
		(0.077)	(0.101)		(0.181)	(0.116)
$lnpop_{jt}$		-0.376***	-0.215***		-0.241	-0.058
		(0.064)	(0.105)		(0.150)	(0.128)
Constant	13.144***	9.121***		14.937***	2.210	
	(0.125)	(1.640)		(0.143)	(4.061)	
Observations	606,710	588,262	339,724	281,016	277,483	146297
R_2	0.906	0.899		0.901	0.900	
Exporter time invariant FE	YES	YES	NO	YES	YES	NO
Importer time invariant FE	YES	YES	NO	YES	YES	NO
Time Varying Exporter FE	YES	NO	NO	YES	NO	NO
Time Varying Importer FE	YES	NO	NO	YES	NO	NO
Country-pair FE	NO	NO	YES	NO	NO	YES
Time FE	YES	YES	YES	YES	YES	YES

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

3.4.1 Colombia's Export Potentials towards a set of EU countries

Trade potentials are calculated following Eq(8) for relative residuals where results can take on values from -100% to +100%. Positive values imply an undertrading condition.

Colombia's average relative residuals for the three last year of our panel reveal untapped export potentials with Austria, Czech Republic, France, Finland, Germany, Greece, Hungary, Poland, Romania and Sweden. See Table 2. These results also suggest that Colombia is overtrading with Netherlands, Spain, Belgium and Portugal. Positioning around the normal

rule of trade arise United Kingdom and to a lesser extent Ireland on the overtrading spectrum, while some potential could be offered by Italy.

Switching from the 1980 - 2012 panel to a more balanced 2000 - 2012 panel doesn't change our main findings. The same can be said when considering only 2012 results instead of the average of the last three year.

Relative Residuals results from Poisson pair country fixed effects on the average of last three years for the period 1980-2012 show export potentials with Austria, Czech Republic, Finland, France, Germany, Hungary and Sweden. When only the year 2012 is analysed Poland and France becomes more attractive. These results remain valid although reviewed downward, except for Austria and Czech Republic when we shift to the 2000-2012 period. Trade potentials with Hungary are wiped out, reflecting the fact that no exports from Colombia to this market have taken place during last thirteen years.

Table 2

Relative Residuals (-100% to +100%) Consolidated Results from Colombia's Exports towards EU Countries.

	PPMLTVFE				PPML TIFE				PPML Adjusted TVFE				PPML Adjusted TIFE				XTPQML Pair-Country FE			
Panel	1980-2012		2000-2012		1980-2012		2000-2012		1980-2012		2000-2012		1980-2012		2000-2012		1980-2012		2000-2012	
Snapshot	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012
COL-AUT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
COL-BEL	-27.4	-24.2	-26.5	-23.0	-35.1	-30.7	-32.8	-28.2	16.5	19.8	10.2	13.9	7.7	12.7	3.5	8.7	8.4	13.6	4.1	9.5
COL-CZE	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
COL-DNK	-30.4	-27.0	-30.4	-26.7	-33.0	-29.2	-33.2	-29.3	13.4	19.3	-2.1	3.4	9.4	16.4	-5.9	0.3	10.3	17.5	-5.5	0.9
COL-FIN	25.0	31.8	25.1	32.3	21.9	31.7	23.9	33.7	41.4	47.5	10.0	17.6	38.1	47.0	7.9	18.3	39.0	47.9	8.3	18.9
COL-FRA	34.6	43.4	35.0	44.1	28.5	39.9	30.0	41.3	21.0	30.6	8.6	19.0	14.4	26.7	3.0	15.7	15.5	27.9	3.4	16.3
COL-DEU	55.6	51.1	55.9	51.6	49.9	46.6	50.8	47.6	65.2	61.4	31.5	25.9	60.4	57.5	25.2	21.0	60.8	58.1	25.4	21.4
COL-GRC	51.2	63.3	51.2	63.6	54.7	66.6	53.4	65.6	-18.8	-1.9	-27.7	-11.0	-14.9	2.8	-25.8	-8.7	-14.0	3.8	-25.5	-8.2
COL-HUN	100	100	100	100	100	100	100	100	100	100	0	0	100	100	0	0	100	100	0	0
COL-IRL	-15.8	-25.1	-15.1	-24.0	-10.6	-17.8	-11.6	-18.6	-9.3	-18.7	-18.1	-26.9	-5.8	-13.0	-16.6	-23.5	-4.5	-11.3	-16.0	-22.6
COL-ITA	10.4	15.9	10.6	16.5	4.4	15.5	5.9	17.1	10.7	16.3	7.9	13.9	4.6	15.8	3.1	14.4	5.6	16.9	3.6	15.0
COL-NLD	-57.9	-60.5	-57.9	-60.3	-66.0	-69.0	-65.5	-68.5	-9.8	-13.7	-13.0	-16.5	-22.2	-27.1	-23.6	-28.5	-21.2	-26.0	-23.2	-27.9
COL-POL	69.9	83.7	69.9	83.8	62.9	80.3	64.3	81.2	39.8	63.7	0.9	31.4	23.2	52.7	-7.6	25.2	24.1	53.6	-7.3	25.7
COL-PRT	-21.7	-39.1	-21.2	-38.2	-22.2	-34.5	-22.1	-34.3	-5.6	-23.9	-1.2	-19.1	-6.8	-19.6	-2.8	-15.6	-6.0	-18.7	-2.5	-15.3
COL-ROM	73.3	80.1	73.3	80.2	70.2	77.9	71.5	79.0	24.2	36.5	-11.1	0.7	-7.3	6.2	-15.7	-2.5	-6.7	7.0	-15.5	-2.1
COL-ESP	-26.9	-59.4	-27.8	-59.8	-30.9	-59.9	-29.1	-58.5	-14.9	-49.8	-14.1	-48.8	-19.0	-50.3	-16.0	-47.7	-17.8	-49.2	-15.5	-47.1
COL-SWE	62.2	62.0	62.2	62.3	60.3	62.4	59.8	62.0	59.6	59.4	19.7	19.8	57.0	59.3	15.7	19.0	57.8	60.3	16.2	19.8
COL-GBR	-4.8	-11.2	-4.4	-10.5	-9.0	-13.8	-10.9	-15.6	-7.9	-14.3	-6.8	-12.8	-13.0	-17.8	-13.5	-18.3	-12.0	-16.6	-13.1	-17.6

Source: Own calculations

Note: TVFE (Time Varying Fixed Effects); TIFE (Time Invariant Fixed Effects)

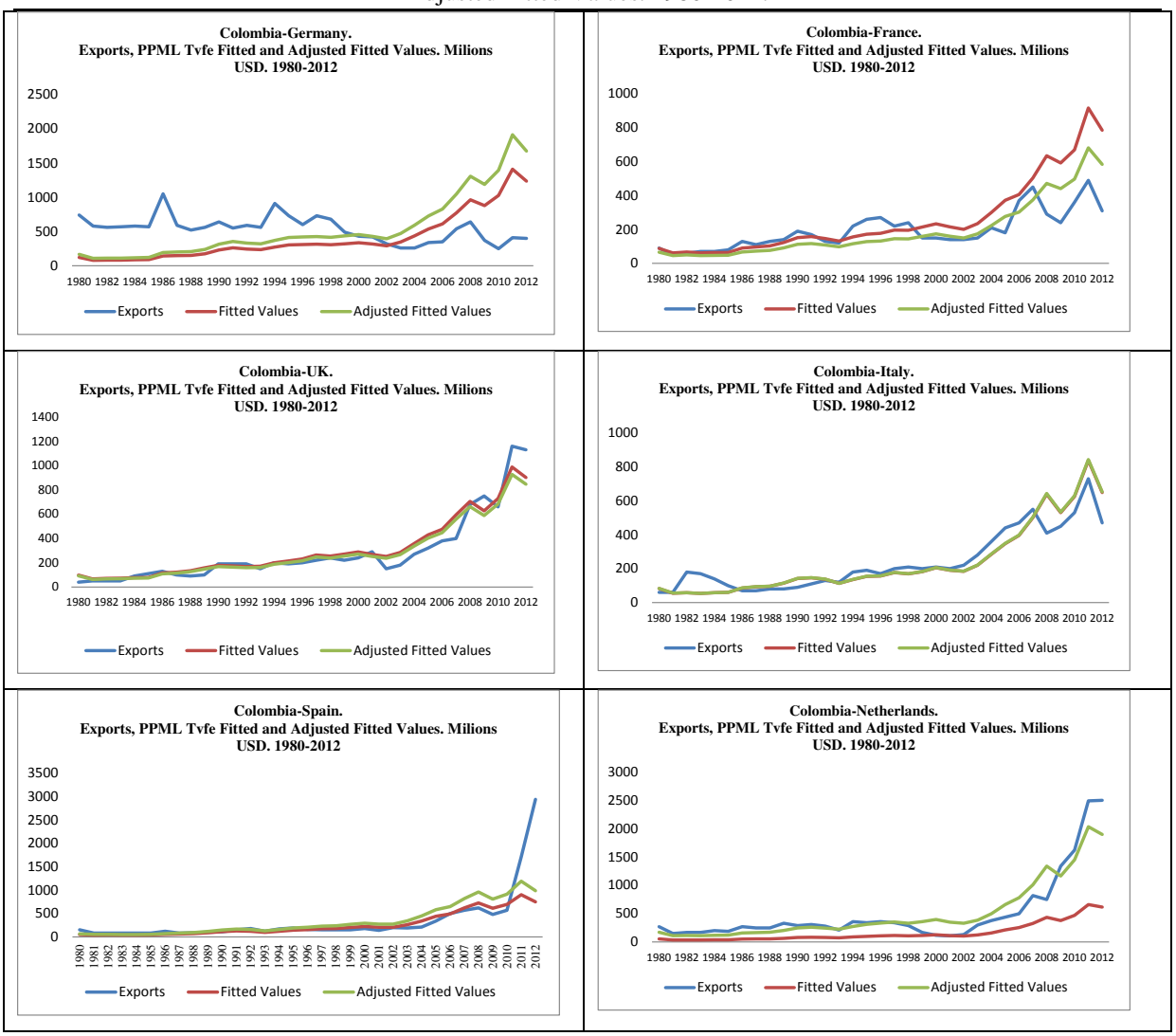
Strong Potential
Some Potential
Around the rule
Overtrading
Strongly overtrading

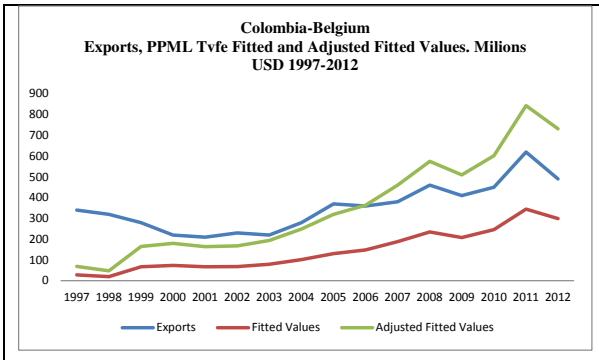
While most of Colombia's exports to EU countries present a rising trend particularly strong for UK, Italy, Netherland, Spain, Portugal and Ireland; exports to Germany and France have respectively experienced a slight decline and a weak advance over the last three decades.

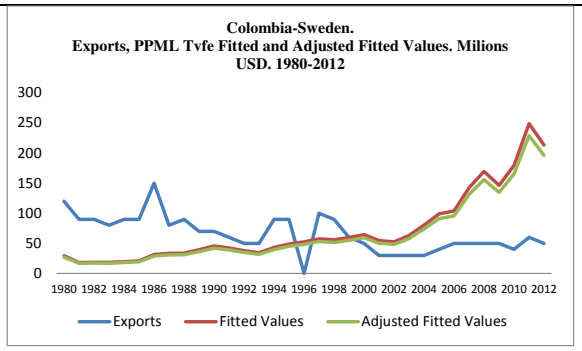
Special attention also deserves Sweden and Finland. Exports to Sweden and Finland display a trend comparable with exports to Germany, so the potentiality of the gap to be filled seems promising.

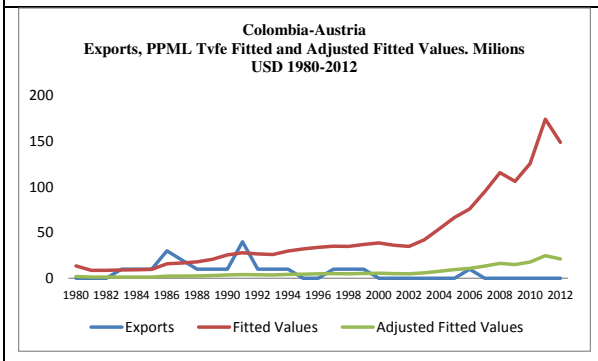
Spain exports skyrocketed during the last three years exhausting trade potentials. Potentiality to markets like Greece, Romania, Poland, Hungary or Chez Republic are harder to evaluate due to the lack of a clear trend and the presence of zero trade flows. Combining trade potential analysis with the graphic perspective offered in figure 1 could at least confirm the attractiveness for Colombia that the two biggest economies in the European Union display.

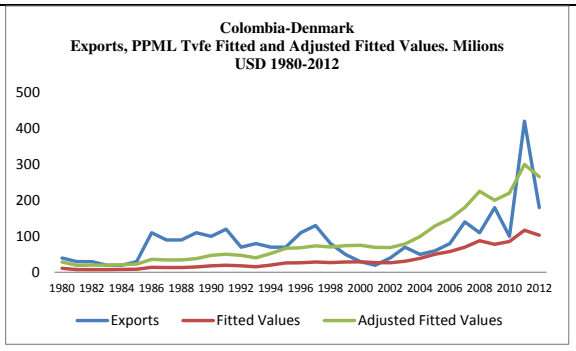
Figure 1
Evolution of bilateral Exports from Colombia to EU countries and its respective PPML Tvfe Fitted and Adjusted Fitted Values. 1980-2012.

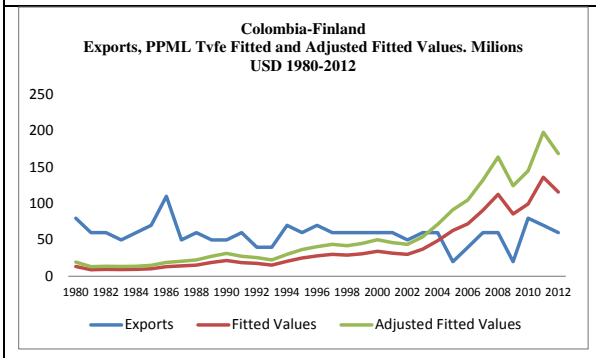


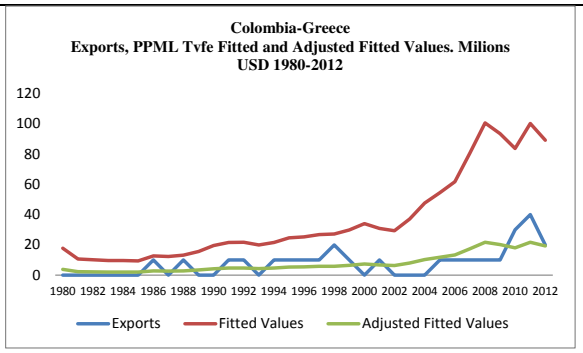

Colombia-Belgium
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions
USD 1997-2012
900
800
700
600
500
400
300
200
100
0
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
Exports
Fitted Values
Adjusted Fitted Values

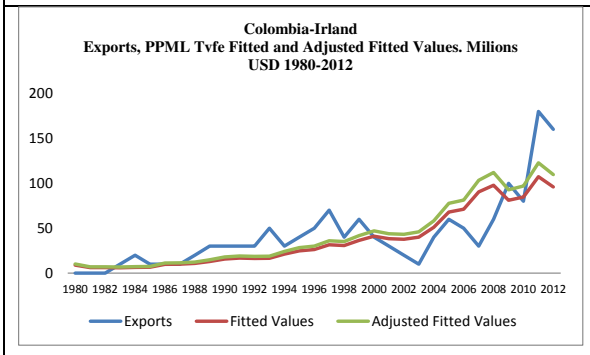

Colombia-Sweden.
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions
USD. 1980-2012
300
250
200
150
100
50
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012
Exports
Fitted Values
Adjusted Fitted Values

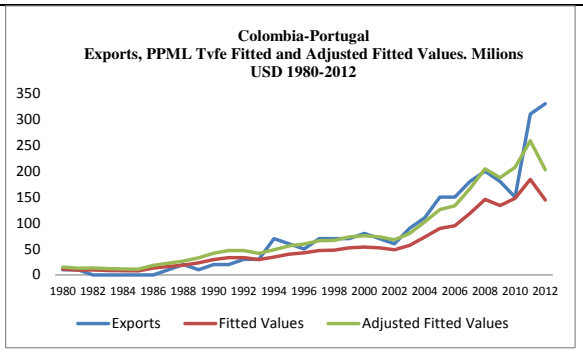

Colombia-Austria
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions
USD 1980-2012
200
150
100
50
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012
Exports
Fitted Values
Adjusted Fitted Values

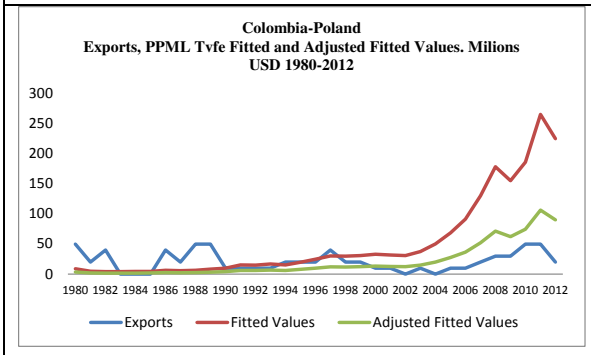

Colombia-Denmark
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions
USD 1980-2012
500
400
300
200
100
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012
Exports
Fitted Values
Adjusted Fitted Values

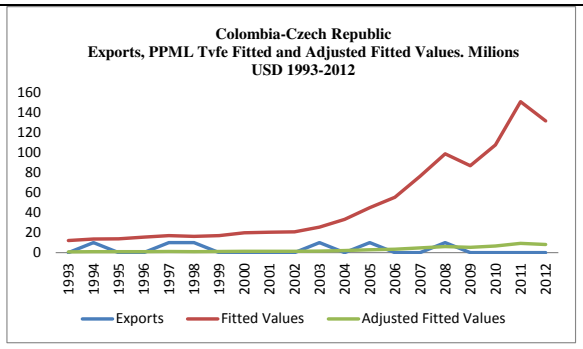

Colombia-Finland
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions
USD 1980-2012
250
200
150
100
50
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012
Exports
Fitted Values
Adjusted Fitted Values

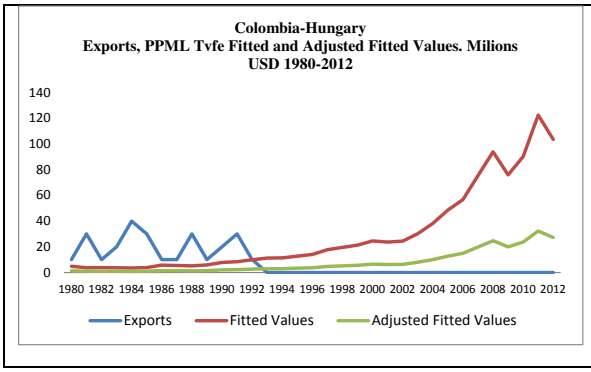

Colombia-Greece
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions
USD 1980-2012
120
100
80
60
40
20
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012
Exports
Fitted Values
Adjusted Fitted Values

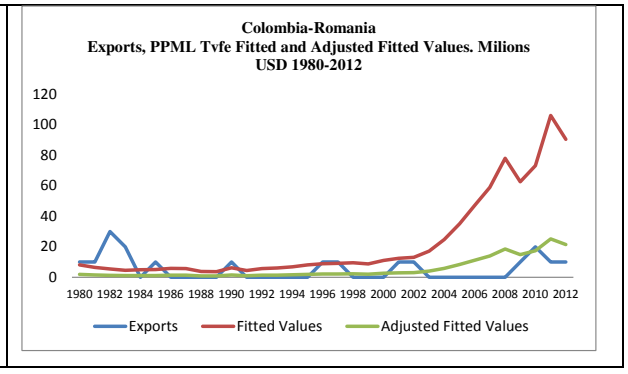

Colombia-Irland
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions
USD 1980-2012
200
150
100
50
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012
Exports
Fitted Values
Adjusted Fitted Values


Colombia-Portugal
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions
USD 1980-2012
350
300
250
200
150
100
50
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012
Exports
Fitted Values
Adjusted Fitted Values


Colombia-Poland
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions
USD 1980-2012
300
250
200
150
100
50
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012
Exports
Fitted Values
Adjusted Fitted Values


Colombia-Czech Republic
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions
USD 1993-2012
160
140
120
100
80
60
40
20
0
1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
Exports
Fitted Values
Adjusted Fitted Values





3.4.2 Colombia's Export Potentials to a Set of Interesting Markets.

It is noteworthy to take a view of Colombia's export potentials towards a group of other interesting markets. Table 3 reveals that Colombia presents some potentials to increase its exports towards Australia, Brazil, Canada, Japan, México, Russia and the EU.

To a lesser extend also Korea Republic makes some appealing. Conversely, Colombia seems to be overtrading with China, India, Turkey, Switzerland and the United States. These results are stable whether we switch the time frame of the panel or the snapshot to observe potentials.

Country pairs Poisson fixed effects relative residuals show that an important group of interesting countries could be already buying Colombia's products around reasonable levels. Unexhausted trade potential persist with the EU, Japan and Russia. These results also reinforce the finding that no potentials are on hand with China, India and Turkey, while casting doubts about potentials with Republic of Korea and Brazil.

Table 3

Relative Residuals (-100% to +100%) Consolidated Results from Colombia's Exports towards the Golbal Main Markets

Panel	1980-2012		2000-2012		1980-2012		2000-2012		1980-2012		2000-2012		1980-2012		2000-2012		1980-2012		2000-2012	
Snapshot	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012
COL-AUS	86.4	86.5	86.7	86.9	86.0	86.6	86.3	86.9	3.3	3.9	2.1	3.1	1.8	4.0	0.8	3.1	3.7	6.4	1.6	4.2
COL-BRA	47.7	48.2	46.8	47.6	40.6	40.1	41.8	41.5	-7.3	-6.7	-4.9	-4.0	-14.9	-15.4	-10.2	-10.7	-17.5	-17.8	-11.5	-11.7
COL-CAN	38.5	56.6	40.0	57.4	36.9	56.8	38.8	57.5	2.2	24.4	1.1	22.6	0.2	24.3	-0.8	22.4	-0.9	15.0	-2.5	11.5
COL-CHE	-55.0	-40.6	-54.6	-40.7	-59.7	-43.2	-58.6	-42.5	-2.7	17.2	8.4	27.3	-9.5	14.6	3.0	25.9	-10.9	4.8	1.3	15.1
COL-CHN	-8.4	-20.9	-8.3	-20.4	-16.6	-25.8	-14.9	-24.1	-18.8	-30.9	-13.7	-25.7	-24.7	-33.5	-18.4	-27.5	-23.2	-31.7	-17.8	-26.6
COL-IND	-17.9	-45.0	-17.3	-44.1	-35.1	-58.8	-29.7	-54.4	-20.5	-47.2	-13.6	-40.8	-35.3	-58.9	-23.1	-49.0	-33.6	-57.4	-22.5	-48.3
COL-JPN	44.8	57.4	44.0	57.0	44.1	56.7	41.0	54.1	20.4	35.8	6.9	23.4	19.2	34.5	3.3	19.4	19.9	35.4	3.6	19.9
COL-KOR	15.8	15.8	15.5	16.2	7.0	9.4	6.6	9.1	-12.0	-12.5	-8.1	-7.8	-20.6	-18.5	-16.0	-13.7	-19.1	-16.7	-15.5	-13.0
COL-MEX	49.0	47.4	48.8	47.6	39.2	36.1	41.0	38.2	11.5	9.4	13.5	11.8	0.9	-2.8	4.3	1.0	1.3	-1.8	5.1	2.3
COL-RUS	62.5	62.9	62.5	63.2	62.9	66.7	62.5	65.2	16.4	16.8	11.5	12.3	16.7	22.8	11.3	15.7	17.6	24.7	11.9	17.9
COL-TUR	-21.5	-44.2	-21.4	-43.8	-30.7	-50.7	-28.6	-48.8	-18.3	-41.3	-8.5	-32.0	-27.1	-47.6	-15.5	-36.9	-25.6	-46.0	-14.8	-36.1
COL-USA	-10.2	0.6	-10.2	0.0	-11.6	1.4	-11.1	0.9	-6.4	4.4	-4.0	6.2	-8.3	4.7	-5.8	6.2	-9.9	-5.4	-7.9	-5.4
COL-EU	49.6	48.4	49.7	48.7	47.6	47.8	47.8	47.9	42.7	42.2	27.0	26.8	38.9	39.9	24.4	25.5	40.6	39.5	24.7	25.8

Source: Own calculations

Note: TVFE (Time Varying Fixed Effects); TIFE (Time Invariant Fixed Effects)

Strong Potential

Some Potential

Around the rule

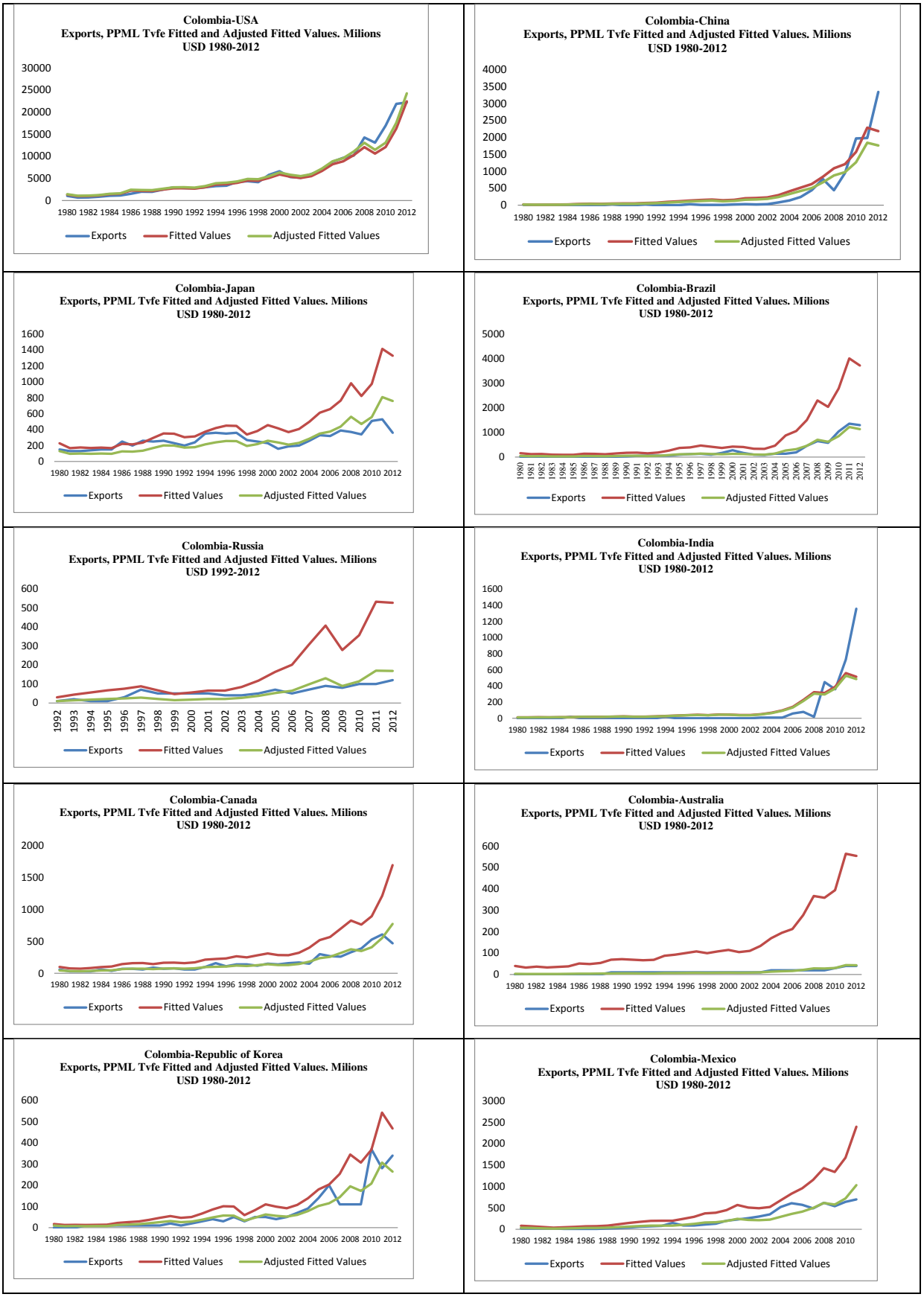
Overtrading

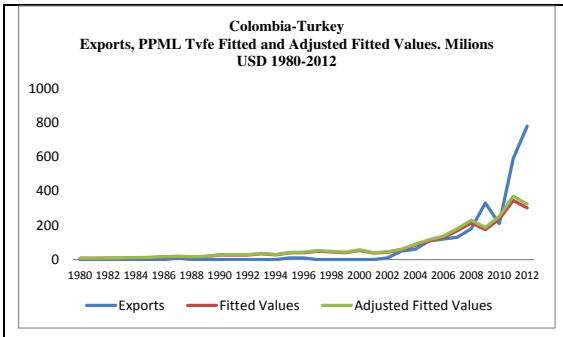
Strongly overtrading

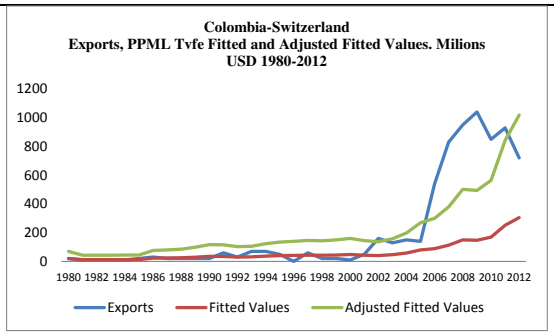
Graphic analysis of the evolution of Colombia's exports to Japan, Russia and Australia over the last three decades shows little dynamics. The gap between the current exports levels and its predicted values is increasing over time with these markets. Combined analysis of trade potentials in Table 3 and export evolution in Figure 2 point in the same direction of a clear trade potential with Japan and Russia.

Colombia has vigorously increased its exports to China the United States. Exports to India and Turkey have ballooned from 2008 and 2010 respectively. Exports to Switzerland, Canada and Korea Republic also ramped up, but have experienced recent trends corrections. Trade potentials with these markets seem to be exhausted.

Figure 2
Evolution of Bilateral Exports from Colombia to a set of key markets and its respective PPML Tvfe Fitted and Adjusted Fitted Values. 1980-2012.







Source: Own calculations

3.4.3 European Union Export Potentials to Colombia.

Reviewing export potential from a set of EU countries towards Colombia we find a very stable result under the PPML time varying country fixed effects specification of relative trade residuals. Traditional big economies of the EU seem to have exhausted their potential with Colombia, but a large group of countries most of them of medium or small size find Colombian consumers as promising. These countries are Czech Republic, Greece, Hungary, Ireland, Poland, Portugal and Sweden. Trade Potentials are stable when switching to a shorter time database or when taking into account only the last year of the sample instead of the average of the last three years. Out of the biggest EU markets, United Kingdom and to a lesser extend Netherlands exhibit some unexhausted margin to increase its exports in Colombia. See Table 4.

Results when Poisson pairs fixed effects indicate that most of EU countries wouldn't find any potential in Colombia no matter what period or snapshot we observe. Sweden could find important potentials in Colombia, yet these are stronger in the longer period. Colombia's appeal is cut down on the shorter database. Finland and Ireland hover over an interesting margin and could consider Colombia a potential market to conquer under this specification. In both databases, Greece potentials are only present on a three-year average measure, as it turns out to be strongly overtrading when only the year 2012 is considered.

Table 4

Relative Residuals (-100% to +100%) Consolidated Results from EU Countries Exports towards Colombia.

panel	1980-2012		2000-2012		1980-2012		2000-2012		1980-2012		2000-2012		1980-2012		2000-2012		1980-2012		2000-2012	
snapshot	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012
AUT-COL	2.4	-4.0	3.0	-3.1	-1.2	-5.9	2.7	-1.5	-9.0	-15.4	-6.0	-12.0	-13.0	-17.7	-6.8	-11.0	-11.4	-15.8	-6.2	-10.1
BEL-COL	-5.3	-13.2	-4.4	-12.0	-5.4	-11.6	-4.6	-10.1	-6.3	-14.2	-5.4	-13.0	-8.0	-14.1	-6.1	-11.6	-7.0	-12.8	-5.5	-10.6
CZE-COL	67.0	58.9	66.9	59.0	61.2	51.4	61.9	52.7	22.0	8.4	10.9	-2.8	12.9	-2.2	3.5	-11.0	13.8	-0.9	4.1	-10.2
DNK-COL	17.4	1.0	17.5	1.5	20.4	5.0	19.4	4.6	-3.7	-20.2	-6.4	-22.6	-1.3	-17.2	-5.3	-20.4	0.2	-15.4	-4.7	-19.6
FIN-COL	11.8	3.4	12.0	3.9	18.9	13.8	18.5	14.0	14.5	6.2	15.4	7.4	20.6	15.5	20.3	15.9	22.1	17.4	20.9	16.8
FRA-COL	-24.1	-25.5	-23.6	-24.7	-22.4	-23.0	-22.5	-22.5	-5.8	-7.3	-5.1	-6.2	-4.6	-5.2	-5.0	-4.9	-2.9	-3.2	-4.3	-4.0
DEU-COL	-7.2	-13.7	-6.9	-13.0	-10.9	-16.1	-9.0	-13.7	4.9	-1.5	0.4	-5.8	0.9	-4.4	-2.0	-6.7	2.3	-2.7	-1.4	-5.9
GRC-COL	87.4	62.4	87.6	62.8	85.2	55.5	84.0	51.9	43.7	-68.8	48.9	-53.3	42.0	-73.9	45.4	-63.7	42.3	-73.1	45.6	-63.2
HUN-COL	79.5	70.5	79.6	70.6	75.9	66.0	77.1	67.9	-7.7	-30.3	-3.1	-25.7	-17.5	-38.3	-9.3	-30.1	-16.4	-37.0	-8.8	-29.4
IRL-COL	66.4	65.6	67.0	66.3	67.2	68.2	68.0	69.5	21.8	20.3	22.0	20.8	21.8	23.7	22.3	24.9	23.4	25.6	23.0	25.9
ITA-COL	-7.3	-10.4	-7.1	-9.9	-7.8	-10.6	-8.2	-10.3	-2.2	-5.4	-4.9	-7.8	-2.9	-5.8	-6.6	-8.7	-1.4	-3.9	-6.0	-7.8
NLD-COL	17.8	17.8	17.7	18.0	7.4	6.6	10.6	10.6	9.1	9.1	8.9	9.2	-1.5	-2.3	2.1	2.1	0.0	-0.4	2.7	3.0
POL-COL	69.3	66.8	69.4	67.0	63.8	61.3	64.8	62.7	38.2	33.6	12.9	7.5	14.8	9.7	5.9	1.1	16.0	11.2	6.4	2.0
PRT-COL	56.7	47.0	57.1	47.7	54.1	42.4	53.5	42.3	-17.4	-30.7	-9.6	-22.9	-20.9	-35.9	-14.5	-29.3	-19.5	-34.5	-14.0	-28.6
ROM-COL	-16.1	-40.6	-16.1	-40.3	-23.7	-46.6	-24.4	-46.7	1.8	-23.9	0.2	-25.2	-4.9	-29.7	-7.6	-31.7	-4.0	-28.6	-7.2	-31.1
ESP-COL	-4.8	-10.5	-5.8	-11.2	-11.2	-17.2	-10.6	-15.9	12.2	6.6	3.5	-1.9	6.1	0.1	-1.4	-6.7	7.8	2.1	-0.7	-5.7
SWE-COL	29.8	31.4	29.9	31.7	32.9	37.7	32.3	37.5	27.5	29.0	11.0	12.9	29.7	34.6	12.5	18.2	31.2	36.4	13.2	19.1
GBR-COL	25.0	19.3	25.4	20.0	31.1	28.1	26.3	23.7	7.9	1.9	0.1	-5.6	13.4	10.1	-0.2	-3.0	14.9	12.0	0.5	-2.0

Source: Own calculations

Note: TVFE (Time Varying Fixed Effects); TIFE (Time Invariant Fixed Effects)

Strong Potential

Some Potential

Around the rule

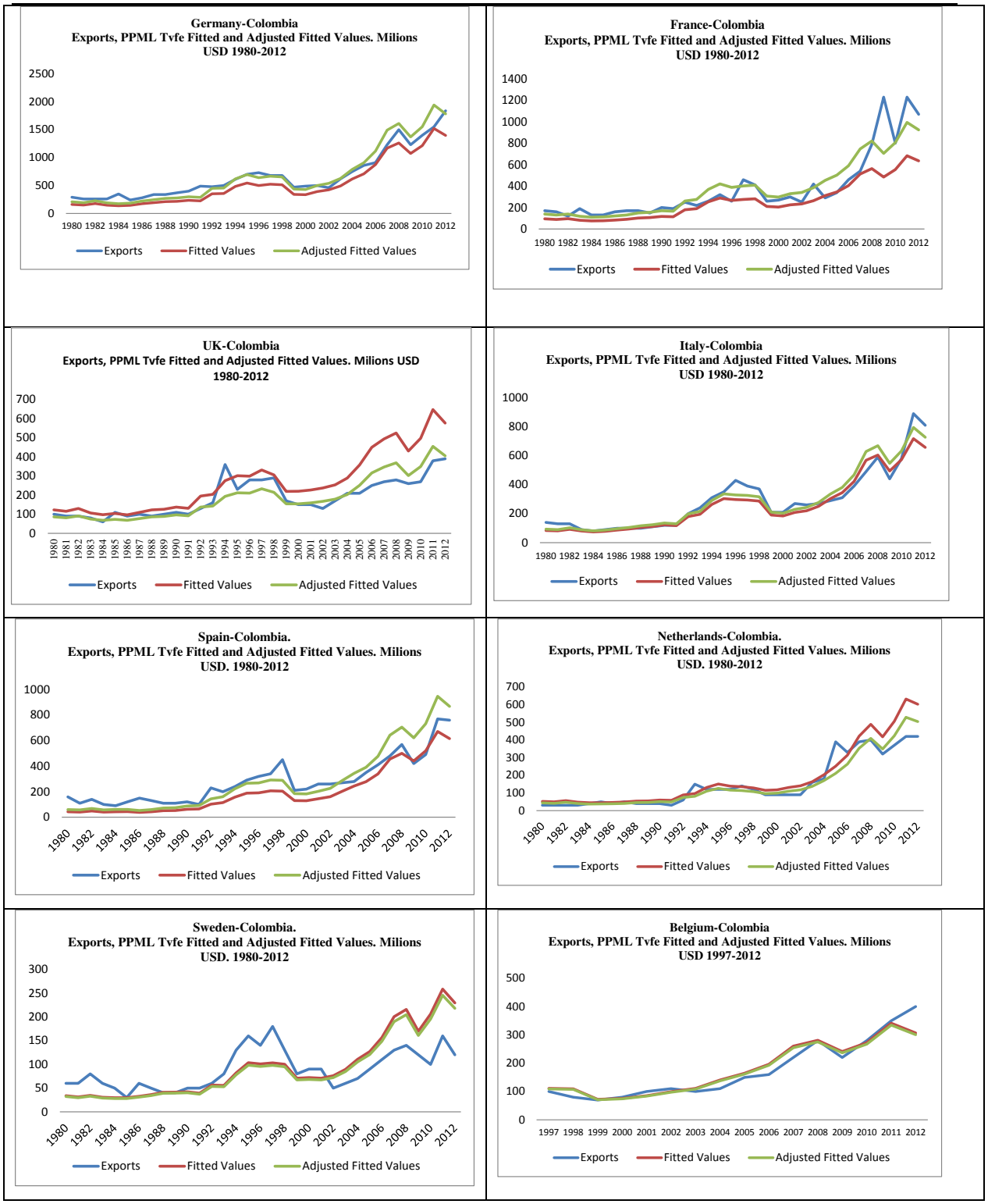
Overtrading

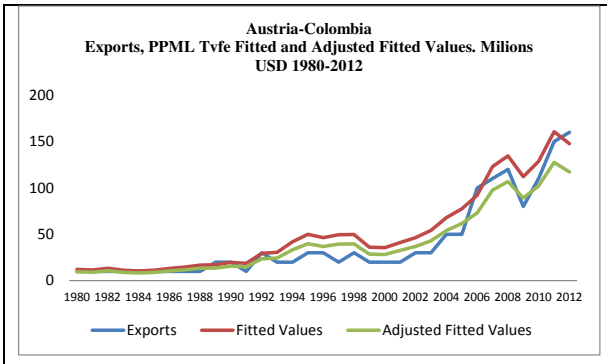
Strongly overtrading

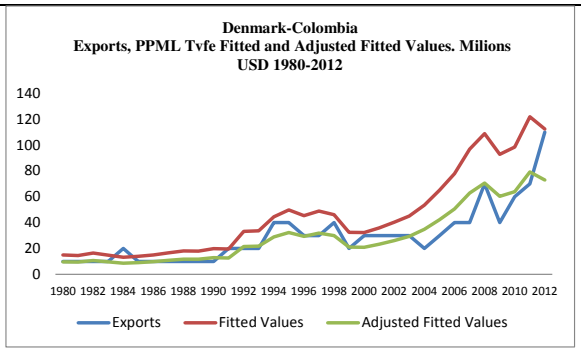
Big market economies in the EU have experience an exponential growth in their sales to Colombia, a dynamic that is also shared by Romania, Austria and Denmark. A notable exception is UK and possibly Netherlands. The lecture of this evolution is a mirror of what trade potentials above have shown, where only UK and Netherlands among EU big economies seem to have some margin to gain exporting Colombia.

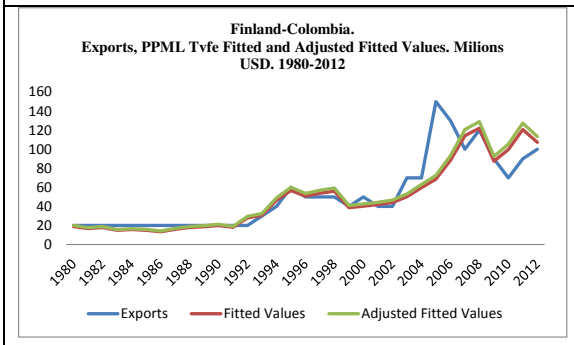
Smaller EU countries exports to Colombia didn't follow an active dynamics and a flat trend persists. Portugal has managed to rebound during the last four years its potential in Colombia is contested under specifications that adjust bilateral flow internal tendencies, model 1 to model 3. Interesting gaps are manifest for Ireland, Sweden, Finland and Poland that are compatible with relative residual indicator in Figure 3. These markets could have an interesting commercial opportunity to explore in this South American country.

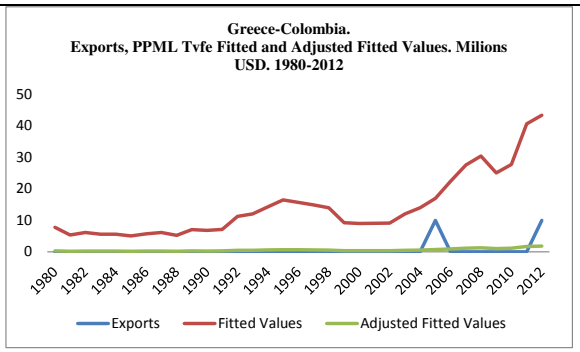
Figure 3
Evolution of bilateral Exports from EU countries to Colombia and its respective PPML Tvfe Fitted and Adjusted Fitted Values. 1980-2012.

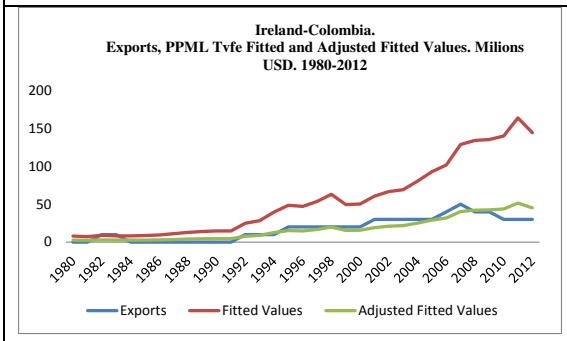


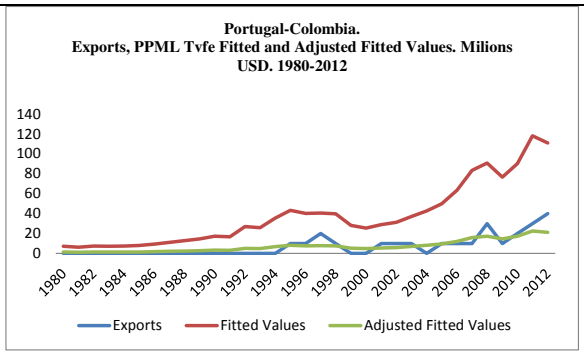

Austria-Colombia
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions USD 1980-2012
Exports
Fitted Values
Adjusted Fitted Values

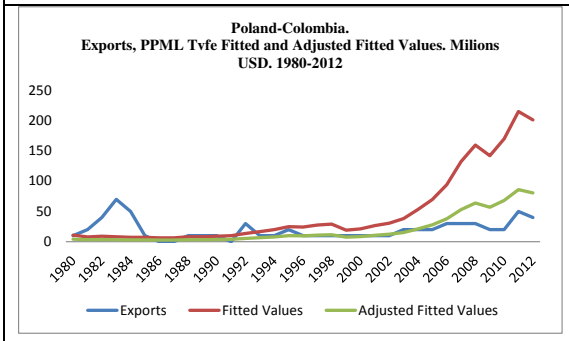

Denmark-Colombia
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions USD 1980-2012
Exports
Fitted Values
Adjusted Fitted Values

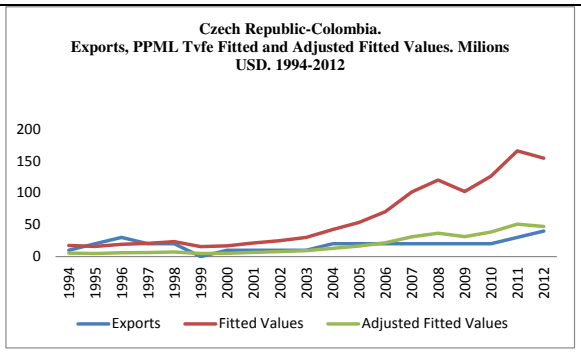

Finland-Colombia.
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions USD. 1980-2012
Exports
Fitted Values
Adjusted Fitted Values

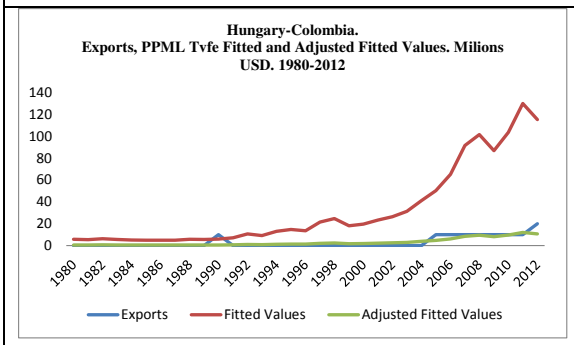

Greece-Colombia.
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions USD. 1980-2012
Exports
Fitted Values
Adjusted Fitted Values

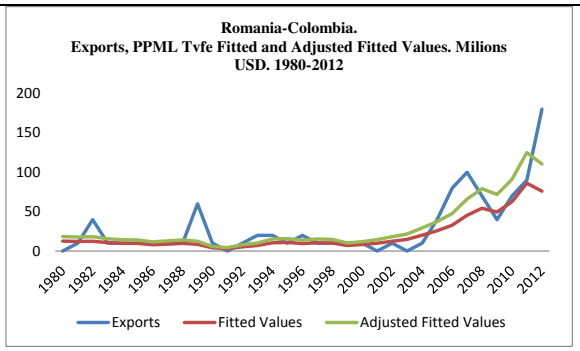

Ireland-Colombia.
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions USD. 1980-2012
Exports
Fitted Values
Adjusted Fitted Values


Portugal-Colombia.
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions USD. 1980-2012
Exports
Fitted Values
Adjusted Fitted Values


Poland-Colombia.
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions USD. 1980-2012
Exports
Fitted Values
Adjusted Fitted Values


Czech Republic-Colombia.
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions USD. 1994-2012
Exports
Fitted Values
Adjusted Fitted Values


Hungary-Colombia.
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions USD. 1980-2012
Exports
Fitted Values
Adjusted Fitted Values


Romania-Colombia.
Exports, PPML Tvfe Fitted and Adjusted Fitted Values. Milions USD. 1980-2012
Exports
Fitted Values
Adjusted Fitted Values

3.4.4 Trade Potentials from a set of interesting countries towards Colombia

When PPML relative residuals are examined under model 1 specification, we find that Australia, Canada, Russia and the EU would find some potential in Colombia. Canada could also find some margin. Conversely, Mexico and Korea Republic seem to be clearly overtrading with Colombia. Again, results are robust to changes of panel and snapshot to call potentials under this specification.

Switching to country pairs Poisson fixed effects relative residuals analysis we find that for the biggest markets almost any Colombian market attractiveness that appears under PPML relative residuals analysis slides back. Only Australia seems to find an important potential in Colombia's market. Most of the countries analysed seem to be already selling its products in Colombia around the reasonable pattern the model predict. If we relax our threshold to determine potentials under this specification, the EU, Brazil, Canada or even Japan could have some gap to profit in Colombia. See Table 5.

Table 5

Relative Residuals (-100% to +100%) Consolidated Results from the Global Main Markets Exports towards Colombia.

Panel	1980-2012		2000-2012		1980-2012		2000-2012		1980-2012		2000-2012		1980-2012		2000-2012		1980-2012		2000-2012	
Snapshot	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012	3avg	2012
AUS-COL	89.7	90.8	89.9	91.1	88.3	90.8	88.5	90.9	35.6	40.6	25.7	31.4	30.1	40.6	19.7	30.8	31.9	42.7	20.4	31.8
BRA-COL	19.0	14.6	17.8	13.6	16.8	12.9	16.4	13.3	14.2	9.7	13.5	9.3	12.0	8.1	12.4	9.2	9.4	5.8	11.1	8.2
CAN-COL	18.9	27.6	20.9	28.7	21.2	32.3	21.3	31.6	10.2	19.2	5.0	13.2	12.1	23.6	4.5	15.5	11.3	14.6	2.9	4.5
CHE-COL	-28.5	-22.1	-28.0	-22.3	-31.7	-24.4	-31.1	-24.3	15.8	22.5	7.2	13.2	12.3	20.2	4.0	11.3	11.3	10.8	2.3	0.2
CHN-COL	-29.1	-34.0	-29.0	-33.6	-30.2	-31.2	-30.8	-32.0	-13.1	-18.3	-8.3	-13.3	-14.4	-15.4	-9.8	-11.1	-12.9	-13.5	-9.2	-10.1
IND-COL	-31.8	-40.6	-31.1	-39.6	-42.9	-50.3	-38.6	-46.0	-0.1	-10.0	7.5	-2.1	-12.3	-21.4	0.6	-8.1	-10.3	-19.0	1.4	-7.1
JPN-COL	2.6	-2.2	1.8	-2.7	9.6	9.9	4.6	5.3	5.3	0.5	-0.4	-4.9	11.5	11.9	0.8	1.5	13.0	13.6	1.4	2.4
KOR-COL	-43.7	-45.1	-43.7	-44.6	-46.7	-43.2	-47.8	-44.0	-9.0	-10.7	-3.0	-4.1	-13.8	-9.5	-8.4	-3.7	-12.2	-7.5	-7.8	-2.7
MEX-COL	-41.4	-43.6	-41.4	-43.4	-50.3	-52.3	-49.4	-50.9	-11.7	-14.3	-6.5	-8.9	-21.6	-24.2	-15.6	-17.4	-21.1	-23.2	-14.8	-16.1
RUS-COL	61.3	48.2	61.3	48.3	66.1	61.1	64.7	57.7	-7.5	-27.2	-10.8	-30.0	-1.7	-10.5	-7.0	-18.6	-0.7	-8.1	-6.3	-16.4
TUR-COL	35.7	21.5	35.9	21.9	28.3	10.1	29.8	12.2	-4.5	-20.7	1.0	-15.0	-11.5	-30.8	-4.0	-23.2	-9.7	-28.8	-3.3	-22.2
USA-COL	-7.6	0.3	-7.4	-0.2	-9.6	0.4	-11.5	-2.3	-2.7	5.3	-1.3	5.9	-4.6	5.5	-5.7	3.6	-5.8	-4.2	-7.7	-7.8
EU-COL	46.2	42.9	46.3	43.2	44.9	42.0	44.9	42.1	13.8	8.3	7.4	2.4	11.1	6.2	5.1	0.7	7.4	12.1	5.6	1.3

Source: Own calculations

Note: TVFE (Time Varying Fixed Effects); TIFE (Time Invariant Fixed Effects)

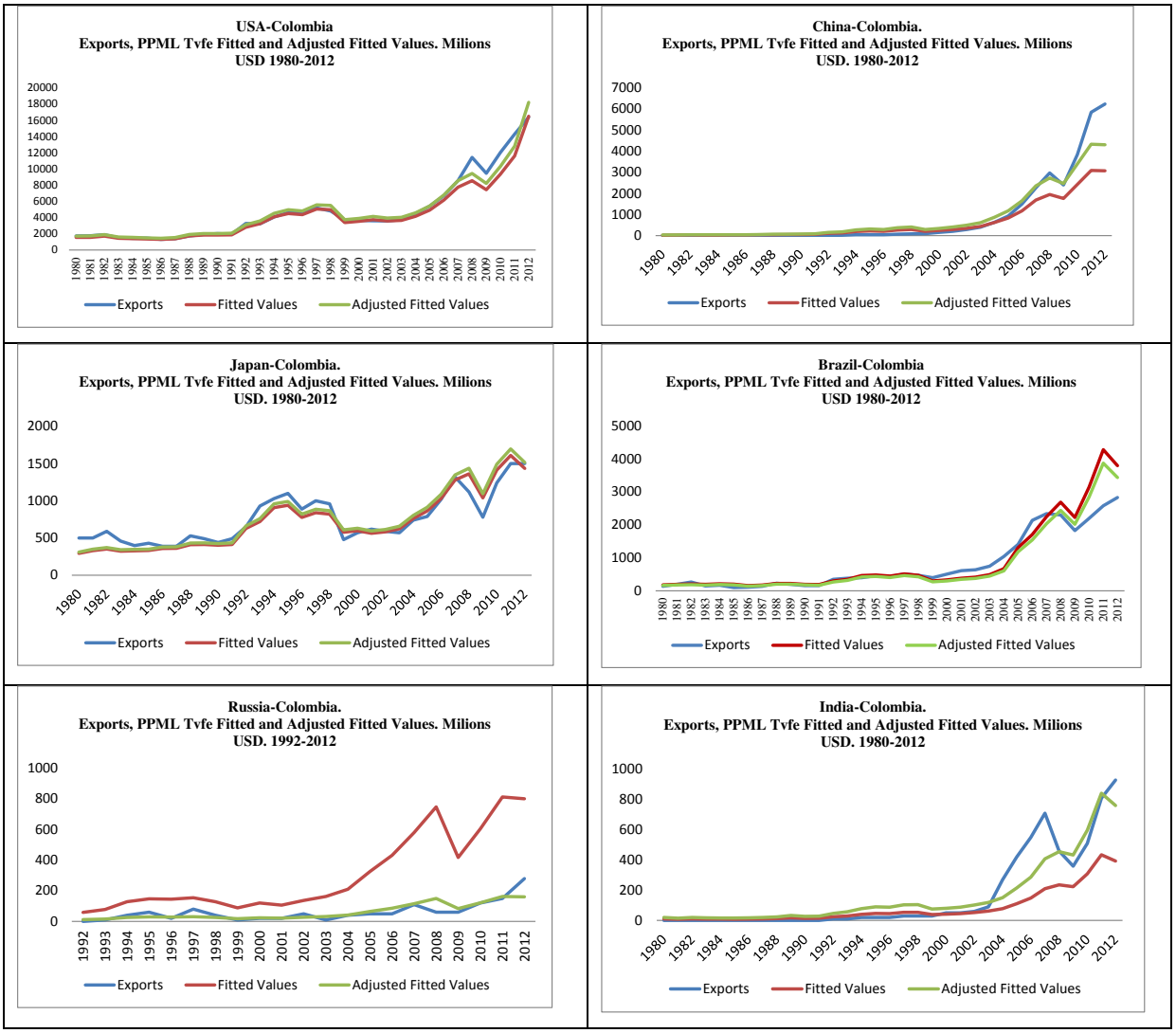
Strong Potential
Some Potential
Around the rule
Overtrading
Strongly overtrading

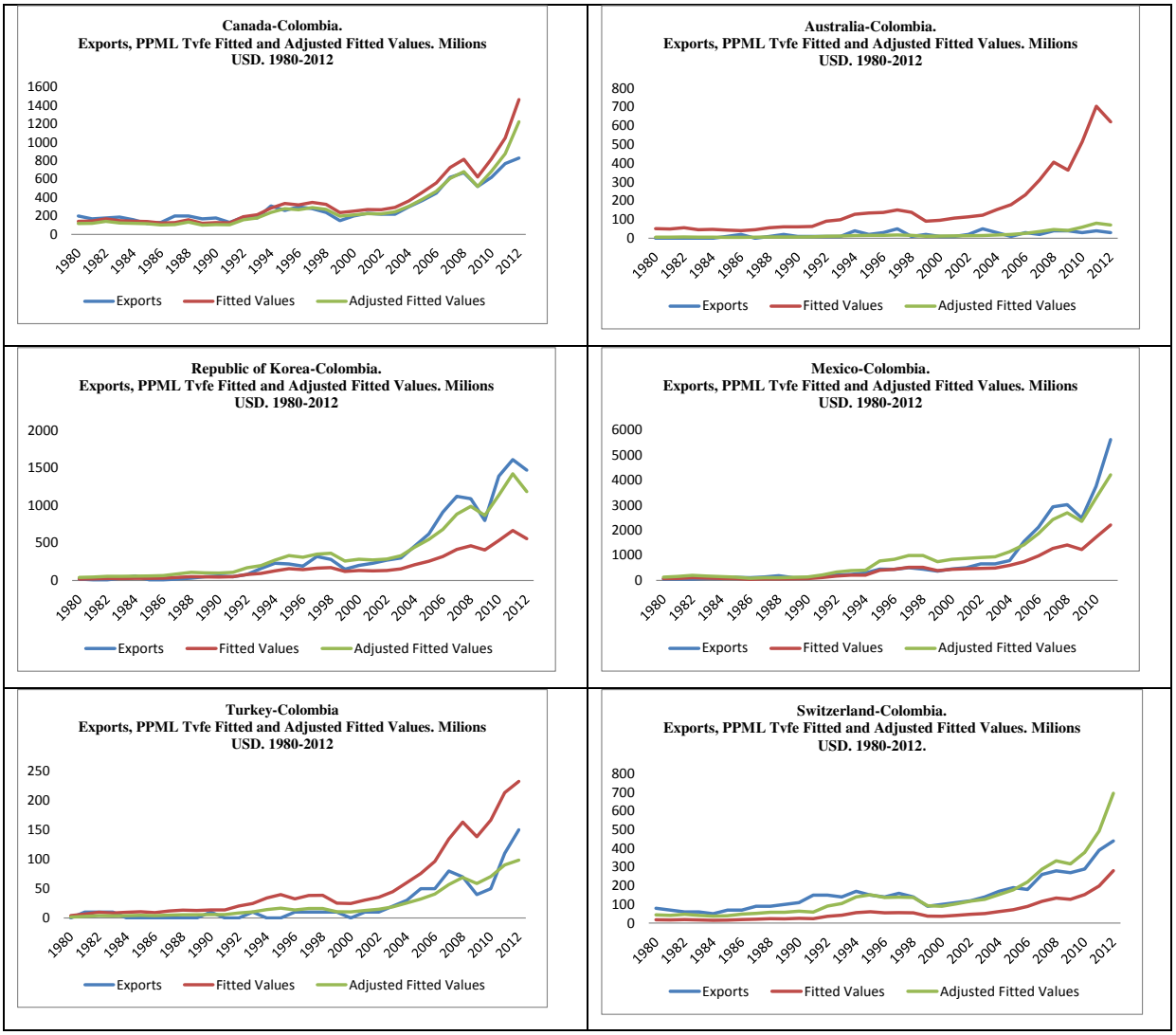
Exports towards Colombia from United States, China, India, México, Korea Republic, and Turkey show a sustainable advance over time. No so vigorous has been the surge in Russian and Swiss exports to Colombia, yet sustainable positive trend are already present.

The global economic crisis of 2009 induced a transitory interruption trade expansion, although Japan, Canada and Brazil exports to Colombia seem to have lost in dynamism generating some king of potentiality to shore up.

Particularly sluggish are exports from Australia, see Figure 4. The gap between current trade and predicted trade have clearly widened over time. Table 5 suggest that Australia's trade potential with Colombia is of a magnitude. Infrastructure and trade policy interventions could help to trigger trade in both directions.

Figure 4
Evolution of bilateral Exports from a set of key markets to Colombia and its respective PPML Tvfe Fitted and Adjusted Fitted Values. 1980-2012.





3.5 Trade Potentials Sensitivity Analysis

This subsection examines the implications on results analysis derived from changes in the fixed effects specification, the snapshot and the database time span we use as well as the inclusion of an adjustment factor to the fitted values.

-Time varying fixed effects, time invariant fixed effects or country pair fixed effects

We notice that at least in the Colombian case of study we are concerned with, adding time varying fixed effects doesn't produce sensitive changes to the conclusion about trade potentials we can derive from the relative residuals analysis, with respect to those drawn for the time invariant fixed effect specification results. On the other hand, results from the

country-pair fixed effects specification produce bigger variations. This shift can affect conclusions about the existence of untapped trade potentials in some cases.

-Snapshot: Average potentials for 2010-2012 vs 2012

When we shift from the average 2010-2012 measure of trade potential to the punctual measure of 2012, some changes are evident, but although they can be large in some cases, the general picture to define trade potentials remain unaffected in most of the cases. This is coherent with some volatility that can make move too much a particular flow from its current trend.

- Changes from the database time span 1980-2012 to 2000-2012

The change in the period of analysis to perform estimations produces changes in the values of the relative residuals. Nevertheless, this variation doesn't affect the final judgement to be made about the existence of trade potentials in most of the cases of this study. One important exception is the export potential towards Hungary that is wiped out by this procedure.

When we stick to PPML results without adjusting them with eq (9) procedure, the exports potentials are robust to the change in the period of analysis. The same can be said across adjusted models. See results for Model 1 and 2 in figures 1 to 4.

-The adjustment factor

The Country pair Poisson Pseudo Maximum model xtpqml needs to be adjusted to produce zero means residuals. This is not the case for the PPML estimator. Never the less, we proceed to adjust PPML results to compare the results. When we apply the adjustment factor to PPML, export potentials are sensitive.

This sensitivity is amplified when changes of period of analysis from 1980-2012 to 2000-2012 intervene under the adjusted results. On the other hand, conclusions about trade potentials are less sensitive to changes from one adjusted model to the other; see results for model 3 to 5 in figures 1-4.

For example, if we look for Colombia's potentials towards EU countries, shifting from PPML relative residuals to adjusted PPML relative residuals reduces or even wipes out trade potentials for some countries. It also brings down trade potentials for the analysed countries towards Colombia.

-The Hausman and Taylor Estimator

Results are sensitive to the use of the Hausman and Taylor estimator. To estimate this model we introduce the same set of confounders as in our previous models, and we augmented the gravity equation by the introduction of variables for surface, landlocked and island status. We made the assumption that the RTA variable is endogenous and introduce time invariant country fixed effects and time fixed effects.

Colombia's export potentials are reduced with respect to previous results. In parallel, the exports potentials that the EU countries and the main markets could find in Colombia are reduced under the Hausman and Taylor method with respect to previous models. These results are mitigated after applying the adjustment factor. Trade potentials from Colombia to Austria and Hungary; and from Australia to Colombia are particularly robust to most specifications. See table 6 and 7.

Table 6

Relative Residuals (-100% to +100%) from the Hausman and Taylor estimator with time-invariant and time fixed effects

Consolidated Results from Colombia's Exports towards EU Countries and the Main Markets.

	H & T TIFE		H & T Adjusted TIFE	
Panel	1980-2012		1980-2012	
Snapshot	3avg	2012	3avg	2012
COL-AUT	63.7	70.2	85.4	88.4
COL-BEL	-67.4	-63.8	6.6	13.0
COL-CZE	30.1	17.4	57.5	48.0
COL-DNK	-88.6	-87.9	5.2	13.1
COL-FIN	-82.7	-78.0	35.6	48.2
COL-FRA	-32.3	-19.7	12.5	25.9
COL-DEU	-7.1	-10.3	57.4	55.3
COL-GRC	-45.9	-27.9	-17.5	4.1
COL-HUN	27.0	36.6	87.6	90.4
COL-IRL	-89.5	-91.1	-5.4	-12.5
COL-ITA	-50.9	-41.6	1.3	13.4
COL-NLD	-82.3	-83.7	-24.8	-28.8
COL-POL	-44.8	-11.9	22.8	57.2
COL-PRT	-74.8	-80.1	-10.6	-22.4
COL-ROM	-44.4	-27.2	8.8	30.3
COL-ESP	-58.3	-78.5	-19.8	-50.5
COL-SWE	-48.1	-43.2	57.1	61.2
COL-GBR	-68.5	-70.5	-15.9	-19.4

	H & T TIFE		H & T Adjusted TIFE	
Panel	1980-2012		1980-2012	
Snapshot	3avg	2012	3avg	2012
COL-AUS	8.3	12.6	3.7	8.0
COL-BRA	-27.2	-26.5	-16.9	-16.2
COL-CAN	-23.8	-4.0	-1.8	18.7
COL-CHE	-90.7	-86.9	-12.5	7.6
COL-CHN	-79.9	-82.9	-25.2	-32.9
COL-IND	-88.8	-93.9	-34.2	-57.2
COL-JPN	-30.7	-15.1	14.5	30.8
COL-KOR	-69.8	-68.2	-22.6	-19.2
COL-MEX	-13.6	-14.5	0.1	-0.8
COL-RUS	-53.1	-48.5	15.5	21.8
COL-TUR	-90.9	-94.5	-26.2	-45.5
COL-USA	-17.1	-8.5	-11.2	-2.4
COL-EU	-25.7	-20.0	31.4	35.2

Strong Potential

Some Potential

Around the rule

Overtrading

Strongly overtrading

Source: Own calculations

Note:H & T (Hausman and Taylor Estimator); TIFE (Time Invariant Fixed Effects)

Table 7

Relative Residuals (-100% to +100%) from the Hausman and Taylor estimator with time-invariant and time fixed effects Consolidated Results from the Exports of the EU Countries and the Main Markets towards Colombia.

	H & T TIFE		H & T Adjusted TIFE	
Panel	1980-2012		1980-2012	
Snapshot	3avg	2012	3avg	2012
AUT-COL	-67.5	-68.8	-10.0	-12.5
BEL-COL	-47.1	-50.2	-7.4	-11.4
CZE-COL	-39.1	-46.0	0.0	1.8
DNK-COL	-30.7	-42.9	0.9	-12.9
FIN-COL	-58.3	-60.5	20.4	17.2
FRA-COL	-57.6	-56.9	-2.6	-1.4
DEU-COL	-56.6	-59.1	2.4	-1.2
GRC-COL	13.8	-3.8	7.7	-10.2
HUN-COL	-29.7	-47.7	0.0	-24.0
IRL-COL	-11.0	-9.9	22.9	24.0
ITA-COL	-52.5	-53.3	-1.0	-2.1
NLD-COL	-34.4	-34.1	0.2	0.6
POL-COL	-34.8	-37.1	0.0	8.4
PRT-COL	-25.1	-39.4	-17.0	-31.8
ROM-COL	-87.9	-92.6	0.0	-28.4
ESP-COL	-43.2	-47.0	8.4	3.8
SWE-COL	-34.6	-28.1	30.7	37.3
GBR-COL	-27.9	-29.1	15.1	13.8

	H & T TIFE		H & T Adjusted TIFE	
Panel	1980-2012		1980-2012	
Snapshot	3avg	2012	3avg	2012
AUS-COL	26.6	40.9	29.7	43.7
BRA-COL	3.8	1.6	10.7	8.5
CAN-COL	-29.2	-21.7	12.5	20.5
CHE-COL	-68.5	-66.0	12.6	17.3
CHN-COL	-78.1	-77.9	0.0	-15.8
IND-COL	-87.8	-89.5	0.0	-17.8
JPN-COL	-48.8	-47.3	13.1	15.1
KOR-COL	-77.9	-75.4	0.0	-7.2
MEX-COL	-81.5	-81.7	0.0	-21.8
RUS-COL	-47.1	-57.6	0.0	-18.1
TUR-COL	-60.0	-70.9	-11.1	-28.1
USA-COL	-5.9	0.4	-4.0	2.3
EU-COL	-28.2	-29.7	5.8	11.3

Strong Potential
Some Potential
Around the rule
Overtrading
Strongly overtrading

Source: Own calculations

Note:H & T (Hausman and Taylor Estimator); TIFE (Time Invariant Fixed Effects)

3.6 Conclusion

Our analysis of PPML relative residuals shows that there are untapped export potentials for Colombia with some countries of the European Union and the other way round.

We find that Colombia can profit his new trade agreement with the EU to increase its exports to the following markets: Austria, Czech Republic, Finland, France, Germany, Greece, Hungary, Poland, Romania and Sweden.

Trade potentials variations between the PPML time varying fixed effects and the PPML time invariant fixed effects are relatively unimportant. Yet they are sensitive to the adjustment factor. Once adjusted, Trade Potentials are not too much sensitive to changes from one adjusted method (PPML adjusted) to the other (xtpqml adjusted).

Swapping from PPML Relative Residuals to adjusted PPML Relative Residuals is less sensitive for the longer timeframe 1980-2012 than for the 2000-2012. Trade potentials are wiped out with Greece and to a lesser stent with Romania under a more cautious scenario depicted by the adjusted models.

Changes in the data base periods from 1980-2012 to 2000-2012 within the same method of relative residuals calculations are not as sensitive in models 1 and 2 as they are for the adjusted models. Hungary is sensible to this test. The snapshot impact from taking into account the average of the last three years instead of the relative residual for the single year 2012 are generally unimportant across specifications. Bearing in mind Colombia's potentials with the EU, their implications are minimal, after reasonable thresholds of prudence are considered. Results are sensitive to the use of the Hausman and Taylor estimator instead of the PPML. Recent literature suggest the use of PPML estimator.

The panorama is less promising the other way round. Most of the EU countries are already trading around the normal rule predicted by the models or are even overtrading with Colombia. This is particularly visible in the case of the bigger countries. Yet, the United Kingdom could still have some margin to gain in Colombia.

A more encouraging picture appears for Sweden, Ireland, Finland and Poland, which can exploit unrealized trade potentials with Colombia. If we only considered Model 1 and Model 2 specifications, also Czech Republic, Greece Hungary and Portugal can claim trade potentials with Colombia.

Besides the EU, in our analysis of the main world markets, Colombia presents stable trade potentials across models with Russia and Japan. If we stick to models 1 and 2 relative residuals analysis Colombia can claim trade potentials with Australia, Canada and Mexico too.

In the other direction of the flows, only Australia presents stable trade potentials with Colombia across all models and to a lesser extent the EU, Brazil and Canada. Based only on models 1 and 2 specifications, Russia and Turkey also display trade potentials to profit with Colombia.

Future research on the ex post effect of the EU-Colombia free trade agreement would be of interest to verify if the agreement have been successful to bridge the gap where unrealised trade potentials have been identified.

Appendix 3A: Gravity Model List of Variables

X_{ijt} : value of the fob merchandise exports from country i to country j in millions of dollars

$lnGDP_{it}$, $lnGDP_{jt}$: natural logarithm for usd current gdp from countries i and j.

$lnpop_{it}$, $lnpop_{jt}$: natural logarithm for the population of countries i and j.

$lndist_{ijt}$: natural logarithm for distance between I and j

$contig_{ijt}$: 1 if there is a common land frontier between i and j

$comlang_{ijt}$: 1 if at least 9% of the pair population share the same language

$col45_{ijt}$: 1 if both countries were under a colonial relationship before 1945.

$gatt_i$, $gatt_j$: 1 if countries i/j. belong to the GATT/WTO

RTA_{ijt} : 1 If both countries share a free trade agreement.

$OECD_{it}$, $OECD_{jt}$: 1 if the countries i/j. belong to the OECD

Z_{ijt} : Vector of dyadic variables

$\boldsymbol{S_{it}}$ **:** Vector of nomadic variables concerning the exporter country

$\boldsymbol{M_{jt}}$ **:** Vector of nomadic variables concerning the importer country

φ_g : Vector of coefficients related to the vector of dyadic variables

ψ_h : Vector of coefficients related nomadic variables concerning the exporter country

ϕ_h : Vector of coefficients related nomadic variables concerning the importer country

α_t, fixed effect for years

α_i and α_j : respectively time-invariant fixed effect for exporter and importer countries. Also denoted by tivfe.

α_{it} and α_{jt} : respectively time-varying fixed effect for exporter and importer countries. Also denoted by tvfe.

α_{ijt}, country-pair fixed effect

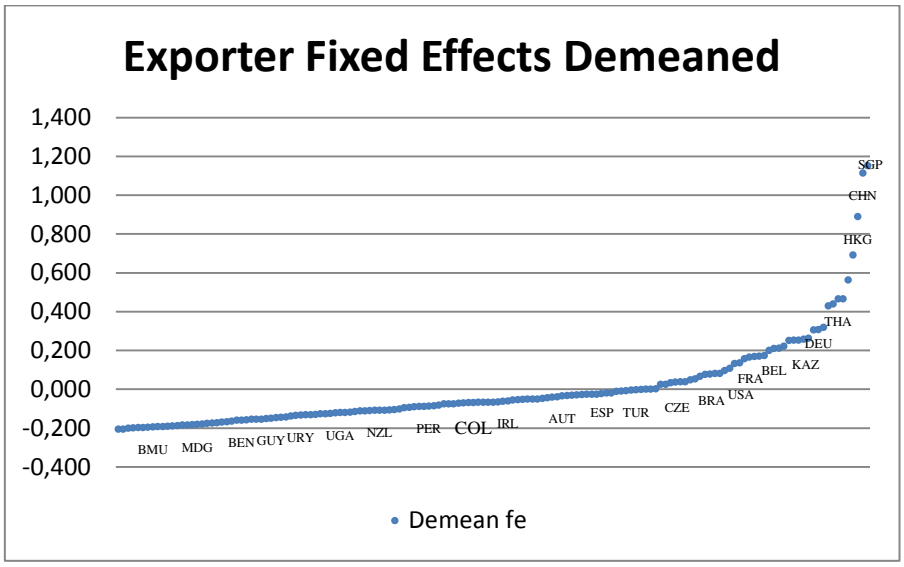
u_{ijt} : idiosyncratic error term.

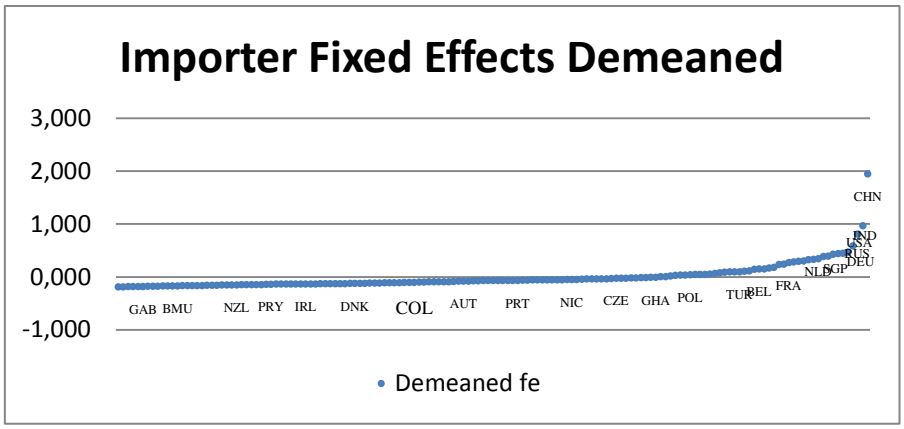
Appendix 3B: Gravity Model Data Set: List of Countries

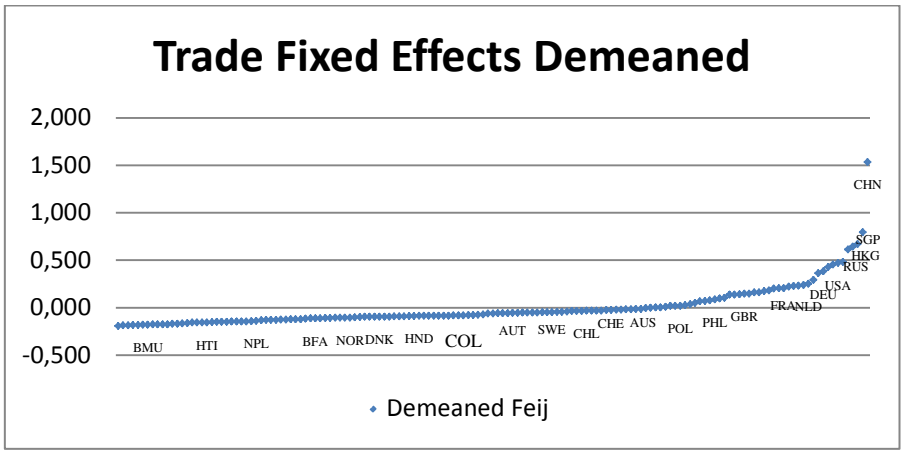
Albania	Djibouti	Korea, South	Russia
Algeria	Dominican Republic	Kuwait	Rwanda
Angola	Ecuador	Kyrgyzstan	Samoa
Argentina	Egypt	Latvia	Saudi Arabia
Australia	El Salvador	Lebanon	Senegal
Austria	Equatorial Guinea	Liberia	Sierra Leone
Azerbaijan	Estonia	Libya	Singapore
Bahrain	Ethiopia	Lithuania	Slovakia
Bangladesh	Fiji	Luxembourg	Slovenia
Barbados	Finland	Madagascar	South Africa
Belarus	France	Malawi	Spain
Belgium	Gabon	Malaysia	Sri Lanka
Belize	Gambia	Mali	Sweden
Benin	Georgia	Malta	Switzerland
Bermuda	Germany	Mauritania	Syria
Bolivia	Ghana	Mauritius	Tajikistan
Brazil	Greece	Mexico	Tanzania
Brunei	Grenada	Moldova	Thailand
Bulgaria	Guatemala	Mongolia	Togo
Burkina Faso	Guinea	Morocco	Tonga
Burundi	Guinea-Bissau	Mozambique	Trinidad and Tobago
Cambodia	Guyana	Nepal	Tunisia
Cameroon	Haiti	Netherlands	Turkey
Canada	Honduras	New Zealand	Turkmenistan
Cape Verde	Hong Kong	Nicaragua	Uganda
Central African Republic	Hungary	Niger	Ukraine
Chad	Iceland	Nigeria	United Arab Emirates
Chile	India	Norway	United Kingdom
China	Indonesia	Oman	United States
Colombia	Iran	Pakistan	Uruguay
Congo Deomocratic	Iraq	Panama	Uzbekistan
Congo Republic	Ireland	Papua New Guinea	Venezuela
Costa Rica	Israel	Paraguay	Vietnam
Cote d'Ivoire	Italy	Peru	Yemen
Croatia	Jamaica	Philippines	Zambia
Cuba	Japan	Poland	Zimbabwe
Cyprus	Jordan	Portugal	
Czech Republic	Kazakhstan	Qatar	
Denmark	Kenya	Romania	

Appendix 3C : Fixed effects graphical analysis

The following charts present the demeaned exporter, importer and trade fixed effects for 153 countries. These effects are obtained after a Poisson fixed effect regression. It is also important to point out that Colombia trades slightly below the average fixed effect the model predict. It is also visible that countries like Hong Kong, Singapore, China, Belgium and Germany trade exceptionally above the mean in what can be understood as a big exporter and importer fixed effect.







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