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An Empirical Assessment of the Economic Effects of WTO Accession and its Commitments

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AN EMPIRICAL ASSESSMENT OF THE ECONOMIC EFFECTS OF WTO ACCESSION

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Abstract: Besides facilitating access to the world market, WTO accession negotiations entail a process of domestic reforms that are expected to improve the supply side of acceding economies. However, measuring the actual impact of accession remains an empirical debate. The present paper contributes to the issue by offering a novel measure of the specific commitments made during the negotiations. These commitments often trigger a series of domestic structural transformations that are expected to impact economic growth. The accession commitment index proposed in the paper reflects the heterogenous distribution of commitments undertaken by Article XII members. This index is used to conduct a thorough statistical exploration of the effect of WTO accession on a series of variables related to economic growth, such as trade and investment. The results show that the impact of WTO membership on the Trade/GDP ratio is significantly higher than previous studies had found for developing countries, both quantitively and qualitatively. The results on investment, be it foreign or domestic, are also encouraging, but are not fully conclusive.

Contents

1 INTRODUCTION

WTO accession negotiations entail a series of institutional and economic domestic reform. Therefore, owing to the differences in the economic structures of Acceding Governments, Accession Packages result in substantial differences across members that acceded to the WTO pursuant to Article XII of the Marrakesh Agreement Establishing the World Trade Organization (hereinafter: Article XII members), in terms of the number of tariff lines bound, the level of bindings and the various accession-specific commitments and obligations they accept both in their market access schedules and on the rules aspect. Although there is a common core of standards and benchmarks, there are variations in bindings and levels of obligation. The strength of obligations and extent of post-accession implementation influence the effectiveness of the benefits from WTO accession (UNCTAD 2013).

Accession-specific commitments provide one of the pillars based on which the multi-lateral trading system functions. In spite of the generally positive economic performance displayed by Article XII members, disparities exist in their country-specific economic performance in terms of trade, foreign direct investment and GDP growth. Therefore, an analysis of accessions commitments could provide insights on the economic effects of WTO accession. In this paper, we attempt to formulate an accession commitment index as a key variable in order to assess the effects of WTO accession.

Since the establishment of the WTO in 1995, the Organization has used accessions as an instrument to integrate diverse economies reflecting a multitude of experiences. Some countries have been more successful than others in making the necessary domestic adjustments stipulated in the report - thus having a better economic performance through well-structured implementation of domestic policies.

Past studies such as Basu (2008) and Tang and Wei (2006) find that economies that have undergone the range of domestic WTO-consistent legal, institutional and structural reforms have tended to be more competitive and have registered higher institutional and economic performance. The quality of governance, which is a critical defining factor in the effective value of accessions obligations, has improved. Furthermore, trade policy making on a platform of accessions to a larger extent countervails the idiosyncratic factors that tend to irrationality in domestic policy making.

The paper proceeds as follows. The section after this introduction details the construction of the Accession Commitment Index, based on both the depth and the spread of commitments negotiated by new acceding governments. Using this index into a modified Difference-in-Difference (D-in-D) analytical approach, a third part assesses whether WTO accession had a positive and significant impact on trade and investment, two key variables for promoting growth. The statistical approach belongs to the Exploratory Data Analysis family, using multilevel regression models. A conclusion summarizes the main results and a series of

annexes present in detail the construction of the Accession Commitment Index and the identification of the control groups used in the D-in-D analysis.

2 DECIPHERING THE ACCESSION COMMITMENT ACQUIS

The accessions process spans over a considerable time-frame; 12.75 years for LDCs, 9.5 years for Non-LDCs and an overall average of 10.3 years for all WTO accessions. The shortest accession was the Kyrgyz Republic while the longest accession was Seychelles with 2.8 and 19.9 years, respectively. During this lengthy period are bouts of domestic, bilateral, plurilateral and multilateral negotiations between the acceding government and the WTO membership interested in engagement. The results of these accession negotiations are embodied in market access schedules containing tariff concessions and Working Party Reports containing specific commitments. WTO accession results have contributed to and expanded the trading system in four particular areas: domestic reforms, market access, rules updates and international cooperation.

By 1995, the WTO had 128 members and the membership accounted for approximately 80% of world trade. In 2016, the WTO has 164 members, and the coverage of WTO rules has been extended to nearly 96% of world trade – a significant leap for the Organization and the dynamics of the global trading system. WTO accessions have facilitated these developments. To date, while there are 36 Article XII members, 21 governments[1] have Working Parties and are at different stages of accession while 5 governments[2] have expressed their interest in joining the WTO. Article XII members now account for 21% of WTO membership and for 17.6% of the extension and coverage of the rules based Multilateral Trading System. The Article XII membership is heterogeneous. Out of 36 Article XII members, 27 acceded on terms and conditions that took account of their development status and particular needs while 9 were classified least-developed countries (LDCs).

Is the effort required to secure accession worth it? In response to an empirical paper done by Rose (2004) in the American Economic Review which found that membership to the GATT/WTO does not in fact significantly increase trade, Tomz et al (2007) argued that if colonies, newly independent states and other entities were included through a reclassification on which parties were bound by the agreements, there was a substantial increase in the amount of trade. Additionally, Subramanian and Wei (2007) also disputed the findings by Rose (2004) and found robust evidence that the WTO/GATT has promoted world trade in an economically and statistically significant way. Gnangnon (2015) provides evidences that being a WTO Member leads on average to higher trade and FDI inflows.

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[1] Algeria, Andorra, Azerbaijan, Bahamas, Belarus, Bhutan, Bosnia and Herzegovina, Comoros, Equatorial Guinea, Ethiopia, Iran, Iraq, Lebanese Republic, Libya, Sao Tome et Principe, Serbia, Somalia, Sudan, Syrian Arab Republic, Timor-Leste and Uzbekistan.
[2] Curacao, Kosovo, Palestine, South Sudan and Turkmenistan.

2.1 Accession-specific Commitments

Central to negotiating WTO membership is the obligation of acceding governments to bring their domestic legislation and trade-related policies to compliance with WTO rules. An important difference between the GATT and the WTO lies in the mandate and modalities of each of these institutions (Gnangnon, 2015). The WTO represents a new and expanded set of GATT disciplines, including a new General Agreement on Trade in Services and a new Agreement on Trade-related Intellectual Property Rights. Moreover, unlike in the GATT, acceding governments cannot cherry-pick the agreements they want to adopt, but have to accept the WTO multilateral texts as a complete package. Thus far, over 7000 pieces of laws and regulations have been notified and passed by the acceding governments resulting in comprehensive domestic reforms. Since 1995, notification of legislation by acceding governments has more than tripled. Before 2000, the average number of legislation that was enacted by acceding governments was approximately 81, but the trend since 2012 reveals that acceding governments have enacted an average of 300 pieces of legislation. With this increase in the importance of 'rule-of-law' in acceding governments, more accession commitments are being made. These commitments/obligations are necessary in stirring up domestic structural transformation.

As stipulated in Article 2 of the WTO Accession Protocol, the accession specific commitments made in the Working Party Reports are integral to the Marrakesh Agreement Establishing the World Trade Organization.[3] Therefore, all Article XII members are bound by the WTO rules and disciplines. Over 36 concluded accessions since 1995; Article XII members have made 1,544 accession-specific commitments[4] in the 36 chapters/sections contained in their accession Working Party Reports and WTO Accession Protocols. It is worth noting that out of this total, 243 commitments were made by Article XII LDCs.[5]

- **Investigating Accession-specific Commitments**

Using a transitive and schematic approach, we synthesize accessions commitments found in the Working Party Reports into indices (See Annex 1). The 'Accession Commitment Index' is based on the following assumptions: 1) WTO accession is a negotiating process. *(Members request the acceding government to undertake commitments in areas they deem crucial to their trading relations.)*; 2) Commitments are related to the degree of global interdependence. *(Most recent accessions reflect greater complexity than earlier accession negotiations.)*; 3) Accessions are affected by geo-political tensions. *(Accessions in countries with geo-political tensions are more arduous than those with political harmony.)*; and, 4) Tariff commitments are inversely related to commitments in behind the border measures. *(Reduced emphasis on tariff obligations and commitments results in deeper & more complex commitments in behind the border measures.)*

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[4] This figure includes commitments present in their Working Party Reports and Accession Protocols.
[5] WTO Accessions 2015 Annual Report by the Director General, WT/ACC/25.

An investigation of the Working Party commitments of all Article XII members birthed some interesting revelations. Whereas acceding governments like China and the Russian Federation's coverage of commitments in the substantive parts of the Working Party Report[6] is relatively high at 84% and 73% respectively, other acceding governments such as Mongolia and Ecuador have a fewer coverage of commitments at 33% and 38% respectively.

Commitments made are not spread equally in each section/sub-section of the Working Party Reports and Accession Protocols. The commitments that almost all the Article XII members undertook during their accessions negotiations are: fees and charges for services rendered; industrial policy, including subsidies; trade-related investment measures; free zones, special economic areas; pricing policies; trading rights; anti-dumping, countervailing duties, safeguard regimes; customs valuation; application of internal taxes on imports; framework for making and enforcing policies; policies affecting trade in services; state ownership and privatization; state trading enterprises; quantitative import restrictions, incl. prohibitions, quotas and licensing systems; trade-related aspects of intellectual property rights; technical barriers to trade; and, sanitary and phytosanitary measures.

At the same time, only a few acceding governments undertook commitments in: balance-of-payments measures; textile regimes; foreign exchange and payments; investment regime; other customs formalities; trade in civil aircraft; and, export duties, fees and charges. More specifically, some selected acceding governments made commitments that most governments had not undertaken. For example, Seychelles made commitments in monetary and fiscal policy and competition policy. Ecuador made a commitment on staging of dismantling of Tariff Adjustment Mechanism. China committed on special trade arrangements, incl. barter trade arrangements; transitional product-specific safeguard mechanism; reservations by WTO members; Transitional Review Mechanism; and, non-discrimination. Chinese Taipei committed to a Chinese Taipei Special Exchange Agreement between the WTO and Chinese Taipei.

2.2 Measuring the Depth of Commitments

This non-homogenous distribution of commitments undertaken by Article XII members signals a difference in the magnitude of importance attached by the WTO membership. As alluded to above, one of the assumptions is that WTO members would only insist that an acceding government make a commitment in an area/ sector that is considered essential and fundamental for the prevailing and potential sustenance of their mutual trading relations. Annex 1 provides a step by step analysis of the formulation of the accession commitment index.

Article XII members with an index of 1 have made commitments in areas that the WTO membership considers less crucial to maintaining their trading relations. These members include Mongolia, Ecuador, Latvia, Estonia, Former Yugoslav Republic of Macedonia,

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[6] The substantive contents of the Working Party Report include: the economic policies and foreign trade; framework for making and enforcing policies affecting foreign trade in goods and services; polices affecting goods; trade-related intellectual property regime; trade-related services regime; transparency; and, trade agreements.

Panama, Nepal, Bulgaria, Lao People's Democratic Republic, Oman and Cabo Verde. These accession specific commitments include: balance-of-payments measures; textile regimes; foreign exchange and payments; investment regime; other customs formalities; trade in civil aircraft; and, export duties, fees and charges. For some obligations such as "trade in civil aircraft", this could be attributed to the fact that not many countries produce aircraft.

An index of 2 signifies that these Article XII members have made commitments in areas that the WTO membership considers moderately crucial to maintaining their trading relations. These members include: Croatia, Moldova, Cambodia, Lithuania, Tonga, Yemen, Georgia, Kyrgyz Republic, Albania, Jordan, Liberia, Vanuatu, Montenegro, Samoa, Afghanistan and Seychelles. The accession specific commitments include: transit; export subsidies; ordinary customs duties; government procurement; pre-shipment inspection; other duties and charges; rules of origin; trade agreements; export restrictions; and, agricultural policies. Export subsidies have always been prohibited since GATT 1947, especially on manufactured products. However, the WTO allows the use of export subsidies on agricultural products in four different situations only.[7] These have remained a key issue in agricultural negotiations as well as accession negotiations.

The highest index of 3 means that these Article XII members have made accession-specific commitments in areas that the WTO membership considers highly crucial to maintaining their trading relations. These members include Republic of Armenia, Tajikistan, Saudi Arabia, Ukraine, Chinese Taipei, Vietnam, Kazakhstan, China and the Russian Federation. The accession specific obligations include: framework for making and enforcing policies; policies affecting trade in services; state ownership and privatization; state trading enterprises; quantitative import restrictions, incl. prohibitions, quotas and licensing systems; trade-related aspects of intellectual property rights; technical barriers to trade; and, sanitary and phytosanitary measures.

The process of WTO accession requires that acceding governments undertake the above-mentioned obligations, assuring the rest of the membership of adherence to the rules-based system through fostering predictability and transparency. But as shown by the accession commitment index – which is an attempt at the *quantification* of accession-specific commitments, there exists a difference in the "depth" of the commitments made by each Article XII member.

The results of the weighting exercise are represented in Figure 1 below.

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[7] (i) export subsidies subject to product-specific reduction commitments within the limits specified in the schedule of the WTO Member concerned; (ii) any excess of budgetary outlays for export subsidies or subsidized export volume over the limits specified in the schedule which is covered by the "downstream flexibility" provision of Article 9.2(b) of the Agreement on Agriculture; (iii) export subsidies consistent with the special and differential treatment provision for developing country Members (Article 9.4 of the Agreement); and (iv) export subsidies other than those subject to reduction commitments provided that they are in conformity with the anti-circumvention disciplines of Article 10 of the Agreement on Agriculture.

Figure 1 Accession Commitment Index and Weighted Scores
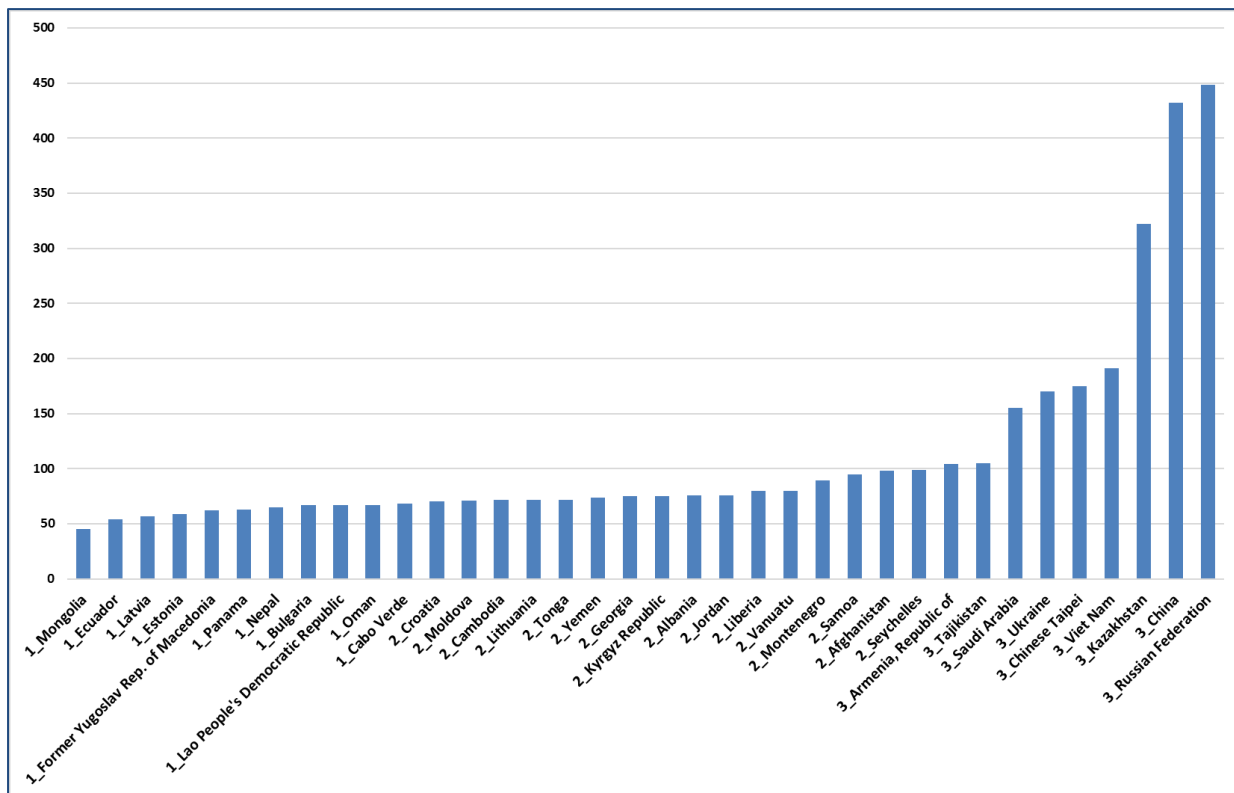
Note: Scores are indicated by the number (1,2 or 3) before the Article XII Member name, the weighted index by the length of the column.
Source: Authors' elaboration.

3 EMPIRICAL ASSESSMENT

In this section, we examine the hypothesis that WTO accession had a positive and significant impact on economic performance. Our approach is an extension of the Difference-in-Difference (D-in-D) analysis where we dispose of a time series of observations before and after treatment, which is WTO accession in this case. It can be assimilated to the family of semi-randomized experiments, with econometric models providing for a way of controlling covariates other than WTO accession which may have affected the outcome.

3.1 The Model and the Data

There are many ways of approaching D-in-D (Imbens and Wooldridge, 2009). The following model provides a simple and general multilevel formulation where the analyst relies on observed covariates with observational (i.e., non-randomized) data but can rely on many pooled time series: [8]

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[8] The feature that distinguishes multi-level models from classical regression is in the modelling of the variation between groups (Gelman and Hill, 2007)

$$y_{igt} = \theta_i + \tau_t + \alpha_g + \beta X + \gamma_i Z_i + \delta_i + u_{igt} \qquad \text{[1]}$$

Where:

i, g and t are indices for, countries, groups of countries and time, respectively;

y is the economic variable that is expected to respond to accession;

θ, τ and α are the (unobserved) country, time and group effects;

X are background economic variables (covariates) that are expected to affect all countries in a similar way;

Z are background covariates for which we expect country-specific reactions (e.g., due to different modes of interaction with the world economy);

δ is our variable of interest and captures the "treatment" effect (WTO accession and the depth of related commitments); and,

u is the error term.

The distinction between covariates of type **X** and type **Z** is largely arbitrary. A thorough and painstaking statistical procedure "à la Leamer (1983)" would be to individually test all the possible combinations. In this paper, we opted for including in the first group, variables that differ from country to country (e.g., GDP rate of growth) but where we expect similar reactions and in the second group, the global environment variables that are shared by all countries but may affect them differently (e.g., World GDP rate of growth). A few (unsystematic) checks show that this choice did not fundamentally affect the main result (the response of the treatment variable δ). Distinguishing countries by sub-groups ("g") limits the bias created by arbitrarily splitting the covariates in these two groups. This also insures that the sub-samples react in similar ways to the background variables as discussed further in the following sections.

The data cover the period 1980-2015 and include, besides our accession commitment index, macroeconomic variables from the World Bank (World Development Indicators).

This multi-level model is very similar to the econometrics used by Tang and Wei (2006), Basu (2008) and Gnangnon (2015) in their exploration of WTO membership on, respectively, macroeconomic and institutional variables. Our approach includes a preliminary matching step to identify more precisely the control groups (see Annex 2). This matching process, proper to the statistical tradition of randomized experiments and multilevel modelling, defines groups of countries (the "g" index) that are expected to be homogeneous for their socio-economic characteristics and includes both control and Article XII members.

In the spirit of Leamer (1983), we will first use a "naïve" model, which is a simplified version of equation [1]. In this naïve model, the influence of the X and Z variable is expected to be captured by the trend variable. In its naïve form, the model [1] boils down to:

$$y_{igt} = \theta_i + \tau_t + \alpha_g + \delta_i + u_{igt} \qquad \text{[2]}$$

The group variables α_g will capture any common behaviour besides individual (fixed) effects and the variable δi (a dummy variable taking the value 0 for the control group for all the years as well as the acceding governments before accession; after accession, the value is set either at 1 or to the value for the accession commitment index).

Equation [2] has the advantage of isolating the apparent impact δ in a close similitude with the traditional difference-in-difference settings. The results from the naïve model may be validated or, at the contrary, falsified when the full-fledged multi-sectoral version [1] will be used. Both [1] and [2] accept alternative specifications. For example, the hypothesis of homogeneous responses by country grouping can be dropped and replaced by individual country fixed effects. Similarly, the time trend can be linear or quadratic; in the latter case, it means that there is an inflexion point in the historical tendency. Finally, the statistical model may need to be adjusted to correct for issues such as heteroscedasticity and autocorrelation in the residuals.

An interesting feature of the trend variable that appears in most regressions is the presence of an inflexion point. Albeit the absolute value of the quadratic coefficient is too small to induce a negative slope at the end of the 1980-2015 period, it clearly indicates a slowdown in the positive trend defined by the linear coefficient. A possible explanation is the depth of the 2008-2009 global crisis and the mediocre "New Normal" that followed after the 2010 recovery. This period of slow growth in both trade and GDP contrasts with the booming period 1990-2005. In the 15 years following the signing of the Uruguay Round and the creation of the WTO, international trade grew much more rapidly than the world economy. This growth took place when the world economy itself was growing much more rapidly than in the previous decades in the wake of the internet and IT revolution. The trade-income elasticity was at its highest in the late 1995s, when an increase in GDP of 1% was associated with an increase in trade of almost 3% (Figure 2).

A possible way of exploring this hypothesis would be to include an additional set of dummy variables and control for the effect of the global crisis. We prefer to return to the original model [1] that includes two indicators of the global business cycle (rates of growth of the world GDP and investment financing, respectively) which will capture the successive phases of the global business cycle. Indeed, the fully-fledged model in equation [1] includes the influence of economic variables, either proper to the country or reflecting the situation of the global business cycle. We opted for including in the covariates of type X the variables that capture each country's business cycle: the variables differ from country to country (e.g., GDP rate of growth) but all countries react more or less similarly to a change in the cycle. In the Z group, we included the variables signalling changes in the global economic environment e.g., world GDP rate of growth and global availability of investment finance (these variables are shared by all countries but may affect them differently). Obviously, the choice is arbitrary but a few explorations on alternative specifications showed that it did not make much difference on the results obtained for δ, the variable of interest.

Figure 2: World trade-GDP ratio and trade-income elasticity, 1970-2015
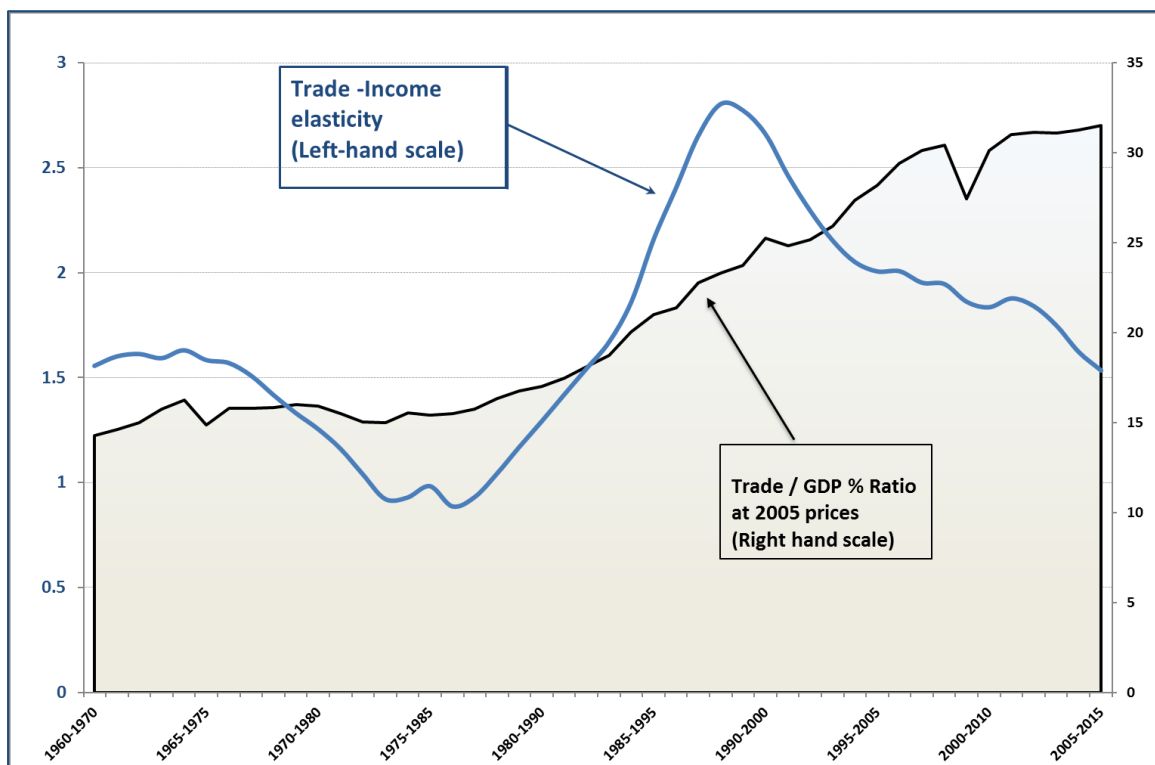
Notes: Merchandise exports only; world GDP and trade at constant 2005 prices; dollar figures for GDP are converted from domestic currencies using official exchange rates. Long-term elasticity is based on 10-year rolling period from 1960-1970 to 2005-2015.
Source: Escaith and Miroudot (2015)

3.2 Matching and Control Groups

To implement difference-in-difference analysis, or its time-series version as it is the case here, we need to compare cases that are similar in behaviour except for the variable being tested (called the "treatment", in our case, WTO accession). As Stuart (2010) mentions in the introduction of her review, "one of the key benefits of randomized experiments for estimating causal effects is that the treated and control groups are guaranteed to be only randomly different from one another on all background covariates, both observed and unobserved". So we would like to compare treated and control groups that are as similar as possible. The process of finding those close neighbours is called "matching" and is usually based on a series of statistical methods (e.g. cluster analysis and propensity scores).

In theory, the control group should include non-WTO members whose characteristics are similar to the acceding governments. For statistical reasons, this is not practical, because the group of countries outside the WTO is relatively small (35) and too heterogeneous to provide

for a control group.[9] For these reasons, we use the WTO developing country members that were already part of the GATT to select the control group.

It is known that, prior to the signature of the Uruguay Round; the level of commitments of the developing country contracting parties at the time of the GATT was *undemanding*. As stated by Rose (2006), the GATT historically made few demands on developing countries in terms of trade liberalization, since most entrants were eligible for lenient "special and differential treatment". The simple average bound tariff for Latin American countries was approximately 35% for industrial products after the Uruguay Round (WTO, 2001). For developing Asian countries, the average bound tariff ranged from 0% for Hong Kong, China to 59% for India. In Africa, bound tariffs ranged from 11% (Zimbabwe) to 34% (Tunisia) in the sample of countries covered by WTO (2001). Tariff peaks (above 15%) were the majority (almost 100% of bound tariffs in Latin America; between 44% and 98% in Africa and developing Asia, except Hong Kong, China and Gabon). Outside Latin America, the binding coverage was often much below 100%.

Subramanian and Wei (2007) note that the favourable empirical results found on the role of GATT/WTO were much weaker for developing countries. Their results suggest that there has been little impact of membership on developing countries' imports, a conclusion compatible with Rose's diagnostic on the shallowness of trade liberalization on the part of the developing countries. They also document that post-Uruguay Round members tend to be systematically more open than old developing country members of the GATT. This result confirms our prior preposition that pre-Uruguay Round developing country members can be considered as a control group.

Different from developing country members that were already part of the GATT at the creation of WTO, Article XII members had to undertake more far-reaching commitments in terms of trade policy and domestic economic policy reforms, as discussed in section 2, above. Because the WTO negotiation process is more stringent than what was the case in the GATT, Article XII members had to implement significant changes in their domestic economic policies and institutional arrangements. Our hypothesis here is that these domestic reforms amplify the positive impact of joining WTO and is reflected in improved economic growth prospects.

It could be argued that during the GATT period, developing countries which suffered balance-of-payments crises had also to implement some of these reforms as part of the conditionality required by the Bretton Woods institutions in their structural adjustment programs. We will control for this issue through a preliminary matching process where Article XII and GATT/WTO members will be paired on the basis of a set of socio-economic variables for a period previous to WTO accession (1995-2000 period). [10] The resulting sub-groups will include

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[9] Moreover, data coverage for these countries –some of them having gone through difficult economic and political situations-- is often patchy.

[10] See Annex 2 for a description of the socio-economic data used in the matching procedure.

countries that were similar in their socio-economic characteristics before the time of accession. This will provide a firmer basis for our control groups.

The matching procedure looks at disaggregating the sample of WTO developing country members (both GATT and Article XII members) into a series of more homogeneous sub-samples which may, for structural reasons, have different reactions to: (i) economic shocks and trends; and, (ii) WTO accession treatment. The procedure, based on a series of structural socio-economic and macroeconomic variables for 1995 - 2000, is implemented through two steps: (1) exclusion of outliers; and, (2) identification of clusters. Annex 2 provides detailed information on the procedure and its results. The five groups are as follows:

Table 1 Definition of five country groups after matching and clustering analysis

ISO3	Validated	Suggested	ISO3	Validated	Suggested	ISO3	Validated	Suggested
ALB	1	1	HRV	4	4	PHL	1	1
BEN	2	2	IDN	1	1	PRY	1	1
BGR	3	3	IND	2	2	RUS	5	5
BLZ	…	3	JAM	…	…	SEN	2	2
BOL	1	1	KEN	2	2	SLV	…	3
BRA	4	4	KGZ	2	2	SUR	5	5
CAF	2	2	KHM	2	2	TCD	2	2
CIV	2	2	LAO	2	2	TGO	2	2
CMR	2	2	LCA	5	5	THA	3	3
COL	…	…	LTU	5	5	TJK	2	2
CRI	5	5	LVA	5	5	TON	1	1
DMA	…	…	MAR	1	1	TUN	…	3
DOM	…	3	MDA	2	2	TUR	4	4
ECU	…	3	MEX	4	4	UKR	1	1
EGY	…	3	MKD		3	URY	4	4
FJI	…	3	MRT	2	2	VCT	3	3
GEO	2	2	MUS	5	5	VNM	2	2
GHA	2	2	NAM	…	3	WSM	1	1
GIN	2	2	NIC	2	2	YEM	2	2
GRD	5	5	NPL	2	2	ZAF	5	5
GTM	…	1	PAK	2	2	ZWE	2	2
HND	…	2	PER	…	3			

Notes and sources: See Annex 2

The outliers that have been excluded during the selection and matching process (denoted by three dots in the table) constitute a 6th group. Including or excluding this 6th group will offer one option to test the robustness of the results obtained from our models [1] and [2]. [11]

There are alternatives to matching methods. They include, *inter alia*, adjusting for background variables in a regression model (Stuart, 2010). Some of these variables are included in **X** and **Z** of model [1]. Therefore, the model allows for the use of both approaches.

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[11] All regressions are implemented using some variant of ordinary least square (OLS). OLS procedures are known to be influenced by outliers.

3.3 Results of the Data Analysis

The focus of the analysis is to assess the impact of the depth of WTO accession-specific commitments on economic performance. Our prior inference is that WTO accession may influence long-term economic growth by fostering trade and improving total factor productivity through increased efficiency in resource allocation and greater exposure to technical and business knowledge. More directly, WTO accession can influence investment measured here through gross capital formation and foreign direct investment inflows.

The first set of regressions looks at the impact of WTO accession on the trade/GDP ratio, but also at its impact on the current account balance. Indeed, as formalized by Thirlwall (1979), in most developing countries, long-term growth is constrained by Balance-of-Payments considerations. Thirlwall's Law derives from the open economy Harrod-Domar model and shows how a shortage of foreign exchange can reduce economic growth by constraining both imports and savings. Therefore, any positive impact on trade exposure that could worsen the current account situation, would not deliver long-term growth effects.

The regression analysis on investment included three potential response variables: i) rate of investment in percentage of GDP; ii) annual growth rate of fixed capital formation in real terms; and, iii) inflows of foreign direct investment as a share of world total.

In all cases, the data analysis procedure was implemented in two main steps, each one with alternative specifications to provide for some initial robustness checks (more thorough robustness checks results are provided in a following section). The first step involved the "naïve" model [2] derived from [1]. Albeit the approach may look simplistic, it provides good results when looking at causal effects, as long as the sample of observations (both treated and untreated cases) are homogeneous enough to react in a similar manner to changes in the environment, as captured by the time indices via a linear trend (or a quadratic one, if we suspect inflexion points).[12]

In a second step, the regression model was enriched by including the background control covariates **X** and **Z** into the right hand side of equation [1]. **X** are background economic variables that are country-specific but expected to affect all countries in a similar way. We include in this group the lagged variations in GDP which act as a proxy for capturing the domestic business cycle. **Z** are background covariates for which we expect country-specific reactions. We include in this group the evolution of the world economy and the availability of investment financing, expecting each country to react differently to the global environment, due to idiosyncratic specificities not fully captured by the country fixed effects (θ_i).

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[12] In practice, we systematically included both linear and quadratic terms, dropping the quadratic term when its coefficient wasn't significant and had the same sign than the linear one. When the signs were different (sign of possible inflexion points), the quadratic term was kept if it could disentangle the effect of collinearity between the time and the accession indices (over the sample, the correlation coefficient between the accession variables and the time index is significantly positive and equal to 0.6).

As it often happens in applied analysis, the estimable models derived from [1] and [2] appeared to suffer from a series of statistical issues, in particular the presence of autocorrelation in the residual term. Such a situation implies that we cannot rely on the usual test of significance such as the p-Student and is often due to a mis-specification of the theoretical model, in particular the omission of some important explanatory variable on the right-hand side.

We dealt (superficially) with the issue by modifying the statistical model. The first modification includes the lagged response variable as an instrument for capturing the influence of other variables and/or care for the presence of partial adjustment. [13] The second option was to formally model the autocorrelation in the error term through an autoregressive AR (1) process. [14]

None of these solutions is fully satisfactory from a formal statistical perspective and due caution needs to be applied when interpreting the results. On the other hand, because the objective of the exercise is exploratory and does not claim to predict future outcomes (see 3.4 Analytical shortcomings p.28), we opted for keeping standard specifications for all regressions – even if not fully satisfactory — rather than optimizing each model individually. [15]

3.3.1 Accession and Trade

The following sections explore the relationship between trade to GDP ratio and WTO accession and the depth of commitments. A naïve approach based on model [2] indicates positive effects, but not significant at the received level of statistical inference (see Table 2).

Table 2 Naïve regression of Trade/GDP ratio

| Model | 1a | | 1b | | 2a | | 2b | |
Variable	Coefficient		Coefficient		Coefficient		Coefficient	
C	51.295	***	12.889	***	51.707	***	12.982	***
Accession Dummy	2.314		1.146		…		…	
Accession Commitment Index	…		…		0.007		0.005	
Trend	1.971	***	0.388	***	1.928	***	0.380	***
Trend^2	-0.034	**	-0.008	**	-0.033	**	-0.008	**
Lagged dependent	…		0.779	***	…		0.778	***
AR(1)	0.779	***			0.778	***		
R-squared	0.91		0.91		0.91		0.91	
Durbin-Watson	2.07		…		2.07		…	

Note: Cross-sections included: 69, total pool (unbalanced) observations: 2218, Fixed effects with White cross-section standard errors & covariance (d.f. corrected). ***, ** and * signal signification level at about 0.01, 0.05 and 0.1, respectively.

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[13] We didn't test for the remanence of autocorrelation after including the lagged endogenous variable, this procedure implying the use of specific tests (the usual ones, such as Durbin-Watson, being biased towards rejecting autocorrelation in such a situation.

[14] Both AR(1) estimation and lagged endogenous models are autoregressive, but differ in their specification and often in their results. In an AR(1) equation, it is not the endogenous (explained) variable Y that follows an AR process but the error terms. A thorough application of an autoregressive ARIMA procedure would require additional steps and time series testing, but –as we mentioned—this is just a naïve exercise.

[15] It means in particular that we kept explanatory variables that didn't pass the t-tests in order to have comparable specifications across the whole exercise. There are a few exceptions to the rule, for example we dropped the quadratic coefficient of the trend when it was not significant and had the same sign as the linear one.

Nevertheless, the coefficients would remain positive even after subtracting one standard deviation from their estimated value (with the exception of model 2a). In a classical regression exercise, this significance level would be too lax for Accession to be a good "predictor" of the trade to GDP ratio. In our case, we do not claim to achieve perfection but only aim at identifying stylized facts. In this type of exercise, especially when using multilevel models such as [1], it is often preferable not to rely too much on the coefficients details and opt instead for having a first idea of the "big picture" (Gelman and Hill, 2007).

The **X** covariates that control for the situation of individual countries in their own business cycle are the previous annual GDP growth rates, with three lags. The **Z** variables that provide information on the economic environment are the contemporaneous growth in World GDP and the increase in total FDI inflows. Table 3 presents the results obtained for the model [1], including a quadratic trend.

Table 3 Multi-level regression of Trade/GDP ratio, including cluster dummies *(selected variables)*

Model	1a Coefficient		1b Coefficient		2a Coefficient		2b Coefficient	
Accession Dummy	5.708	***	2.185	***	…		…	
Accession Commitment Index	…		…		0.015	*	0.006	*
Cluster 1	-44.815	*	5.267	**	-44.934	*	5.385	**
Cluster 2	-43.591	**	1.917		-43.768	**	1.984	
Cluster 3	-34.618	*	3.275		-35.656	*	3.180	
Cluster 4	-72.446	***	-0.254		-73.817	***	-0.361	
Cluster 5	-33.504		5.200	*	-35.255		5.035	
Cluster 6	-35.860	*	5.234		-35.339	*	5.413	*
Trend	6.368	***	0.482	***	6.301	***	0.465	***
Trend^2	-0.094	***	-0.010	***	-0.091	***	-0.009	***
AR(1)	0.932	***	…		0.934	***	…	
Lagged dependent	…		0.819	***	…		0.821	***
R-squared	0.91		0.92		0.91		0.92	
Durbin-Watson stat.	2.20		…		2.20		…	

Note: Cross-sections included: 69; Total pool (unbalanced) number of observations: between 1965-2029; White cross-section standard errors & covariance (d.f. corrected). The table omits results for the X covariates (annual GDP growth rates, with three lags) and Z variables (contemporaneous growth in World GDP and the increase in total FDI inflows).

Most of the regressions presented in the paper will include at least one time trend, even when not statistically significant. Diverging from the "econometric" practice of moving from general to simplified by dropping non-significant variables has two objectives. One is of comparability: because our aim is an "exploratory" one across different potential impacts, we prefer keeping the same basic specification in order to have comparable results. The other is probably more important from a "confirmatory" perspective: we noticed the strong positive correlation between the accession variables and the time trend: dropping the time trend almost systematically improves the role of accession. To stay on the safe side and avoid inflating our

results, we opted for the conservative approach of keeping the same specification across all regressions. [16]

As the initial models for the Accession Dummy and the accession commitment index are plagued with autocorrelation in the residuals, for each one of them, two alternative models (AR(1) and lagged dependent variable) are also displayed. Because the exercise is exploratory and descriptive, all regressions include the same variables, even when not significant.

The fully fledged multilevel model [1] indicates that Accession has a positive and statistically significant impact on trade intensity, as measured by the Trade/GDP ratio. The impact is more closely associated to the accession process itself (captured by the Accession Dummy) than the depth of commitments (Accession Commitment Index), even if the latter is also statistically significant and indicates a positive relationship. The time trend shows an inflexion point (especially in model 2a) even after including the Z variables capturing the effect of the global business cycle. This may be the sign of some missing variables, a possibility reinforced by the fact that the time trend loses in significance when the lagged dependent variable is included (models 1b and 2b) compared to the alternative AR(1) error process (models 1a and 2a). As mentioned, we note the possible mis-specification of the exploratory model but will not try in this exercise to find a better fit.

A first robustness check is now conducted on the model by dropping the group variables and replacing them by individual country fixed effects (Table 4).

Table 4 Multi-level regression of Trade/GDP ratio, including country fixed effects (selected variables)

Model	1.a		2.a	
Variable	Coefficient		Coefficient	
Accession Dummy	3.577	**		
Accession Commitment Index			0.014	*
Trend	2.013	**	2.002	**
Trend^2	-0.034	*	-0.033	*
AR(1)	0.780	***	0.780	***
R-squared	0.92		0.92	
Durbin-Watson	2.08		2.08	

Note: Cross-sections included: 69; Total pool (unbalanced) observations: 2029 ; White cross-section standard errors & covariance (d.f. corrected). Model numbers correspond to those in the previous table. See also Table 3 for the list of omitted results.

To remain on the safe side, we present only the results obtained with the AR(1) model, even when the results from the lagged-dependent variable model are higher. This conservative posture is due to the possible upward bias in the D-W and t-statistics when the model includes

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[16] Even when including non-Article XII members, the correlation coefficient between the accession dummy and the time trend is 0.69. Including the time trend with "capture" part of the accession impact, conversely, excluding the time trend might attribute to accession some effects that are simply due to the passing of time and remove a significant variable for the non-acceding members. Without any better alternative at this exploratory stage, we kept both variables.

the lagged dependent variable. The results on the effect of accession are modified in level for model 1a, but none is affected in its statistical significance. We can therefore consider them as relatively robust for the sample of 69 countries covered in this exercise.

But other doubts persist. Some of the observations – namely, the 10 countries pertaining to Cluster 6 – have been identified as outliers (see Annex B). In order to check if the results were due to some possible outsized influence of these outliers, the model was re-estimated using only observations pertaining to clusters 1 to 5. Table 5shows the results of this robustness check, based on two model specifications: with group effects (1.a and 1.b) and with country-specific fixed effects (2.a and 2.b). While the depth of accession loses in statistical significance (the probability of the true coefficient being nil rises to about 0.20 in both model specifications), the impact of accession itself remains significantly positive. Therefore, the positive influence of accession on trade intensity remains positive, even after taking out outliers, in particular China.

Table 5 Multi-level regression of Trade/GDP ratio, with/without clusters or country fixed effects, excluding outliers *(selected variables)*

Model	1.a		1.b		2.a		2.b	
Variable	Coefficient		Coefficient		Coefficient		Coefficient	
Accession Dummy	5.719	***	...		5.441	***		
Accession Commitment							0.028	
Index			0.028					
Cluster 1	-47.356	*	-47.561	*	...		...	
Cluster 2	-41.730	*	-41.756	*	...		...	
Cluster 3	-38.148	*	-38.924	*	...		...	
Cluster 4	-74.487	***	-75.574	***	...		...	
Cluster 5	-27.950		-29.008		...		...	
AR(1)	0.935	***	0.936	***	0.947	***	0.948	***
R-squared	0.92		0.92		0.92		0.92	
Durbin-Watson					2.06		2.06	

Note: Cross-sections included: 59; Total pool (unbalanced) observations: 1669 ; White cross-section standard errors & covariance (d.f. corrected). 2.a and 2.b include country fixed effects. See Table 3 for the list of omitted results (variables **X** and **Z**).

The improvement in trade intensity is not only quantitative, but also qualitative. The following results (Table 6) show that trade in services (sum of service exports and imports divided by the value of GDP at current U.S. dollars) also increased under the influence of accession. This is particularly important considering the increasing role of services in boosting competitiveness and productivity. It has been identified as one of the vectors of export diversification and up-grading through global value chains (Low and Pasadilla, 2015). Table 6 indicates that WTO Accession and, in a less significant measure, the depth of commitments, do positively influence trade in services, in percentage of GDP. Incidentally, it also indicates that the previous increase in the Trade/GDP intensity is genuine and wasn't due to the increase in the price of commodities, which lasted between 2003 and 2011, if we exclude the drop during the 2008-2009 crisis.

Table 6 Multi-level regression of Trade in Services /GDP ratio, including clusters dummies *(selected variables)*

Model Variable	1.a		1.b		2.a		2.b	
Accession Dummy	1.715	**	0.887	***				
Accession Commitment Index	…		…		0.005		0.002	*
Cluster 1	-24.777	**	1.383	***	-24.420	*	1.431	***
Cluster 2	-27.010	*	1.134	*	-26.629	*	1.185	*
Cluster 3	-22.745	*	1.084		-22.973		1.047	
Cluster 4	-41.444	***	0.279		-41.945	***	0.241	
Cluster 5	-18.193		2.180	*	-18.741		2.097	*
Cluster 6	-10.262		2.078	**	-9.355		2.160	**
Trend	1.757	***	0.080	**	1.728	***	0.071	*
Trend^2	-0.024	***	-0.002	**	-0.023	***	-0.002	*
AR(1)	0.968	***	…		0.969	***		
Lagged dependent	…		0.894	***			0.896	***
R-squared	0.96		0.96		0.96		0.96	
Durbin-Watson stat	1.96		…		1.96		…	

Note: Cross-sections included: 69; Total pool (unbalanced) observations: 1771 ; White cross-section standard errors & covariance (d.f. corrected). See also Table 3 for the list of omitted results.

The results are also robust to changes in model specification (individual country fixed effects instead of group effects) and to the exclusion of outliers (not shown here). The depth of accession loses some of its significance, but the mere fact of acceding to WTO membership remains positive and highly significant (the probability that the coefficient is actually nil is lower than 0.05 in the worst-case scenario).

Those positive results would not be sustainable in the long run if more trade openness resulted also in an unfavourable current account balance. Actually, the fear of liberalization inducing balance of payment issues is not uncommon and is often used as an argument against adopting WTO-consistent trade regulations. Using a similar approach to ours, and comparing WTO Members with a non-WTO control group, Gnangnon (2015) finds a negative impact of WTO membership on trade balance. Our results obtained through variants of model [1] do not support this pessimistic hypothesis, on the contrary. The influence of accession is always positive, sometimes significantly so. Table 7 below shows the results for trade balance obtained after correcting for error autocorrelation with an AR (1) process, with two alternative specifications: 1.a and 1.b including the country clusters; and, 2.a and 2.b including individual country fixed effects.

As before, a robustness check was conducted, taking out the 10 outlier countries pertaining to the 6th cluster. The results (not shown here) point to accession losing in statistical significance in strengthening the current account balance of Article XII members. Probably, this is due, *inter alia*, to the absence of China in the sub-sample. Yet, if accession does not have a significant positive impact, its proven leverage in promoting trade intensity does not put the external equilibrium of Article XII members at risk. This means that the expected positive influence of trade exposure on efficiency of resource allocation and total factor productivity

respects the conditions of the Thirlwall Law and is sustainable in the long term from a balance of payments perspective.[17]

Table 7 Multi-level regression of Current Account/GDP ratio, with/without clusters or country fixed effects *(selected variables)*

Model Variable	1.a Coefficient		1.b Coefficient		2.a Coefficient		2.b Coefficient	
Accession Dummy	0.646		…		1.515	*		
Accession Commitment Index	…		0.008	**	…		0.005	
Cluster 1	-2.933		-0.213		…		…	
Cluster 2	-6.139	***	-3.338	**	…		…	
Cluster 3	-3.752	**	-1.018		…		…	
Cluster 4	-1.315		1.360		…		…	
Cluster 5	-5.548	***	-2.865	*	…		…	
Cluster 6	-5.365	***	-2.715	*	…		…	
AR(1)	0.799	***	0.793	***	0.658	***	0.659	***
R-squared	0.69		0.69		0.72		0.72	
Durbin-Watson	2.06		2.06		1.98		1.99	

Note: Cross-sections included: 69; Total pool (unbalanced) observations: 1771 ; White cross-section standard errors & covariance (d.f. corrected). 2.a and 2.b include country fixed effects. See also Table 3 for the list of omitted results.

3.3.2 Accession and Real Investment

We look now at the impact of accession on two investment-related variables: Rate of investment in percentage of GDP and in real growth rate.

a. Naïve model

- **Investment/GDP ratio**

Table 9Table 8 presents the results obtained with the simplest model, using alternatively the Accession Dummy and the Commitment Index. As in other cases, the specification includes time series variables to correct for autocorrelation in the residuals.

In all cases, the simplified equation based on [2] reflects the data well (high R-squared) and the effect of accession is positive. Nevertheless, it is highly significant only when the lagged endogenous variable is included to correct for mis-specification. In this case, we have to take the results with caution, as the t-Statistics are upwardly biased.

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[17] The assumption of balance of payments equilibrium on current account can in theory be relaxed to allow for capital flows, but the experience of balance of payments crisis in the 1980s and 1990s shows that developing countries will see their access to refinancing curtailed when large disequilibria persist.

Table 8 Naïve regression of investment/GDP ratio *(selected variables)*

Model	1		2		3		4	
Variable	Coefficient		Coefficient		Coefficient		Coefficient	
C	4.482	***	17.843	***	4.533	***	17.846	***
Accession Dummy	1.292	***	0.512		…			
Accession								
Commitment Index	…		…		0.006	***	0.004	
Trend	…		0.162	***	…		0.163	***
Trend^2	…		…		…			
Lagged dependent	0.786	***	…		0.786	***	…	
AR(1)	…		0.781	***	…		0.781	***
R-squared	0.79		0.79		0.79		0.79	
Durbin-Watson	…		1.86		…		1.86	

Note: Cross-sections included: 68; total pool (unbalanced) observations: 2131, Fixed effects with White cross-section standard errors & covariance (d.f. corrected). ***, ** and * signal signification level at 0.01, 0.4 and 0.1, respectively.

For the next step, (Table 9) we enrich our "naïve model" with the group variables α_g in [1]. We have a total of six possible groupings: five clusters, resulting from the matching exercise described in Annex B, and a residual group of "outliers" made of countries that could not be closely regrouped with others on their socio-economic characteristics. The results in terms of statistical significance are very similar to the previous ones

Table 9 Naïve regression of investment/GDP ratio, differentiating by clusters *(selected variables)*

Model	1		2		3		4	
Variables								
Accession Dummy	…				0.624	***	0.353	
Accession Commitment								
Index	0.004	***	0.003		…			
Cluster 1	2.074	***	14.197	***	2.173	***	8.568	**
Cluster 2	1.846	***	12.375	***	2.001	***	7.193	*
Cluster 3	2.085	***	14.072	***	2.190	***	8.468	**
Cluster 4	1.797	***	11.684	***	1.906	***	6.113	
Cluster 5	2.260	***	15.591	***	2.406	***	10.071	**
Cluster 6	2.293	***	16.690	***	2.407	***	11.189	***
Time index	0.030	***	0.288	***	0.027	**	0.828	***
Time index^2	…		…				-0.012	***
AR(1)	…		0.877	***	…		0.874	***
Lagged dep. Variable	0.876	***	…		0.873	***	…	
R-squared	0.78		0.78		0.78		0.78	
Durbin-Watson stat	…		1.92		…		1.92	

Note: Clusters are identified by a dummy variable taking the value "1" if the country belongs to the group, "0" if not. White cross-section standard errors & covariance (d.f. corrected).
Source: see Table 1

The impact of accession - be it through a simple dummy variable or through the accession commitment index measuring the depth of commitments - is positive, but not un-disputably significant due to possible upward bias in the t-statistics in models (1) and (3). In all model specifications, the clusters show differences in the level of reaction, as measured by their

respective dummy variables. Cluster 6, made of outliers, is the one showing the largest reaction, followed by cluster 5 (see Annex 2 for its composition). [18]

- **Real investment rate of growth**

To complement the analysis, we looked at the impact on the annual real investment growth (Table 10).

Table 10 Naïve regression of annual variation in real investment, differentiating by clusters *(selected variables)*

Model	1.a		2.a		1.b		2.b	
Variables								
C	-0.091	***	-0.318		…		…	
Accession Dummy	…		3.442	**	…		-0.730	
Accession Commitment Index	0.002	**	…		-0.002			
Cluster 1	…		…		0.105		0.075	***
Cluster 2	…		…		4.141	*	4.125	*
Cluster 3	…		…		1.111		1.062	
Cluster 4	…		…		-0.262		-0.336	
Cluster 5	…		…		0.591		0.506	
Cluster 6	…		…		2.360		2.435	
Time index	0.571		0.596		0.192	***	0.196	***
Time index^2	-0.011		-0.012					
R-squared	0.09		0.09		0.01		0.01	
F-Statistics	2.39		2.42		…		…	
Durbin-Watson stat	2.05		2.05		1.89		1.89	

Note: Constant term and F-Statistics not calculated when cluster dummies are introduced.

The overall fit on the real investment growth rate is extremely poor, something to be expected when using such a naïve modelling on first difference data. Against this background, accession has a significant positive impact, but it is not robust to a change in specification when clusters are introduced. Moreover, the accession variables in model 1a and 2a are significant only when the time trend includes a quadratic term. The negative sign of the quadratic term indicates an inflexion point at the end of the period. It is only after controlling for this trend that the accession variables have a significant positive impact. One possible interpretation –with all due caveats considering the low explanatory power of this naïve equation-- would be that Article XII Members were able to sustain their investment growth when it went down in the rest of developing countries.

b. Multi-level modelling

The fully-fledged model in equation [1] includes the influence of economic variables, either proper to the country or reflecting the situation of the global business cycle. We opted to include in the covariates of type **X**, the variables that capture each country's business cycle and

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[18] The dummy variables measure the differences in average for the whole equation and should not be interpreted as focusing only on the impact of accession.

differ from country to country (GDP rate of growth with three time lags) but all countries react more or less similarly to a change in the cycle. [19] In the **Z** group, we included two variables signalling changes in the global economic environment (World GDP rate of growth; and changes in global availability of investment finance): these variables are shared by all countries but may affect them differently. Obviously, the choice is arbitrary but a few explorations on alternative specifications showed that it didn't make much difference on the results obtained for δ, the variable of interest.

Table 11 presents the results obtained for the model [1], including a quadratic trend. As before, because of the presence of autocorrelation in the residuals, two alternative models (AR(1) and the lagged dependent variable) are also displayed. Because the exercise is exploratory and descriptive, all regressions include the same variables, even when not significant.

Table 11 Multi-level regression of investment/GDP ratio, including clusters dummies *(selected variables)*

Model	1a		1b		1c		2a		2b		2c	
Variable	Coefficient		Coefficient		Coefficient		Coefficient		Coefficient		Coefficient	
	Accession Dummy						*Accession Commitment Index*					
Accession Dummy	0.847	**	-0.006		0.628	*						
Accession Commitment Index							0.013	***	0.004		0.005	***
Cluster 1	19.049	***	5.012		3.419	***	18.991	***	5.071		3.475	***
Cluster 2	17.852	***	3.767		3.091	***	17.870	***	3.837		3.158	***
Cluster 3	19.703	***	5.750	**	3.641	***	19.731	***	5.859	**	3.690	***
Cluster 4	16.972	***	3.123		2.702	***	17.001	***	3.239		2.734	***
Cluster 5	21.938	***	7.816	***	3.999	***	21.878	***	7.874	***	4.017	***
Cluster 6	24.334	***	9.213	***	4.437	***	24.120	***	9.128	***	4.481	***
Time Trend	-0.046		1.013	***	0.072	*	-0.039		1.013	***	0.071	*
Time Trend^2	0.004	**	-0.015	***	-0.001		0.004	*	-0.015	***	-0.001	
AR(1)			0.856	***					0.855	***		
Lagged dependent variable					0.755	***					0.753	***
R-squared	0.53		0.79		0.81		0.53		0.79		0.81	
Durbin-Watson	0.72		1.95		…		0.72		1.95		…	

Note: Cross-sections included: 68; Total pool (unbalanced) observations: 1959; White cross-section standard errors & covariance (d.f. corrected). See also Table 3 for the list of omitted results.

The accession commitment indices return a positive signal, with the exception of model 1b. Nevertheless, we cannot consider that the favourable impulse provided by WTO accession on investment is statistically significant, because of the uncertainty caused by the autocorrelation found in the error term. We see that correcting for this autocorrelation reduces the size of the coefficient, and often its significance, so we should remain prudent: there is possibly a positive impact on investment ratio, but it is not systematic.

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[19] Institutional quality, an important variable for investment, in particular when attracting foreign flows, is not considered here, as it is our implicit assumption that WTO accession improves the institutional environment. See Basu (2008) and Gnangnon (2015) for a discussion.

c. Robustness checks

The previous results are encouraging but not fully conclusive. Here, we acknowledge one of the most serious limitations of our exercise, i.e. the relatively short period of time to observe the impact of accession, as most countries acceded in the 2000s and 2010s. Note also that the quadratic term in the trend polynomial structure is always negative when the linear part is positive. This inflection possibly indicates the effect of the 2008-2009 crisis which may have constrained investment. Unfortunately, it is not possible at this stage to take out the crisis years, as it would dramatically reduce the number of observations after accession for many Article XII members.

A series of alternative explorations were realized, in order to check for the robustness of the results and look into particular cases. The variations included changes in the specification (in particular merging all clusters together) and changes in the country and time samples. Without providing details of this exercise, the variations on the full sample, replacing group effects by country-specific fixed effects did not change much of the results obtained.

But the results are not robust to a change in specification and sample size. In particular, they could not be replicated when restricting the sample to the countries that belonged to the five clusters, ignoring outliers. So, the most probable outcome is that accession had a positive impact on investment on some Article XII members, but the result is not homogeneous across countries. The next section will look with more details into this heterogeneity.

Table 12 Multi-level regression of investment/GDP ratio, differentiating by clusters *(selected variables)*

Model **a/**	Group1		Group 2		Group 3		Group 5		Group 1		Group 2		Group 3		Group 5	
Variable	Coefficient		Coefficient		Coefficient		Coefficient		Coefficient		Coefficient		Coefficient		Coefficient	
	Accession Dummy								*Accession Commitment Index*							
Accession Dummy	3.864	**	-0.735		-0.187		1.189	**b/**								
Accession Commitment Index									0.023	*	-0.005		-0.003		0.000	
Time Trend	0.139	*	0.291	***	0.041		0.164	**	0.172	**	0.289	***	0.041		0.168	***
													0.800			
AR(1)	0.801	***	0.655	***	0.798	***	0.821	*	0.801	***	0.655	***		***	0.821	
R-squared	0.88		0.74		0.84		0.78		0.88		0.74		0.84		0.78	
Durbin-Watson	1.64		1.92		1.79		2.14		1.64		1.92		1.79		2.14	

Note: See Table 3 for the list of omitted results.

a/ The regressions were based on model [1] with X being the countries' annual GDP growth rates, with three lags and Y variables including the contemporaneous growth in World GDP and the increase in total FDI inflows. Cross-sections included: Group 1: 9; Group 2:24; Group 3:12; Group 5: 9 (Group 4 was omitted for not having enough Article XII members) White cross-section standard errors & covariance (d.f. corrected).

b/ With a slightly different specification including a quadratic trend, the signification level raises to 0.2.

- **Investment/GDP Ratio by Cluster**

An interesting feature of multilevel regression modelling is the ability to model variations between groups, up to a limit. Including the clusters through a group index allows capturing the differences in average level of the regression equation [1], but not the differences in each of its coefficients. It is possible that each sub-group, made of homogeneous countries, react differently to accession. Table 12 above presents the results obtained by applying model [1] group by group. As before, in order to maintain comparability, we use a standard specification for all groups, without looking at optimizing the results.

Only Group 1 shows very significant response to accession variables, with Group 5 indicating some positive reaction to the accession dummy but not for the commitment depth. Those results confirm the heterogeneity of responses, and the fact that a thorough investigation would require looking more at the economic characteristics of acceding governments.

Figure 3 illustrates this heterogeneity in the response of the investment/GDP ratio to accession and its depth.
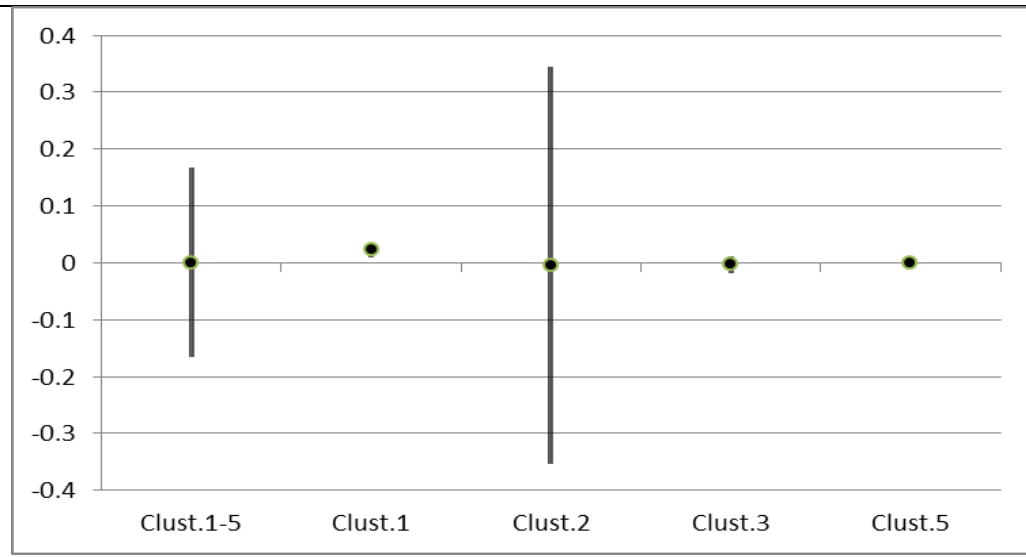
Figure 3 Investment Ratio: Heterogeneous responses to accession by country groupings

1. Accession Dummy: Estimated coefficients plus or minus one standard error

…/…
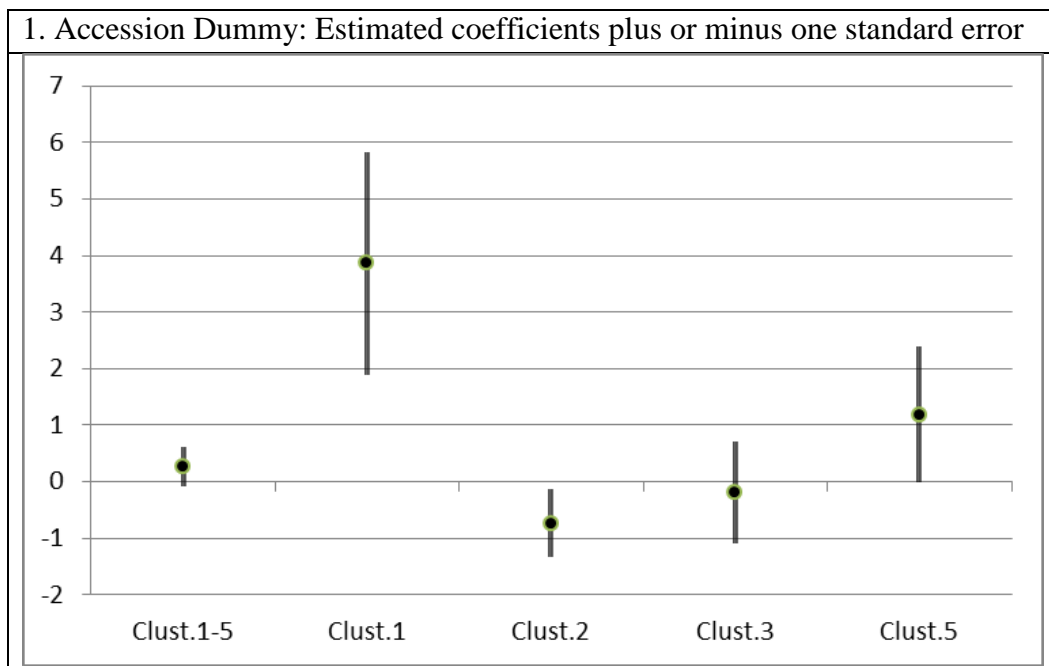
Figure 3 (cont.)
2. Accession Depth: Estimated coefficients plus or minus one standard error

Note: All regressions based on Model [1], with quadratic trend and fixed individual effects after correcting for autocorrelation in the residual and for cross-section standard errors covariance. Results are only illustrative as the number of observations differs widely between clusters.

3.3.3 Accession and Foreign Direct Investment

Gnangnon (2015) found that the establishment of the WTO had a positive impact on attracting FDI for both WTO and non-WTO members, with a stronger effect for WTO membership. Indeed, WTO accession is often understood as a signalling device that lowers institutional uncertainty and promotes foreign direct investment. Together with delivering a better and more definite access to trade, the objective of attracting more FDI through WTO membership ranks high in the list of policy makers' objectives.

Table 13 Naïve regression on share of world FDI inflows *(selected variables)*

Model	1.a		1.b		2.a		2.b	
Variable	Coefficient		Coefficient		Coefficient		Coefficient	
Accession Dummy	0.169		0.106		…		…	
Accession Commitment Index	…		…		0.003	*	0.002	*
Trend	-0.130		-0.001		-0.094		0.001	
Trend^2	0.002		0.000		0.002		0.000	
AR(1)	0.952	***			0.944	***		
	Lagged dep		0.949	***			0.907	***
R-squared	0.93		0.93		0.93		0.93	
Durbin-Watson stat	1.91		…		1.90		…	

Note: Cross-sections included: 69 over the 1980-2015 period; Total pool (unbalanced) observations (after adjustments): 2111. White cross-section standard errors & covariance (d.f. corrected)

The dependent variable in the set of exploratory regressions in Table 14 is the share of world FDI inflows. As before, we proceed through successive steps, starting with those naïve

regressions. Accession depth resulted in a positive and significant response of FDI inflows (models 2.a and 2.b), but not accession itself. So, the depth of commitments seems to have a stronger impact than accession itself.

Robustness checks performed by including in the specification the group effects weakens the significance, but not completely. Nevertheless, further investigation (not shown here) shows that the positive pulse was probably due to the group of outliers (cluster 6), out of which China is an outstanding member for its economic weight and the main destination of FDI directed to developing countries.

Table 14 Naïve regression on share of world FDI inflows, differentiating by cluster *(selected variables)*

Model	1		2		3		4	
Variables	Coefficient		Coefficient		Coefficient		Coefficient	
Accession Dummy	0.155		0.0451					
Accession Commitment Index	…				0.002	*	0.003	
Cluster 1	-0.364		-0.016		-0.012		-0.005	
Cluster 2	-0.312		-0.016		-0.009		-0.002	
Cluster 3	-0.137		-0.022		-0.004		0.217	
Cluster 4	0.376		-0.037		0.027		0.687	
Cluster 5	-0.298		-0.015		-0.003		0.164	
Cluster 6	-1.565		0.021		0.015		-1.367	
Time index	-0.031		0.001					
AR(1)	1.035	***					1.033	***
Lagged dep. Variable	…		1.034	***	0.998	***	…	
R-squared	0.92		0.92		0.93		0.92	
Durbin-Watson stat	1.97		…		…		1.97	

Note: Cross-sections included: 69 over the 1980-2015 period; White cross-section standard errors & covariance (d.f. corrected)

Despite some positive outcomes, the signals extracted from the naïve models are too weak to conclude that WTO accession and the depth of the related commitments have a significant impact on attracting foreign investment.

At the difference of the naïve regressions, the multi-level regressions presented in
Table 15 include the X covariates that control for the situation of individual countries in their own business cycle and the Z variables that provide information on the economic environment (contemporaneous growth in World GDP and the increase in total FDI inflows).

The results when applying the fully-fledged model are positive but not statistically significant. The t-statistics associated with models 1.a and 2.a is 0.27 for the accession commitment index and 0.25 for its depth. [20]   This means that the probability that accession does not have any impact on FDI inflows is 0.25. So, best practices in statistics tell us to reject the hypothesis.

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[20] The t-statistics associated with models 1.b and 2.b may suffer from upward biases, due to the presence of the lagged endogenous variable in the regression, and are not considered here.

Table 15 Multi-level regression on share of FDI inflows ratio, differentiating by clusters
(selected variables)

Model	1.a		1.b		2.a		2.b	
Variable	Coefficient		Coefficient		Coefficient		Coefficient	
Accession Dummy	0.158		0.036		…		…	
Accession Commitment Index	…		…		0.003		0.001	
Cluster 1	-0.338		-0.061		-0.332		-0.068	*
Cluster 2	-0.334		-0.046		-0.347		-0.047	
Cluster 3	-0.145		-0.067	*	-0.165		-0.063	*
Cluster 4	0.164		-0.314	**	0.096		-0.282	**
Cluster 5	-0.256		-0.150	**	-0.162		-0.149	**
Cluster 6	-1.368		0.005		-1.448		0.003	
Time index	-0.030		0.003		-0.030		0.004	
Time index^2	0.000		0.000		0.000		0.000	
AR(1)	1.041	***	…		1.038	***	…	
Lagged dep. Variable	…		0.983	***	…		0.963	***
R-squared	0.94		0.94		0.94		0.94	
Durbin-Watson	1.69				1.70			

Note: The results on the X and Z variables are not shown in the table (see note in Table 3). Cross-sections included: 69 over the 1980-2015 period; Total pool (unbalanced) observations (after adjustments): 1947 for models 1.b and 2.b, 2003 otherwise. White cross-section standard errors & covariance (d.f. corrected). See also Table 3 for the list of omitted results.

But absence of proof is not proof of absence. The odd ratio of accession having a positive impact is therefore 3 to 1. It is still gambling from a scientific viewpoint of confirmatory statistics, but it remains an interesting one from an exploratory one. More importantly, it remains relevant from a policy-making perspective. While the odds ratio is not a sound measure of association for a scientist, it is not an illogical one when decisions have to be based on limited insights. We are confronted here to a situation where the statistician's perspective may diverge from the policy-maker's one and yet, both may have good reasons to do so. [21]

3.4 Analytical Shortcomings

The results shown in the empirical part of the study provide reasonable insights on the impact of accession, in the sense that the empirics followed a rigorous procedure and recommended practices when using regressions in exploratory analysis. [22] Nevertheless, all methods have their flaws and the analytics suffer from a series of statistical shortcomings that should not be ignored.

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[21] Actually, from a Popperian epistemological perspective, the role of statistics and experiments is not to validate and support theoretical models, but to falsify them by finding exceptions to the "general" theory. Statistics are therefore stumbling blocks rather than stepping stones. Obviously, the policy makers who have to act in a much more subjective environment than scientific research, expect from statisticians some more positive type of guidance.

[22] The analysis presented here remains exploratory, because we do not know the theoretical model that is expected to "explain" the impact of accession on economic growth. We are therefore reduced to explore conjectures.

One is the specification issues that were identified in our models: modelling the impact of accession requires more sophisticated modelling than the general approach we used here. Indeed, specifying correctly the underlying theoretical model is an issue that plagues most econometrics, because the statistical robustness of the results cannot be deducted from the usual parametric tests (Leamer, 1983). Moreover, the one-size-fits-all approach may probably not be doable: we saw that the reaction of countries differed when we sub-divided the countries into more homogenous clusters. It is often argued that Difference in Difference approaches, as other randomised control experiments, are theory-free specifications that escape the specification issue. Even if the approach used in this paper requires minimal assumptions and can be applied without prior knowledge of a formal causality model, Deaton and Cartwright (2016) invite ─when the analysis is not backed by theory─ that caution be exerted when extrapolating the results outside the context in which the analysis is conducted.

On a more practical basis, matching developing country members by sub-group and defining as a control group those who were already GATT members remains a rough hypothesis. Indeed, even if the GATT discipline was relatively undemanding for developing countries, many of them had to implement economic reforms in the 1990s under the conditionality imposed by the IMF, the World Bank or other multilateral development banks. Considering all of them as a control group reduced the discriminating power of the statistical methods used in the paper. In this sense, one may conclude that our results underestimate the impact of accession because some of the control group participants may have implemented part of the commitments under other types of agreements.

Another incognita is the date at which accession starts influencing the economy. Is it at the time of signature, before when the deal is known to be almost made, or a few years after when reforms are in place? We opted for the first option as the middle way because of a lack of uniform Article XII experiences.

Data availability is another shortcoming. The most obvious one is the lack of sufficiently long data series for Article XII members' post-accession years. Moreover, for many Article XII members, the post-accession years have coincided with the 2008-2009 financial crisis and the global stagnation which followed. We need more data for post-accession and it is probably still too early to undertake a thorough statistical analysis of the impact of accession.

Finally, we cannot totally ignore the risk of self-selection and endogeneity. A common risk in policy evaluation exercises is one of self-selection bias. It is possible that only countries that wish to pursue pro-growth open trade policies apply for WTO membership. In this case, membership is more a result than a cause. This bias is common to all statistical randomized control experiments and differs from another bias, which is more specific to the econometric branch of statistics; endogeneity of some explanatory variables that may be "caused" by other truly exogenous factors.

Tang and Wei (2006), using an econometric approach based on statistical procedures broadly similar to ours, revise the possible sources of such biases and conclude that the risks of bias are minor, or even on the down-side: "our estimates of the effects of accession might even be biased downward as they do not account for the continued support of economic activities that might otherwise be unsustainable without the long-term trade privileges guaranteed by WTO/GATT membership".

Another – and simpler – cause of endogeneity occurs when the right and left hand side variables are closely related through an accounting identity. This is particularly the case when an individual country is large enough to influence the world aggregate. Most of our observations relate to developing countries that are relatively small in economic terms, especially when calculating their GDP at market exchange rate (we do not use Purchasing Power Parities in this paper). With the exception of China and, possibly, India, we can safely assume that this risk is limited. As can be seen from Annex 2, China was identified as an outlier and not included in the final clustering exercise.

4 CONCLUSIONS

Besides facilitating access to the world market, WTO accession negotiations entail a process of domestic institutional and economic reform that are expected to improve the supply side of acceding economies. Measuring the actual impact of WTO accession remains an empirical debate, which was ignited by the results of Rose (2004) which found that membership to the GATT/WTO did not significantly increase trade. Other studies have found, at the contrary, that membership had a substantial impact on trade and a positive contribution on the overall governance situation.

The present research contributes to the debate by offering a measure of the accession-specific commitments made during the negotiations. These commitments often trigger a series of domestic structural transformation that typically have an impact on economic growth. Some of these commitments are common to all the Article XII members, but others are quite specific. For example, only a few acceding governments undertook commitments in balance-of-payments measures, foreign exchange and payments, investment regime or export duties, fees and charges. Some Article XII members made commitments in monetary and fiscal policy or in competition policy. The commitment index proposed in the paper reflects the heterogeneous distribution of commitments undertaken by Article XII members.

This innovative index serves as the basis for a statistical exploration of the impact of WTO accession on a series of variables related to economic growth. After a procedure of matching, the Article XII members are compared with a control group of developing countries that joined the GATT/WTO without being subjected to a similar negotiation process. The data analysis procedure adopts an exploratory approach which systematically looks at alternative specifications. The objective was to gain on robustness, even at the cost of elegance.

Our results show that the impact of WTO membership on ratio Trade/GDP is significantly higher than previous studies had found for developing countries. The improvement in trade intensity is not only quantitative, but also qualitative. In particular, we found that trade in services increased under the influence of accession. Moreover, greater openness does not negatively affect the trade balance of Article XII Members, showing that increases in imports are balanced by larger exports. Our results on investment, be it foreign or domestic, are mixed; while the results are encouraging, they are not fully conclusive. Indeed, when positive outcomes are usually found, the measures are often not robust to changes in specification.

We are probably facing here one of the most serious limitations of our exercise i.e. the relatively short period of time to observe the impact of accession, as most countries acceded in the 2000s and 2010s. Moreover, this short period of time was marked by the economic commotion caused by the 2008-2009 crisis. Only the passing of time can provide better data and it is hoped that, in the future, researchers will build on the accession commitment index presented in the paper and apply it to a longer time series.

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6 ANNEXES

A-1: FORMULATING THE ACCESSIONS COMMITMENT INDEX

Step by step review and weighting of commitments

Step 1: The number of all the commitments listed in a Member's WPR is compiled and listed in a descending order.

Step 2: This number list is then sub- categorized into three parts;
- Category 1: (1-19)
- Category 2: (20- 39)
- Category 3: (40+)

Step 3: Introducing weights;

Category 1 Frequency (1-19)

1) Monetary and Fiscal Policy
2) Competition Policy
3) Staging of dismantling of Tariff Adjustment Mechanism
4) Special trade arrangements, incl. barter trade arrangements
5) Transitional product-specific safeguard mechanism
6) Reservations by WTO members
7) Transitional Review Mechanism
8) Special Exchange Agreement between the WTO and Chinese Taipei
9) Balance-of-payments measures
10) Non-discrimination/ China's working party reports and Protocol

11) Textile regimes	14) Other customs formalities
12) Foreign exchange and payments	15) Trade in civil aircraft
13) Investment regime	16) Export duties, fees and charges

These commitments are given a weight of (1)

Category 2 Frequency (20- 39)

1) Transit	8) Trade agreements
2) Export subsidies	9) Export restrictions
3) Ordinary customs duties	10) Agricultural policies
4) Government procurement	11) Tariff rate quotas, tariff exemptions
5) Pre-shipment inspection	12) Transparency - publication of information on trade
6) Other duties and charges	
7) Rules of origin	13) Transparency - notification

These commitments are given a weight of (2)

Category 3 Frequency (40+)

1) Fees and charges for services rendered	
2) Industrial policy, including subsidies	11) Policies affecting trade in services
3) Trade-related investment measures	12) State ownership and privatization; state trading enterprises
4) Free zones, special economic areas	13) Quantitative import restrictions, incl. prohibitions, quotas and licensing systems
5) Pricing policies	
6) Trading rights	
7) Anti-dumping, countervailing duties, safeguard regimes	14) Trade-related aspects of intellectual property rights
8) Customs valuation	15) Technical barriers to trade
9) Application of internal taxes on imports	16) Sanitary and phytosanitary measures
10) Framework for making and enforcing policies	

These commitments are given a weight of (3)

Step 4: The commitment frequencies are then multiplied by their respective weights resulting in individual figures for each respective Member for a specific area. The resulting weighted frequencies are then listed in a descending order.

Step 5: The weighted frequencies are given an index following the categorization below;
- 40-69= 1
- 70-99=2
- 100+=3

A-2: MATCHING THROUGH CLUSTERING

The matching procedure looks at disaggregating the sample of WTO developing country members (both GATT and Article XII members) into a series of more homogeneous sub-samples which may, for structural reason, have different reaction to (i) economic shocks and trends, and (ii) Accession treatment. The procedure is implemented through two steps: first, exclusion of outliers, then identification of clusters.

The variables used for specifying socio-economic similarities and differences are the following:

Agricultural land (% of land area); Food production index; Exports of goods and services (% of GDP); Industry, value added (% of GDP); GNI per capita, PPP; Labour force participation rate for ages 15-24, total (%); Population age 15-64 (% of total); Population growth (annual %); Rural population (% of total); Human Development Index (UNDP); External balance on goods and services (% of GDP); Foreign direct investment, net inflows (% of GDP); GDP per capita (constant 2010 US$); GDP per capita growth (annual %); Gross domestic savings (% of GDP); Imports of goods and services (% of GDP); Imports of goods and services (annual % growth); International tourism, receipts (% of total exports); Labour force participation rate for ages 15-24, total (%); Net ODA received (% of GNI); Tariff rate, most favoured nation, simple mean, manufactured products (%); Export Diversification indexes (intensive, extensive, market penetration).

The information is mainly sourced from the World Bank, except for HDI (UNDP) and Tariff rate (WTO). Ideally, those variables are observed for the years preceding WTO accession; due to data availability, the values correspond to 1995-2000 averages based on existing data. The extent of missing data is used to build an index of statistical quality, which may be used to weight the observations.

Exclusion is done via strict hierarchical clustering. We look for strict partitioning clustering with outliers: objects can also belong to no cluster, and are considered outliers. Those are candidates for exclusion. Very small clusters (2 or 3) may also qualify as outliers. Excluded observations will later be treated into a single case of "outliers", with a dedicated dummy.

Once the outliers are excluded, K-mean clustering is used to define 5 or more homogeneous sub-groups. The K-Means algorithm favours clusters of approximately similar size, as it will assign an observation to the nearest centroid. This often leads to incorrectly cut borders in between of clusters (which is not surprising, as the algorithm optimized cluster centres, not cluster borders). The final composition of sample will therefore be a matter of choice (balance between Article-XII and other Members, for example)

a. Exclusion
First run applies hierarchical clustering on all variables, using the Mahalanobis distance following Stuart (2010). Ideally, the idea is to find 5 or more homogeneous clusters. In the first

run, AGO, LBR, LSO and PLW are classified outliers, to be excluded from the revised sample due to their dissimilarity with the rest of countries

Results by class:	1	2	3	4	5
Objects	1	96	1	1	1
Within-class variance	0.00	16123653.75	0.00	0.00	0.00
Average distance to centroid	0.00	3358.48	0.00	0.00	0.00
Maximum distance to centroid	0.00	12733.38	0.00	0.00	0.00
	0_AGO	1_ALB	1_LBR	0_LSO	0_PLW
		1_ARM			
		0_BEN			
		0_BGD			
		1_BGR			

Note: WTO members are identified by their ISO3 code. The prefix 0_ and 1_ before the ISO code denote historical and Article XII members, respectively.

Similarly, a second run on the remaining countries provide the following results:

Results by class:	1	2	3	4	5
Objects	92	1	1	1	1
Within-class variance	14747749.05	0.00	0.00	0.00	0.00
Average distance to centroid	3260.96	0.00	0.00	0.00	0.00
Maximum distance to centroid	11520.58	0.00	0.00	0.00	0.00
	1_ALB	0_BRB	1_CHN	0_GNB	0_MDV
	1_ARM				
	0_BEN				
	0_BGD				
	1_BGR				
	0_BLZ				

In this case, BRB, CHN, GNB and MDV need also to be excluded.

The next steps gave the following results:

- Third Run (results not shown): CPV, CUB, GUY, HTI, MNG and ZMB excluded.
- Fourth run: ARM, COD, MMR, MNE, and VUT excluded
- Fifth round: BWA, COG, DJI, EST, SWZ, GMB, PAN excluded
- Sixth round: JOR, NGA, PNG, SLB, VEN excluded
- Seventh round: BGD, CHL, KAZ, SLB, LKA.

Further rounds didn't produce clear outliers but small clusters of 3 or 4 countries. So the procedure was stopped there.

Because the Mahalanobis distance is quite demanding and didn't produce balanced clusters, we used the more encompassing Euclidian distance to provide for a first grouping. Using the Euclidian distance with hierarchical clustering leads to defining the following 5 groups:

Class	1	2		3	4	5
Objects	9	25		17	5	9
Within-class variance	440252.796	568271.554		1211001.265	1457355.971	706299.822
Average distance to centroid	597.458	637.522		960.711	1010.507	689.143
Maximum distance to centroid	969.839	1247.341		1771.533	1571.552	1467.608
	1_ALB	0_BEN	…/…	1_BGR	0_BRA	0_CRI
	0_BOL	0_CAF	0_PAK	0_BLZ	1_HRV	0_GRD
	0_IDN	0_CIV	0_SEN	0_COL	0_MEX	0_LCA
	0_MAR	0_CMR	0_TCD	0_DMA	0_TUR	1_LTU
	0_PHL	1_GEO	0_TGO	0_DOM	0_URY	1_LVA
	0_PRY	0_GHA	1_TJK	1_ECU		0_MUS
	1_TON	0_GIN	1_VNM	0_EGY		1_RUS
	1_UKR	0_HND	1_YEM	0_FJI		0_SUR
	1_WSM	0_IND	0_ZWE	0_GTM		0_ZAF

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Class (Continued…/…)	1	2	3	4	5
		0_KEN		0_JAM	
		1_KGZ		1_MKD	
		1_KHM		0_NAM	
		1_LAO		0_PER	
		1_MDA		0_SLV	
		0_MRT		0_THA	
		0_NIC		0_TUN	
		1_NPL		0_VCT	

b. K-Means final clustering

Once the outliers are excluded and set aside in a special group (#6), K-mean clustering is used to define 5 homogeneous sub-groups. Variables can enter with equal weights (not shown here) or be weighted according to their statistical quality (inversely based on the number of imputations done in the original dataset used in the clustering procedure).

The difference when weighting for statistical quality is minimal. The final clustering presented in Table 1 was based on these results:

Five groups, variable weights for statistical quality *("quality" is inversely based on number of imputations)*					
Class	1	2	3	4	5
Objects	10	25	13	5	12
Within-class variance	488937.264	568271.554	802325.540	1457355.971	1202943.914
Average distance to centroid	614.779	618.034	743.880	981.290	888.154
Maximum distance to centroid	932.227	1211.118	1503.164	1527.006	1679.778
	1_ALB	0_BEN 1_MDA	1_BGR	0_BRA	0_COL
	0_BOL	0_CAF 0_MRT	0_BLZ	1_HRV	0_CRI
	0_GTM	0_CIV 0_NIC	0_DOM	0_MEX	0_DMA
	0_IDN	0_CMR 1_NPL	1_ECU	0_TUR	0_GRD
	0_MAR	1_GEO 0_PAK	0_EGY	0_URY	0_JAM
	0_PHL	0_GHA 0_SEN	0_FJI		0_LCA
	0_PRY	0_GIN 0_TCD	1_MKD		1_LTU
	1_TON	0_HND 0_TGO	0_NAM		1_LVA
	1_UKR	0_IND 1_TJK	0_PER		0_MUS
	1_WSM	0_KEN 1_VNM	0_SLV		1_RUS
		1_KGZ 1_YEM	0_THA		0_SUR
		1_KHM 0_ZWE	0_TUN		0_ZAF
		1_LAO	0_VCT		

The 6th group used in robustness checks performed during the analysis is made of the outliers which were eliminated during the "exclusion" process previously mentioned.