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How Restrictive Are ASEAN's RoO? *

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Abstract: *This paper uses a disaggregated (product-level) gravity approach to estimate the effect of ASEAN's product-specific rules of origin (RoO) on regional trade, using original data on rules applicable at the six-digit level of the harmonized system. Overall, we find that the average ad-valorem equivalent (AVE) of ASEAN's RoO's is 3.40 percent across all instruments and sectors. The trade-weighted average is 2.09 percent. This moderate estimate is in line with the existing literature. However, we also find fairly high AVEs for some sectors including leather, textile and apparel, footwear, and automobiles. We also find that some rules appear more restrictive than others; in this regard, the Textile Rule seems to stand out as a relatively more trade-inhibiting rule than others.*

Keywords: Rules of Origin, Gravity equation, International Trade, ASEAN, Global Value Chains
JEL Classification: F12, F13, F14, F15

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1. Introduction

Two major trends characterize the world trading system today. On the one hand, it is increasingly structured by preferential trade agreements (PTAs), of which there are close to 300 today, and a new one almost every month (Calvo-Pardo, *et al*. 2009). On the other hand, international trade has increasingly involved "trade in tasks" within global value chains (GVCs). Rules of origin (RoO) stand in the middle of these two major trends and have the potential to make them incompatible, because they constrain the sourcing choices of multinational firms along regional patterns dictated by existing PTAs, whereas GVC optimization may call for different choices. One of the challenges of multilateralizing regionalism—an expression coined by Baldwin (2006)—is to prevent RoOs from working at cross-purposes with the rise of GVCs.

The issues are salient in East Asia and the Pacific (EAP), where regionalism is a relatively recent phenomenon (see Kimura 2010) but is spreading rapidly. Since the creation of the ASEAN Free Trade Area (AFTA) in 1992, the drive for regional trade liberalization has accelerated, in particular after the Asian currency crisis of the late 1990s. Although the tariff-elimination schedule was more progressive in ASEAN than for instance in NAFTA, it proceeded largely on time, and tariff elimination between the six founding members[1] was largely completed by 2010, i.e. only two years after the scheduled date, and covered over 90 percent of intra-bloc trade (Calvo-Pardo, *et al*. 2010). ASEAN+3 and ASEAN+6 initiatives have gained momentum with their upgrading to so-called track-1 level (government-to-government). Finally, the TPP, launched in 2006 by Brunei, Chile, New Zealand and Singapore as Pacific-4 has gained considerable momentum and visibility with President Obama's 2011 announcement that the U.S. would join (in September 2008, the US firstly announced to join the negotiations in early 2009). Given that MFN tariffs are still substantial in at least some of the member countries, tariff preference margins can make a difference.

Compared to other regional blocs, in particular in the South, East Asian and trans-pacific regionalism have several distinguishing features. NAFTA and the E.U. association/partnership agreements were arguably of a hegemonic nature; for instance,

[1] Brunei Darussalam, Indonesia, Malaysia, the Philippines, Singapore and Thailand. ASEAN later expanded to Viet Nam, Lao PDR, Myanmar and Cambodia.

the E.U. Association agreements with some of its Mediterranean partners mandate the harmonization of NTMs on E.U. standards; similarly, rules of origin in both NAFTA and the E.U.'s Paneuro system have been largely dictated by the Northern partner (the U.S. and E.U. respectively). They were also characterized by strong hub-and-spoke trade structures. By contrast, East Asian/Pacific regionalism brings together a multipolar region with several economic and political heavyweights, including Japan, China, and the U.S., and a number of mid-size but politically sophisticated partners like Korea, Australia and New Zealand. Second, and perhaps most importantly, a large chunk of the region's trade is in manufactured products (e.g. electronics) characterized by economies of scale and the prevalence of large firms organized in cross-border value chains. Together, these features imply that the political economy of RoOs is likely to be quite different from that in NAFTA or E.U. partnerships.

A voluminous literature (for recent surveys, see Medalla and Balboa, 2009; Kelleher, 2013, or Cadot *et al.*, 2006a and 2006b, and references therein) has looked into the drivers and effects of rules of origin (henceforth RoOs) in PTAs. In principle, their objective is to prevent trade deflection in the absence of external-tariff harmonization. However, the literature has also highlighted their power to depress preference uptake by forcing inefficient sourcing and by imposing fixed compliance costs—paperwork and bureaucratic hassle—explaining sometimes low utilization rates in spite of high tariff-preference margins, as for textiles in NAFTA. Essentially, the political-economy mechanism behind restrictive RoOs in North-South agreements is double. First, costly RoOs are a way of "denying preferences" granted to Southern producers and hence of relieving the competitive pressures generated within the bloc by tariff phase-outs. That is, when Moroccan shirt producers are forced to procure relatively expensive fabric in the E.U. preferential zone instead of more price-competitive Asian fabric, one source of their competitiveness is eliminated and they become less of a competitive threat for Portuguese or Italian shirt producers. Second, when the Northern country has a comparative advantage in upstream, capital-intensive sectors—like weaving in the textile & apparel sector, or the making of engines in the automobile sector—RoOs create a captive market for those intermediates in the Southern partner where, under bilateral cumulation, assemblers have no choice but to source those intermediates with the Northern (hegemonic) country. While these

considerations have no doubt receded in importance over the last decade, they were very much behind the initially complex and restrictive design of product-specific RoOs in both NAFTA and PANEURO.

Given the different patterns of economic and political fundamentals in the EAP region, these political-economy drivers are likely to be weaker, although not necessarily absent. First, as noted by Kimura (2010), neither Japan nor China, the region's heavyweights, have played as engines of regional integration, as the U.S. and E.U. did in their respective spheres of influence. Japan, in particular, has not sought to create a Japan-centered hub-and-spoke regional trade bloc. In part, this is because part of the motivation for U.S. and E.U. trade preferences with Southern partners—Mexico for the U.S., Central Europe and the Mediterranean countries for the E.U.—was to create "mini-worlds" where the gains from specialization could be reaped while at the same time maintaining some degree of trade protection vis-à-vis efficient Asian countries, in particular in the textile & apparel sector where high MFN tariffs made preferential liberalization highly relevant.[2] This motivation was much weaker, although not necessarily absent in at least some sectors, for Japan.

Second, although there is no systematic data on firm-level control over GVCs,[3] many of the GVCs in the electronics sector are dominated by large firms which internalize all complementarities along it. Those firms have no interest in forcing inefficient sourcing at any stage of processing. Even in the absence of vertical integration, subcontracting relationships are rarely arms-length, and economies of scale are so strong that many components are produced in a handful of establishments serving the entire world market. In such conditions, throwing in RoOs to hurt the competitiveness of some of the downstream assemblers in order to favor others makes little sense.

Thus, there is prima-facie reason to believe that RoOs in the Asia-Pacific region are less susceptible to be distorted by special-interest capture than their equivalents in NAFTA or PANEURO. However, they could still be trade-restricting because they are unnecessarily complex or cumbersome to satisfy. This is essentially an empirical

[2] The idea that trade-diverting PTAs are more appealing politically than trade-creating one was developed theoretically in Grossman and Helpman (1995). Empirical evidence, however, is mixed.
[3] See Dedrick, *et al*., 2008 for an in-depth study of two electronics value chains.

question that should be settled by statistical analysis. This is what we set out to do in this paper, using the variation in trade flows across country pairs and products as the identification mechanism to detect any trade-inhibiting effect of RoOs. Our exploration is guided by the gravity equation, workhorse of much empirical work in international trade. We run a disaggregated gravity equation at the product (HS6) level, controlling for the gravity's usual determinants as well as tariffs and a vector of dummies marking the presence of each type of product-specific RoO.

To preview our results, we find that ASEAN's RoOs have significant and quantitatively substantial trade-inhibiting effects. The simple average of the ad-valorem equivalent of ASEAN's RoOs, across instruments and HS sections, is 3.40 percent, in line with estimates in the literature. This means that RoOs inhibit ASEAN's trade by an amount roughly equivalent to one quarter of its MFN tariffs. Put differently, RoOs seem to "nullify" one quarter of the effect of tariff-preference margins. The trade-weighted average is substantially lower, at 2.09 percent. However, the effect is heterogeneous. While it is small in sectors like electronics or capital equipment, where anyway MFN tariffs are low so trade is only weakly affected by preferences, it peaks in sectors that matter for the development of ASEAN's poorest member states like fats (6.7 percent), leather products (9 percent), textile and apparel (8.3 percent), footwear (12.7 percent), or automobiles (6.9 percent). Thus, the streamlining of ASEAN's RoOs should be viewed as part of its own development agenda.

The paper is organized as follows. Section 2 summarizes the existing literature on the analysis of RoOs (2.1), stylized facts about ASEAN's RoOs (2.2) and about EAP trade (2.3), highlighting in particular the prevalence of GVCs in the light of recent data on trade in value added. Section 3 briefly details econometric analyses which includes an explanation on data, an estimation strategy, results, and section 4 concludes.

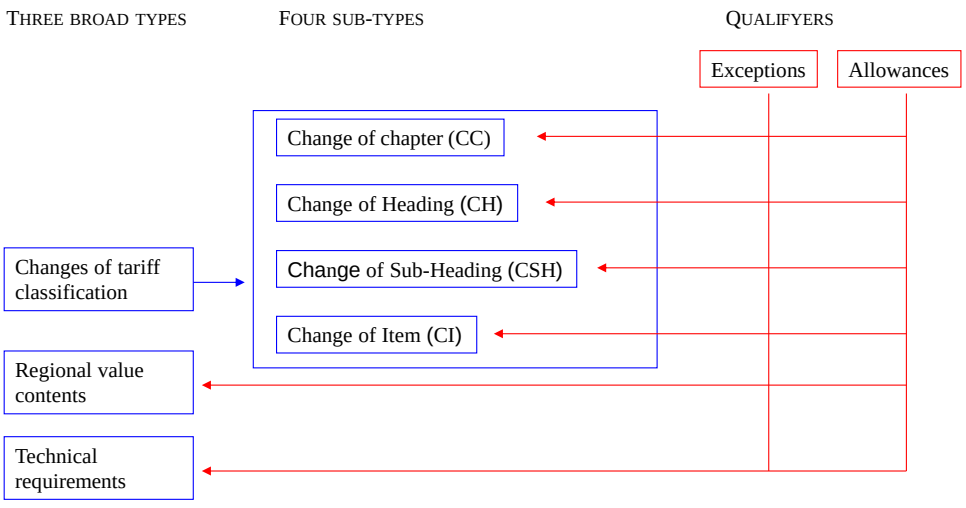
2. Stylized Facts

2.1. Rules of Origin: How Do They Work?

While the legal form of RoOs varies, they are essentially local-content requirements imposed on exporters of final goods who want to claim the benefit of preferential tariffs within a trade bloc. In principle, their objective is twofold. First, it is to prevent arbitraging of external tariff differences in FTAs. This makes them redundant in customs unions although some of them like MERCOSUR have RoOs. Second, it is to prevent superficial assembly operations with little or no value added that would, de facto, extend the benefit of preferential access to non-eligible intermediate producers upstream of those assembly operations.

There are two broad types of RoOs: product-specific rules and regime-wide rules. Product-specific rules specify the minimum degree of local transformation needed to qualify for preferential treatment. They typically take a limited number of legal forms, each of which has advantages and disadvantages for exporters: changes in tariff classification, regional value contents, or technical requirements (Figure 1).

Figure 1: Types of Product-specific RoOs



Changes in tariff classification (CTC) impose that when a final good is produced using intermediates imported from outside the bloc, it ought not to belong to the same category as those intermediates. The tariff classification is typically the harmonized

system (HS), and the change can be specified at either the chapter level (HS2, with 99 categories), the heading level (HS4, with over 1'000 categories) or sub-heading (HS6, with over 5'000 categories). In principle, the lower the level (HS2 being the highest and HS6 the lowest), the less stringent is the rule, as a jump from a subheading to another may entail relatively minor transformation compared to a jump from a chapter to another. However, the reality is more complex, as the HS system has narrower categories for, say, textile & apparel than for machinery and equipment.

Regional value contents (RVCs) can take various forms, including a maximum share of imported intermediates in total intermediates or a minimum share of local value added in the product's price. The definition of local value added (inclusion or not of overheads, distribution, etc.) varies across agreements and is typically a subject of bargaining; so is the price definition (ex-works price, i.e. factory-door, wholesale price, etc.). Some rules even used weight as the criterion, although this led to so many distortions that weight-based criteria have largely been eliminated. One extreme case of value content is the wholly-obtained category which allows no foreign content at all. Most agricultural products, vegetal or animal, are subject to the wholly-obtained requirement. Finally, technical requirements can take as many forms as imagination allows, being sometimes tailor-made to benefit narrow interests (see Hirsch, 2002 or Chase, 2007).[4]

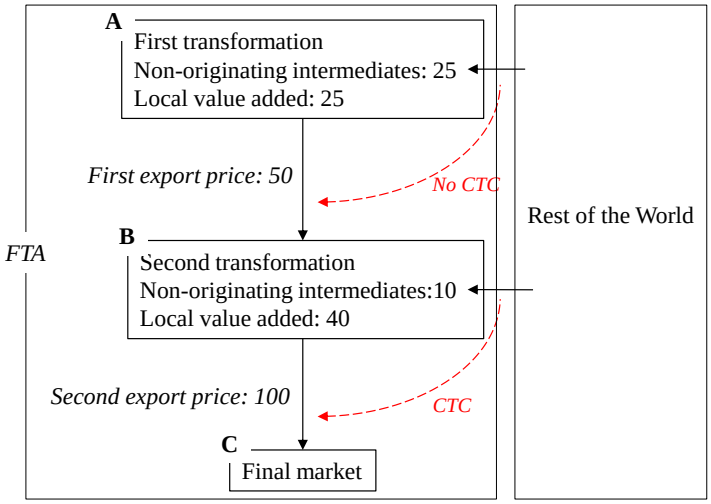
Each product-specific RoO can be qualified by either an exception or an allowance. Exceptions make the rule more stringent. For instance, applied to a change of tariff subheading, an exception will specify that, if a final product belonging to subheading *x* is assembled from imported intermediates, those must come from any subheading other than *x*, except *z*. By contrast, allowances relax the stringency of RoOs.

Regime-wide rules—essentially cumulation rules, the other ones being of secondary importance—specify the treatment of intermediates imported from other countries in the same bloc or countries with special status in terms of cumulation. There are three broad types of cumulation: bilateral, diagonal, and full. Under bilateral

[4] For instance, one of NAFTA's rules for certain textile products used to specify that intermediates had to be woven « with a loom width of less than 76cm, woven in the United Kingdom in accordance with the rules and regulations of the Harris Tweed Association, Ltd, and so certified by the Association.

cumulation (a clause that applies only to bilateral FTAs), if an exporter from A exports to B, only intermediates from A or B count as local. Under diagonal cumulation, in an FTA between A, B and C, when exporting to B, A can count intermediates from C as local. Full cumulation is the most complicated, in particular in the case of a multi-stage production process. Consider an FTA between three countries, A, B and C, and the following production process. A firm in A imports $25 of intermediate products from the rest of the world (ROW) and does a first transformation involving $25 of local value added. The firm then exports the resulting product, still an intermediate one, to B for a price of $50. In B, another firm again transforms it, adding $10 more of intermediates imported from the ROW and $40 of value added. Finally, the product is re-exported to C at a price of $100. Assume that between the intermediates imported from the ROW to A and the transformed intermediate exported from A to B, there is no change of tariff classification (CTC), whereas between the intermediates imported into B and the final good exported from B to C, there is a CTC. The value chain is represented in Figure 2.

Figure 2: A Representative Value Chain with Cumulation



In order to understand the interplay of product-specific and regime-wide RoOs, consider now two product-specific RoOs, a CTC and a 60 percent local content, and two regime-wide rules, diagonal and full cumulation. Together, these generate four cases.

Suppose first that the product-specific RoO is a CTC. Under diagonal cumulation, when exported from B to C, the final product would *not* be eligible, because the first stage fails to satisfy the CTC requirement. Under full cumulation, by contrast, the entire value of intermediates imported from A to B would be counted as local; therefore only the CTC at the second stage would count, and as it is satisfied, the final product exported to C would satisfy the RoO.

Suppose now that the product-specific RoO is a 60 percent local value content. Under diagonal cumulation, the eligible local content would be $40 (the last transformation) out of a sales price of $100, which does not pass the mark. Under full cumulation, by contrast, the eligible local content would be $40 + $25, or $65, which would pass the mark. The final product would then be eligible.

Thus, mechanically, full cumulation is less stringent than diagonal cumulation. However, in practice, proving compliance with full-cumulation rules implies complete traceability of the production process and sourcing of intermediates. This is a heavy burden for many companies both in terms of paperwork and—more importantly—in terms of disclosure of sensitive price and supplier information. So some firms prefer not to use full cumulation instead of its advantages on paper.

RoOs also raise potentially difficult issues in terms of legal liability. If certificates of origin are issued by officials in the exporting country, there has to be mutual recognition of those certificates of origin, which is not always the case when customs administrations distrust each other. Alternatively, the ultimate importing country (C in our example) may take importer local-content declarations at face value, as they do with product valuation. But if, later on, a fraud is uncovered, the importer will be held liable and will be expected to turn against his own suppliers, at his own expense. As this would involve auctioning foreign jurisdictions in the export country with uncertain prospects for redress, the importer will typically not pass on the preferential tariff reduction to his suppliers, either keeping it as "legal insurance" or forsaking altogether the benefit of preferential treatment. In both cases, the objective of the preferential tariff reduction will be missed.

2.2. The Trade Effects of RoO: What Do We Know?

Assessing the impact of RoOs means establishing a causal relationship between a measure of RoOs and a measure of trade performance. All three (measuring RoOs, measuring trade performance, and establishing causation) involve difficult issues.

The modern analysis of RoOs goes back to the measurement work of Estevadeordal (2000) who coded NAFTA's product-specific rules and aggregated them into a restrictiveness index. Index values were assigned on the basis of logic; for instance, changes of tariff classification were classified as increasingly stringent as one goes up the hierarchy of HS categories (that is, a change of heading had a higher index value than a change of sub-heading, and so on). Technical requirements were ranked highest in terms of restrictiveness, because—as already argued—they are often deliberately cumbersome to satisfy. Similar indices have been constructed since then by Australia's Productivity Commission (2004), Anson *et al.*, (2005), and Harris (2007), involving variants from Estevadeordal's. For instance, Estevadeordal treated the wholly-obtained requirement as the most stringent; however, it is typically applied to agricultural products, for which it is not binding; so Anson *et al.*., by contrast, coded it as least stringent. This difference of treatment illustrates the notion that the stringency of a given RoO depends on which sector it applies to, an issue to which we will come back later on.

As for the dependent variable, ideally one would like to have data on shipments by regime (MFN vs. preferential). However, preference-utilization data is sometimes taken by governments—although without much rationale—as confidential and sensitive. Thus, the performance measure is often taken as relative trade flows—trade flows in a pair of countries affected by the RoO vs. in a pair not affected, under the assumption that stiff RoOs will not just make the utilization of preferences redundant, but will also stifle trade itself, by denying preferences. That is, ceteris paribus, a stringent RoO acts like a reduction in the tariff-preference margin and thus reduces trade flows.

Given data constraints on the dependent variable, identification is often roundabout. One would want to equate RoOs with a "treatment" and compare treated trade flows with untreated ones, using standard approaches like difference-in-differences. Part of the literature has taken that route. Other approaches, in particular

when utilization-rate data are available, have instead relied on a revealed preference argument. That is, suppose that firm compliance costs are distributed around some central value corresponding to the average firm. Suppose that the tariff preference margin for a certain product and country pair is 5 percent. If the rate of preference utilization is 100 percent, it must be that all firms have RoO compliance costs below 5 percent; then 5 percent can be taken as an upper bound on the ad-valorem equivalent (AVE) of the average compliance cost. If the utilization rate is 0 percent, it must be that all firms have compliance costs above 5 percent, so 5 percent gives a lower bound of the compliance cost's AVE. Finally, if the utilization rate is somewhere between zero and one hundred, it must be that some firms have more than 5 percent compliance costs while others have less. One can then take 5 percent as the best approximation for the average compliance cost.

Using this revealed-preference approach, Herin (1986) estimated the compliance costs of E.U. RoOs for Central European countries at 5 percent; Cadot *et al.*, (2005) found 2 percent for NAFTA. Manchin and Pelkmans-Balaoing (2007) noted that the AFTA utilization rate was on average only 5 percent and attributed this low uptake to RoO and other documentation requirements. They also found threshold effects in tariff-preference margins (only at high levels did they affect trade), again suggestive of compliance costs offsetting the benefit of tariff reductions. Brenton and Manchin (2000) and others noted similarly low utilization rates for E.U. preferences, but the issue was muddled in the case of the E.U. by the large number of overlapping schemes which depressed uptake for every one taken in isolation while E.U. preferences, as a whole, had high combined uptake (see Candau and Jean 2005).

Using econometric approaches instead, Francois *et al.*, (2006) estimated compliance costs at 4 percent and Cadot *et al.* at 6.5 percent. Beyond averages, Cadot *et al.*, (2006a), Estevadeordal (2000) and Estevadeordal *et al.* (2008) found that RoO restrictiveness was typically higher in sectors also characterized by tariff peaks. Portugal-Perez (2009) decomposed NAFTA's RoOs into a component reflecting traditional trade-deflection concerns (proxied by the tariff differential between the U.S. and Mexico) and political-economy interference, and found that the latter raised the compliance costs of RoOs on average by 4.5 percentage points. Most recently, Kelleher (2013) modified Harris' restrictiveness index to take cumulation rules into

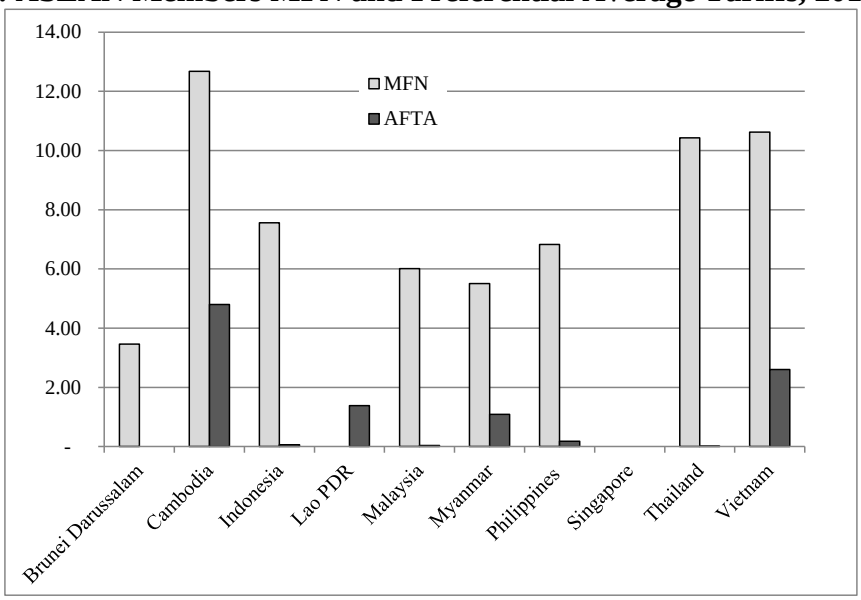
account. She proxied the facilitation effect of cumulation rules by the economic size of the cumulation zone (the share of the zone's combined GDPs in world GDP), and found a significant and sizable trade-inhibiting effect associated with higher values of her modified restrictiveness index, in particular in the textile & apparel sector.

2.3. ASEAN's Tariffs and RoOs

2.3.1. MFN and Preferential Tariffs

RoOs can be binding only when tariff-preference margins are substantial, which in turn requires the presence of sufficiently large MFN tariffs. ASEAN has made rapid progress in the phasing out of preferential tariffs except for Cambodia and, to a lesser extent, Viet Nam (see Figure 3), so tariff-preference margins are essentially MFN rates. These rates are not negligible, implying that tariff-preference margins are substantial and confer benefits to exporters justifying the choice of the preferential regime even in the presence of compliance costs.

Figure 3: ASEAN Members MFN and Preferential Average Tariffs, 2010



Source: ASEAN Secretariat.

Decomposing MFN tariffs by sector, Table 1 shows, on the basis of the limited availability of tariffs from the multilateral TRAINS database, that ASEAN member states have substantial MFN tariffs in particular on sensitive sectors like food & beverages (section 4), textiles & apparel (Section 11), footwear (section 12), and vehicles (section 17). These are all sensitive sectors in terms of employment but also

sectors where cross-border GVCs are most prevalent, and hence where RoOs can substantially constrain firms. Going down one level of disaggregation, the picture at the level of HS chapters (not shown for brevity) is largely the same. Except for Singapore and Brunei Darussalam which have very low MFN tariffs, the number of zero-rated chapters is relatively low. Out of 98 chapters, Brunei has 68, Indonesia just one, the Philippines none, Singapore 96, and Viet Nam 6.

Table 1: ASEAN's Average MFN Tariffs by HS Section

Section	Summary description	Brunei	Indonesia	Philippines	Singapore	Vietnam
1	Live animals; animal products	-	5.05	10.78	-	13.46
2	Vegetable products	-	5.08	9.41	-	15.94
3	Animal or vegetable fats	-	4.28	5.91	-	10.61
4	Food and beverages	0.08	6.76	11.57	-	28.78
5	Mineral products	-	3.79	2.53	-	4.47
6	Products of the chemical or allied industries	0.46	5.02	3.07	-	2.93
7	Plastics and articles thereof; rubber and articles thereof	1.71	8.30	7.26	-	9.09
8	Leather and leather products	1.22	5.25	6.53	-	11.33
9	Wood and articles of wood	12.09	3.49	7.72	-	7.98
10	Pulp and paper	-	4.00	5.14	-	12.20
11	Textiles and apparel	0.50	10.47	10.44	-	12.00
12	Footwear	5.31	14.61	10.86	-	28.51
13	Cement, glass and stone	0.49	7.88	7.32	-	18.81
14	Precious metals and stones	2.26	6.13	4.91	-	8.79
15	Base metals and articles of base metal	0.05	6.87	5.19	-	7.07
16	Machinery and electrical equipment	9.60	5.45	2.74	-	5.15
17	Vehicles	3.32	9.16	8.92	-	17.57
18	Precision instruments, optics, watchmaking	8.22	5.77	2.85	-	6.20
19	Arms and ammunition; parts and accessories thereof	-	6.05	13.47	-	4.86
20	Miscellaneous manufactured articles	2.47	9.80	7.44	-	19.24
21	Works of art, collectors' pieces and antiques	-	6.19	7.86	-	4.29

Note: Data available on WITS from the TRAINS multilateral tariff databases includes only Brunei Darussalam, Indonesia, the Philippines, Singapore and Vietnam.
Source: Author calculations using TRAINS

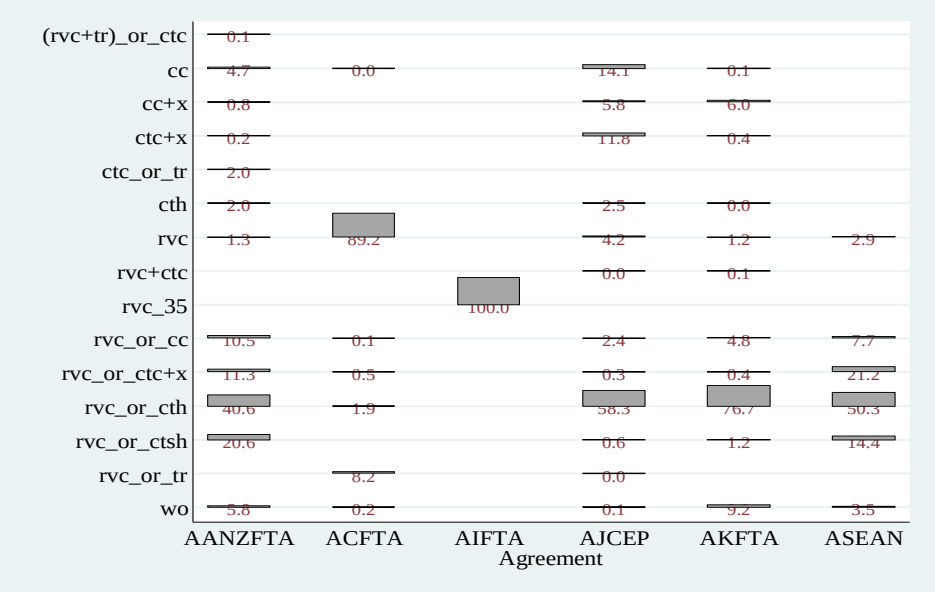
2.3.2. Rules of origin

ASEAN's rules of origin have a relatively simple structure compared to, say, NAFTA or PANEURO, as they are largely based on a 40 percent regional value content. Moreover, in many cases, the importer can choose which rule to use among two. However, behind the relatively simple logical structure, there is substantial variation at the product level.

The most prevalent combination of instruments at the product level is a choice between a regional value content at 40 percent and a change of tariff heading (HS4). This concerns 11,764 product lines in all of ASEAN's trade (internal and bilateral with preferential partners), or 37.74 percent of the product lines. Another 6 percent of the lines give the importer the choice between the same regional value content and a change of tariff sub-heading (HS6).

At the level of individual agreements, the use of instruments varies substantially. Figure 4 reports frequency ratios in percentage for each rule and agreement. Frequency ratios measure the incidence of rules by product without trade-weighting; that is, a frequency ratio of 0.1 for (rvc + tr) or ctc in AANZFTA means that for 0.1 percent of all HS6 products, the importer claiming the preferential regime in the ASEAN-ANZ agreement can choose between a change of tariff classification or the combination of a regional value content and the textile rule. Those products are obviously in section 11 (textile and apparel).

Figure 4: RoO Frequency Ratios, by Agreement and Type of Rule

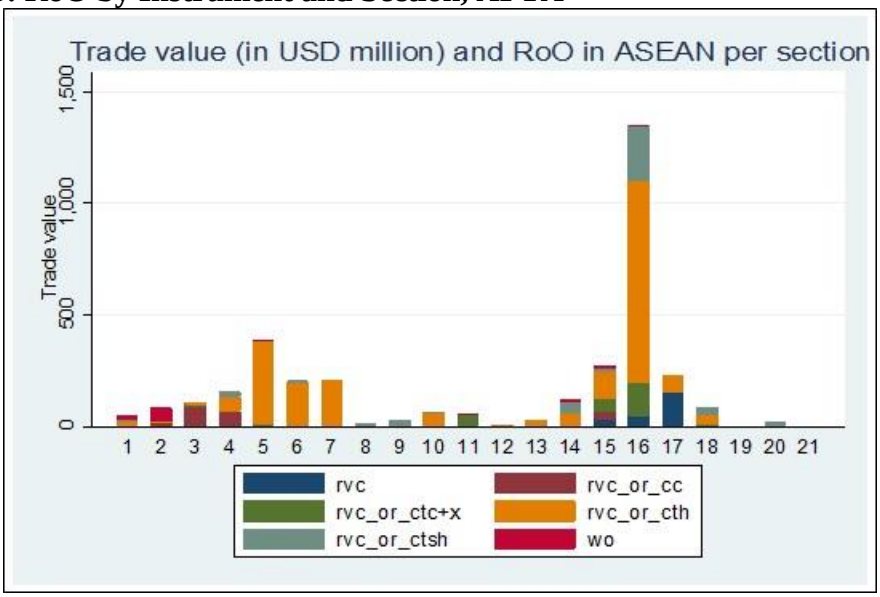


Note: rvc: regional value content (all thresholds combined except 35 percent); rvc_35: regional value content at the 35 percent threshold; cc: change of chapter; ctc: change of tariff classification (any aggregation level); cth: change of tariff heading; ctsh: change of tariff subheading; x: exception; tr: textile rule; wo: wholly obtained.
AANZFTA: ASEAN-Australia/New Zealand FTA; ACFTA: ASEAN-China FTA; AIFTA: ASEAN-India FTA; AJCEP: ASEAN-Japan Economic Partnership; AKFTA: ASEAN-Korea FTA.
Source: Walz (2014).

Some agreements, like the ASEAN-Japan agreement, display substantial complexity when looking at frequency ratios. However, some rules may become secondary when looking at the importance of traded goods to which they apply. In order to get a feel for this second approach, Figure 5 shows trade-weighted incidence of different types of RoO by agreement and by section of the HS classification of goods. Figure 5 shows that the AFTA makes large use of a rule giving the importer the choice of a regional value content (RVC) at 40 percent or a change of tariff heading (HS4), shown in grey. This formula is largely used in particular in the electrical-equipment sector which includes the all- important electronics industry.

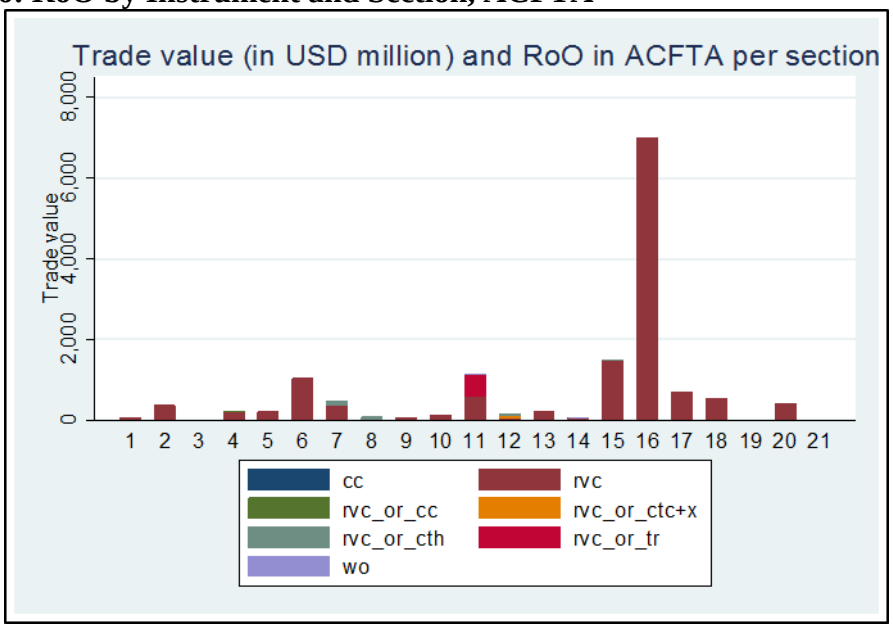
The ASEAN-China FTA (Figure 6) is one of the simplest, making use essentially of a regional-value content. Moreover, a large chunk of the trade is in the electronics sector where MFN tariffs are low.

Figure 5: RoO by Instrument and Section, AFTA



Note: Section 1-3: agricultural products; section 4: prepared foods; section 5: commodities; section 6: chemicals; section 7: plastics; section 8: leather; section 9: wood; section 10: pulp & paper; section 11: textile & apparel; section 12: footwear; sections 13-14: cement, stone etc.; section 15: base metals; section 16: machinery & electronics; section 17: transport equipment; section 18: precision instruments; sections 19-21: miscellaneous.
Source: Walz (2014).

Figure 6: RoO by Instrument and Section, ACFTA



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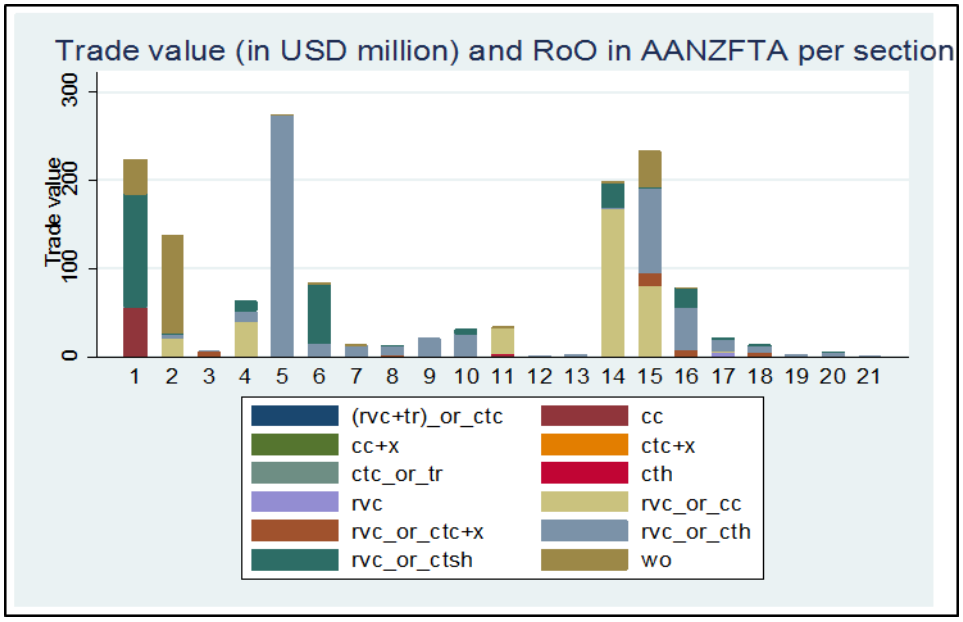
Source: Walz (2014).

Figure 7 shows that the ASEAN-ANZ FTA has the most complex structure, with a large number of instruments used in combination with each other. This complicated structure which smacks of special interest interference resembles that of NAFTA's RoO or of PANEURO.

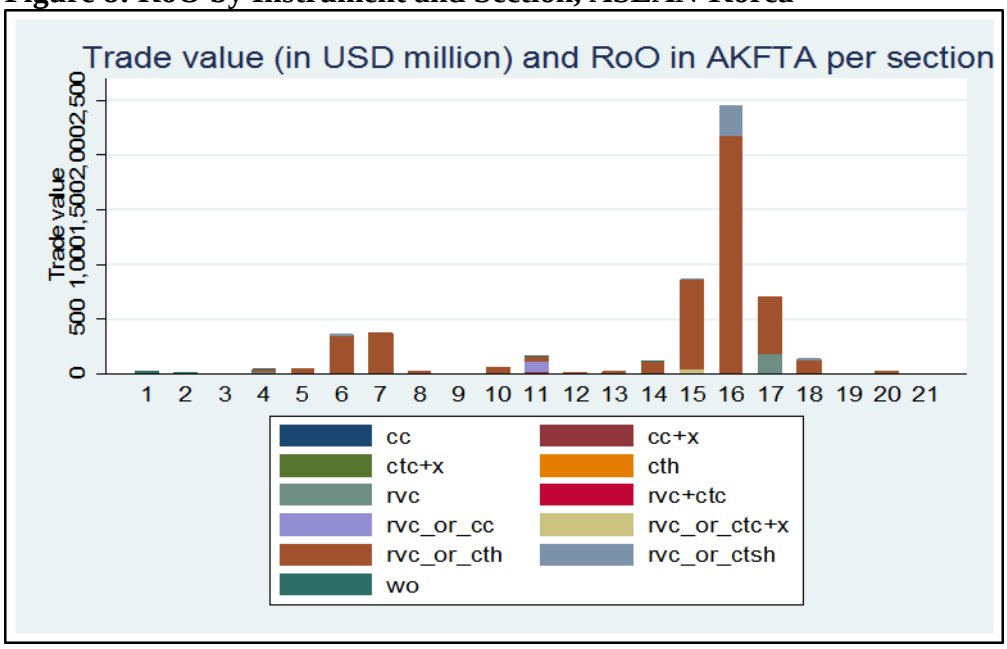
Figure 7: RoO by Instrument and Section, ASEAN-ANZ



Note: Section 1-3: agricultural products; section 4: prepared foods; section 5: commodities; section 6: chemicals; section 7: plastics; section 8: leather; section 9: wood; section 10: pulp & paper; section 11: textile & apparel; section 12: footwear; sections 13-14: cement, stone etc.; section 15: base metals; section 16: machinery & electronics; section 17: transport equipment; section 18: precision instruments; sections 19-21: miscellaneous.
Source: Walz (2014).

The ASEAN-Korea FTA (Figure 8) and ASEAN-Japan agreement (Figure 9), by contrast, have relatively simple structures once weighted by trade values; although the ASEAN-Japan has a number of complex exceptions in the textile sector.

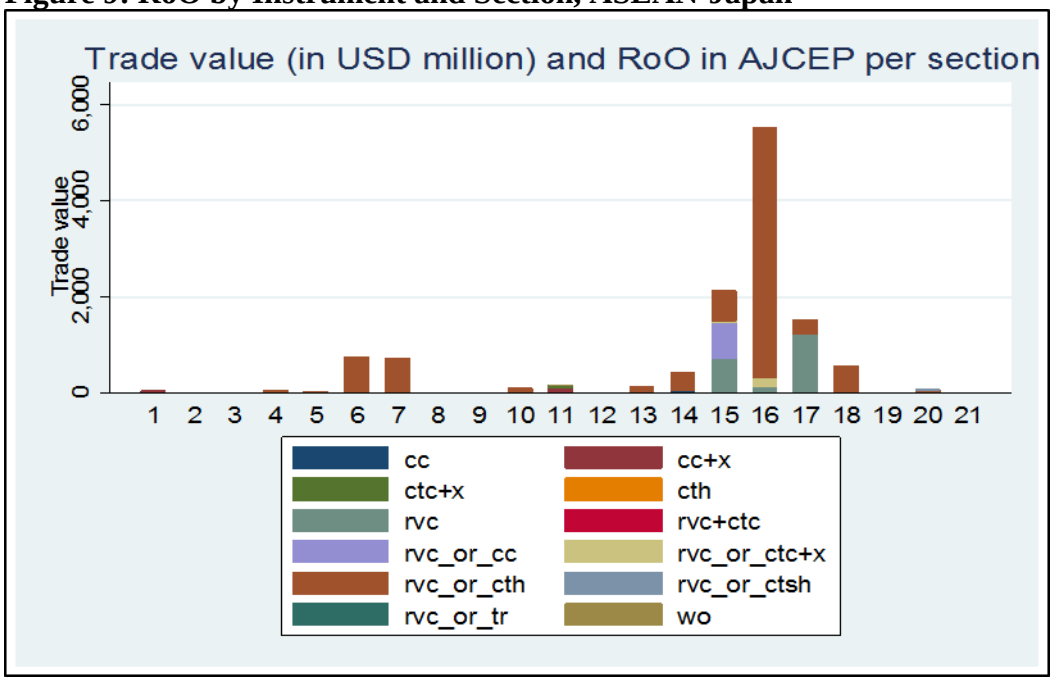
Figure 8: RoO by Instrument and Section, ASEAN-Korea



Note: Section 1-3: agricultural products; section 4: prepared foods; section 5: commodities; section 6: chemicals; section 7: plastics; section 8: leather; section 9: wood; section 10: pulp & paper; section 11: textile & apparel; section 12: footwear; sections 13-14: cement, stone etc.; section 15: base metals; section 16: machinery & electronics; section 17: transport equipment; section 18: precision instruments; sections 19-21: miscellaneous.

Source: Walz (2014).

Figure 9: RoO by Instrument and Section, ASEAN-Japan



Note: Section 1-3: agricultural products; section 4: prepared foods; section 5: commodities; section 6: chemicals; section 7: plastics; section 8: leather; section 9: wood; section 10: pulp & paper; section 11: textile & apparel; section 12: footwear; sections 13-14: cement, stone etc.; section 15: base metals; section 16: machinery & electronics; section 17: transport equipment; section 18: precision instruments; sections 19-21: miscellaneous.

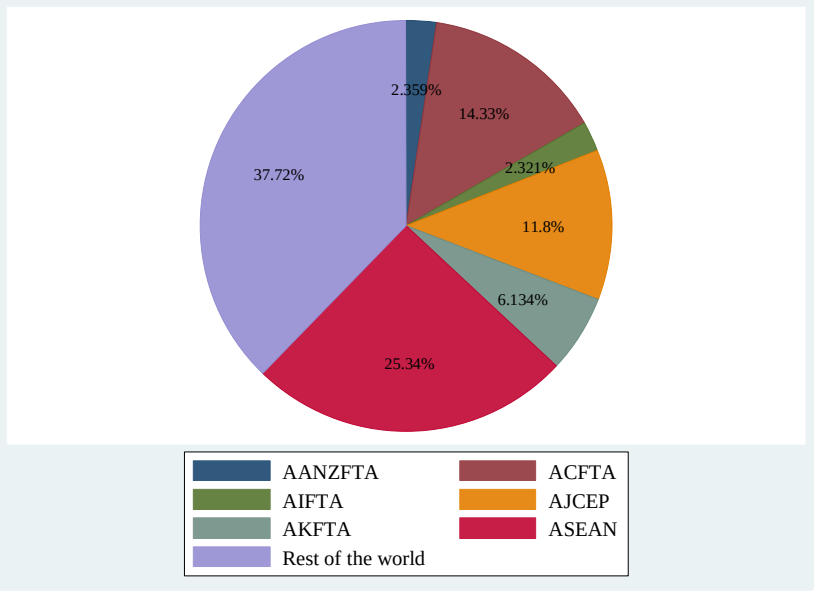
Source: Walz (2014).

Thus, the picture emerging is one of (i) a structure that is dominated by regional value contents and changes of tariff classification, often giving the importer the choice of rule; (ii) a relatively large palette of instruments on paper, but (iii) a limited range of instruments actually used if one takes trade values into account.

2.4. Trade Patterns in the Asia-Pacific Region

As background, in order to get a feel for the importance of ASEAN's preferential trade as a share of the region's overall imports,

Figure 10: ASEAN Imports from Its Various Preferential Zones, in Percentage (2010)



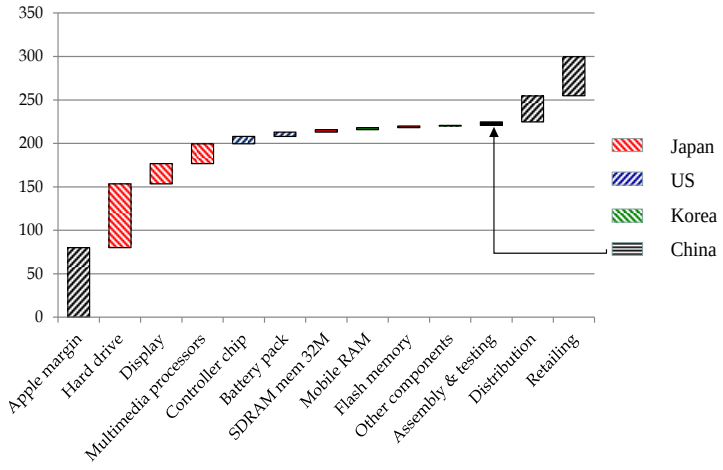
Note: World means Rest of the world, after excluding imports from all countries in the agreements shown separately. AANZFTA: ASEAN-Australia/New Zealand FTA; ACFTA: ASEAN-China FTA; AIFTA: ASEAN-India FTA; AJCEP: ASEAN-Japan Economic Partnership; AKFTA: ASEAN-Korea FTA.
Source: Walz (2014), using trade data from BACI.

The various preferential zones thus represent a substantial chunk of ASEAN's imports, underscoring the potential impact of preferential rules. As already discussed, one of the key issues raised by the presence of RoOs in PTAs is that they mandate a minimum degree of local transformation in order to grant tariff preferences while in many sectors, the degree of local transformation of intermediate products is determined by multinational companies on the basis of technology and country fundamentals. This is a particularly serious issue for electronics value chains in the

East Asia & Pacific (EAP) region where local content can sometimes represent a very thin slice of the overall value generated along the chain.

For instance, Figure 11, adapted from Dedrick *et al.*, (2008), provides a visual representation of the iPod's global value chain, color-coded differently for each participating country. It can be seen that industrial countries –Japan and the U.S.– capture the lion's share of value added along the chain. While the product retailed in 2008 for $299, the value added retained in China, the assembly country, was only $3.86, or less than 2 percent. Moreover, the value of imported intermediates, at over $140 (essentially capital-intensive intermediates including the hard drive and display, all produced in Japan), was already 35 times the value added in assembly and testing, which represented only 2.7 percent of the ex-factory price of the product (this without counting the wholesale and retail distribution margins). In such a situation, any local-content rule could only be violated.

Figure 11: The iPod's Value Chain



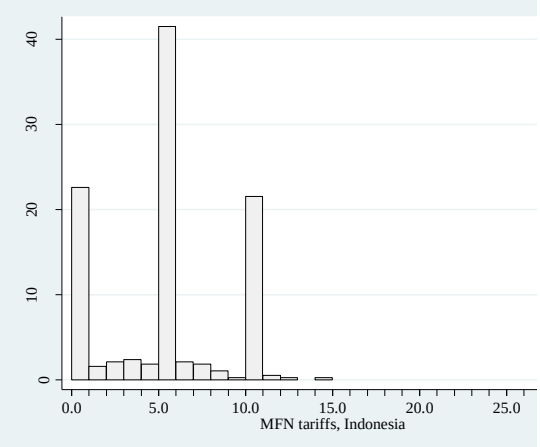
Source: Adapted from Dedrick *et al.*, (2008).

However, in this case, the trade-inhibiting potential of RoOs is not as severe as one might expect. First, global electronics companies have lobbied the governments of large industrial countries in the 1990s to lower tariffs to practically zero on most electronics products and in particular on components, precisely in order to make RoOs irrelevant, knowing that they would be incompatible with the organization of production. This lobbying effort led to the signing of the WTO's Information Technology Agreement by 29 countries at the Singapore Ministerial in 1996 and

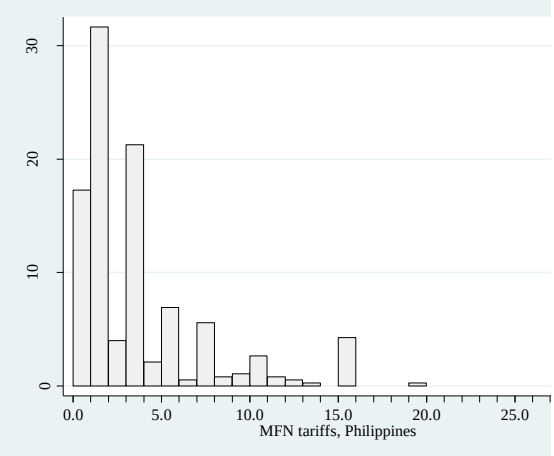
subsequent phasing out on the majority of electronics products.[5] In the case of ASEAN countries, MFN tariffs are zero-rated on computers and most electronics products, but some positive rates linger on. Figure 12 shows the distribution of MFN tariff rates for chapters 84-86 which comprise all machinery and electronics products, both industrial and consumer, for the three ASEAN members with data for which MFN tariffs are substantially away from zero: Indonesia, the Philippines, and Viet Nam.

Figure 12: Distribution of MFN Tariffs in Chapters 84-86 (Machinery and Electronics Products)

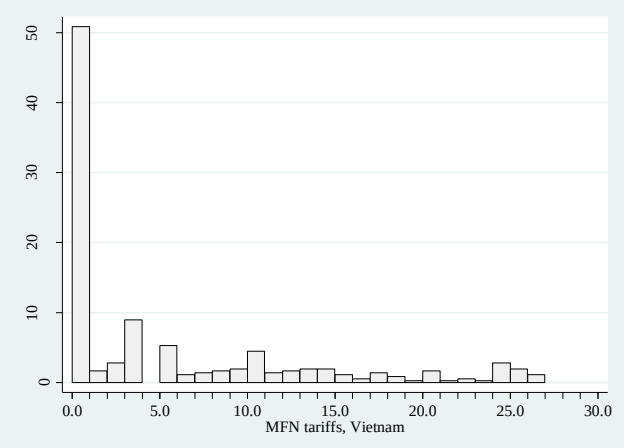
(a) Indonesia



(b) Philippines



(c) Vietnam

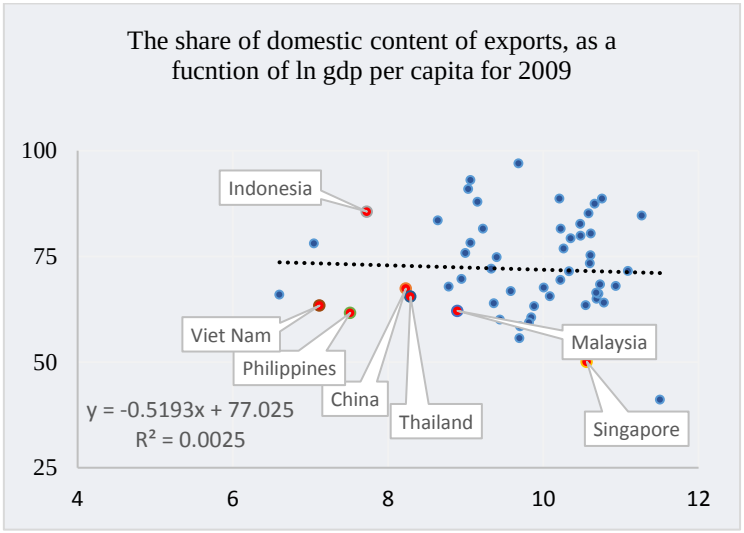


[5] Six out of 10 ASEAN countries, Indonesia, Malaysia, the Philippines, Singapore, Thailand and Viet Nam, were members of the ITA-1; and almost all ASEAN's main trading partners, such as Australia, India, Japan, Korea and New Zealand, are also members of ITA. China is in the process of accession. The ITA provides all members to completely eliminate duties on IT products covered by the Agreement. In 2013, the ITA-1 had 70 members which have trade of about 97 percent of world trade in information technology products. The ITA-2 is now in the progress on negotiations.

Second, a significant chunk of China's iPod exports go to the U.S. and E.U., where ASEAN RoOs do not apply. Even those shipped to Japan are affected only by the ASEAN-Japan rules rather than AFTA's.

Beyond the special case of the electronics sector, what is the evidence on the importance of domestic vs. foreign content in exports? The evidence can only be fragmentary given that the calculation of foreign content requires the combination of trade data with detailed input-output data which is currently not available. However, Johnson and Nogueira (2010) and Koopman *et al.*, (2011) have recently calculated the value-added content of exports using innovative methodologies. Intuitively, one would expect the share of domestic content in export to rise with the level of economic development, as low-income and lower-middle income countries tend to confine their participation in GVCs to superficial assembly work (as suggested by the example of the iPod in Figure 11). This conjecture has been used in policy debates about the reform of RoOs in the E.U. to justify relaxed RVC levels for LDCs. However, Figure 13 shows that it does not seem to stand scrutiny on the sample of countries covered by Johnson and Nogueira's calculations, as the average domestic content of exports shrinks instead of rising with the level of income.

Figure 13: Average Domestic Content of Exports, As a Function of Exporter Income

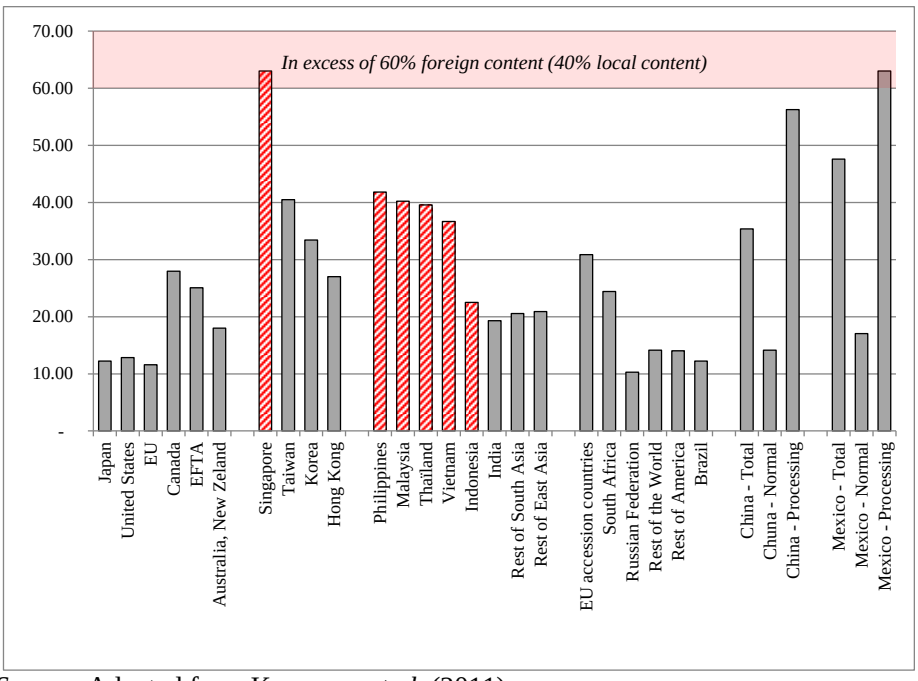


Source: Ing, Lili Yan and Chandra Tri Putra, 'Imported inputs on Indonesia's exports: firm level evidence', calculated based on OECD TiVA [work in progress], reconstruction of Johnson and Noguera (2010) for 56 countries.

However, this result should be interpreted very cautiously as the picture may change when the sample is enlarged to LDCs. Also, it may be a composition effect, with at least some lower-middle-income countries in the sample exporting relatively more agricultural products while upper-middle income countries exporting more electronics and other products in which assembly represents a very thin slice.

Figure 14, constructed using Koopman *et al*.'s data, gives prima-facie evidence of how constraining could ASEAN's RVC be by plotting the average foreign content of exports for countries in Koopman *et al.*'s sample. With a 40 percent RVC, the foreign content of exports should be no more than 60 percent. Koopman *et al*. did not calculate the regional value added in gross exports, but only the domestic vs. foreign (all origins including both regional and non-regional). So only foreign content widely in excess of 60 percent would put a country's exports at risk of violating the 40 percent RVC. Figure 14 shows that for most of ASEAN's member states for which data are available, the foreign content of exports is less than 60 percent, suggesting that prima facie ASEAN's RoO should not be overly constraining.

Figure 14: Foreign Content of Exports, by Exporting Country



Source: Adapted from Koopman *et al.* (2011)

Thus, by and large, prima facie evidence suggests that RoOs should be only moderately constraining to ASEAN's trade. But the prima facie evidence can hide substantial effects once the sectoral composition of trade is taken into account. Moreover, the bureaucratic hassle of proving compliance may be perceived by companies to be a burden. Only econometric analysis, controlling for various possible confounding influences, can give a response.

3. Econometric Analysis

3.1 Data and Estimation

RoO data in the form of precise requirements at the HS6 level of product classification were provided to us by the ASEAN Secretariat. Trade data in thousand U.S. dollars are from the CEPII's BACI database, which is based on COMTRADE but reconciles direct export and mirrored import data. Gravity variables are from the CEPII's free-access online database.

Our estimation strategy is based on the ubiquitous gravity equation, but we estimate it at a disaggregated (product) level, which requires some adjustment in the formulation of the estimation equation. Appendix 1 derives our estimation equation from the standard Anderson-van Wincoop (2004) framework after relaxing key symmetry assumptions about production costs and trade costs. That is, we allow for variation in those costs across products and estimate the gravity at the product-country pair level. The baseline formulation is

$$\ln v_{ijk} = \beta \ln \tau_{ijk} + \delta_{jk} + \delta_{ik} + u_{ijk} \qquad (1)$$

where v_{ijk} is the dollar value of trade from *i* to *j* in product *k*, τ_{ijk} is a product-specific trade cost and δ_{jk} and δ_{ik} are importer-product and exporter-product fixed effects controlling respectively for preferences and comparative advantage.

In the presence of RTAs, market access is affected by both MFN and preferential tariffs. Let

$$I_{ij}^{RTA} = \begin{cases} 1 & \text{if } i \text{ and } j \text{ are members of the same RTA} \\ 0 & \text{otherwise} \end{cases} \quad (2)$$

be a dummy variable marking preferential trade (for any RTA), let

$$r_{ijk\ell} = \begin{cases} 1 & \text{if RoO } \ell \text{ applies to product } k \text{ in the agreement between } i \text{ and } j \\ 0 & \text{otherwise} \end{cases} \quad (3)$$

where ℓ indexes the various forms of RoOs (CTC, local content, etc.), let t_{ijk}^{MFN} be the MFN tariff rate on product *k* applicable to trade between *i* and *j* , and let finally $\mathbf{x}_{ij}$ be a vector of country-pair attributes such as distance, common language etc. The trade-cost expression is then

$$\tau_{ijk} = \exp\left[\beta_1 t_{ijk}^{\text{MFN}} + \beta_2\left(I_{ij}^{RTA} \times t_{ijk}^{\text{MFN}}\right) + \beta_3 I_{ij}^{RTA} + \sum_{\ell} \beta_{4\ell}\left(I_{ij}^{RTA} \times r_{ijk\ell}\right) + \mathbf{x}_{ij}\boldsymbol{\gamma}\right] \quad (4)$$

Expressions (1)-(4) represent an "ideal" formulation that we need to adapt to data constraints. First, we have RoO data only for ASEAN countries and not for other preferential agreements in the world. Therefore we can hope to disentangle the effect of tariffs from those of RoOs for ASEAN country pairs but not for others.

Accordingly, we mark all country pairs eligible for preferential rules with a single dummy variable defined as in (2). Because the value of preferences depends on MFN tariffs (for instance, when MFN tariffs are zero, preferences are nonexistent), we include MFN tariffs in the estimation, both linearly and interacted with the RTA dummy. Given that for most RTAs, preferential tariffs are set to zero, the coefficient on the interaction term gives the effect of tariff preference margins in RTAs (and should therefore be positive).

For RTAs other than ASEAN, the RTA dummy and interaction term together capture the average effect of trade-preference packages including both tariff-preference margins and RoOs. For ASEAN pairs, however, we also include the applicable RoO in the form of a vector of dummies, one for each type of RoO, as in (3). Thus, for ASEAN country pairs, the RTA dummy and its interaction with the MFN

tariff capture only the effect of tariff-preference margins, while the RoO dummies capture specifically the effect of RoOs.

Country-product fixed effects at HS6 as in (1) imply the estimation of one million coefficients. Estimating a system with about 30 million observations and over one million coefficients is beyond the computational capabilities of most computers and would tie up too much costly time on a super-computer. Therefore we simplify the estimation in several ways. First, we replace country-product fixed effects by a vector of fixed effects by exporter, importer, and product, totaling about five thousand instead of one million. This gives the following alternative formulation:

$$\ln v_{ijk} = \beta_1 t_{ijk}^{MFN} + \beta_2 \left(I_{ij}^{RTA} \times t_{ijk}^{MFN} \right) + \beta_3 I_{ij}^{RTA} + \sum_{\ell} \beta_{4\ell} I_{ij}^{\text{ASEAN}} r_{ijk\ell} + \mathbf{x}_{ij}\boldsymbol{\gamma} + \delta_i + \delta_j + \delta_{s(k)} + u_{ijk} \tag{5}$$

where δ_i, δ_j and $\delta_{s(k)}$ are respectively exporter, importer and sector (HS4) fixed effects, $s(k)$ being the HS4 sector to which HS6 product k belongs. Using HS4 instead of HS6 fixed effects reduces the number of fixed effects from five thousand to one thousand, substantially reducing the estimation's computational demands.

We also carry out the estimation by section, making sure that each section includes goods with different types of RoO. We then convert estimates into ad-valorem equivalents (AVEs) of RoOs using a standard formula for semi-logarithmic equations, namely

$$AVE_{\ell} = e^{\beta_{4\ell}} - 1. \tag{6}$$

3.2. Aggregate Results

Baseline results are presented in Table 2. In all regressions, commodities and oil products are excluded. Columns 1 and 2 present estimates for the whole sample of non-commodity trade; in column 1, RoO variables are omitted, while in column 2, they are included. Column 3 presents results for manufactured products only. For readability, the table is split into two parts, the first with standard gravity control

variables plus tariffs and RTA markers, and the second with RoO coefficients only. These two parts refer to the same regressions.

Parameter estimates on standard gravity controls are as expected. Note that the trading countries' GDPs are not included because they are absorbed by exporter and importer fixed effects. This formulation is superior to one with GDPs as fixed effects control adequately for "multilateral resistance terms".

Table 2: Gravity Regression Results, Non-commodity Trade: Control Variables

Estimator Sample Dependent variable: ln(trade value)	OLS (within) All a/ (1)	OLS (within) All a/ (2)	OLS (within) Manufacturing (3)
Gravity controls			
ln(distance)	-0.442 (268.00)***	-0.448 (260.15)***	-0.477 (264.38)***
Comm. border	0.420 (97.47)***	0.415 (95.84)***	0.407 (89.42)***
Comm. language	0.189 (55.28)***	0.191 (55.77)***	0.227 (63.38)***
Comm. colonizer	0.234 (38.24)***	0.235 (38.18)***	0.234 (36.33)***
Trade policy variables			
MFN tariff	-0.005 (22.52)***	-0.005 (22.30)***	-0.009 (38.31)***
RTA pair	0.223 (54.28)***	0.223 (54.13)***	0.231 (54.22)***
MFN tariff x RTA	0.001 (3.59)***	0.001 (2.96)***	0.001 (2.56)**

Table 2: (continued): Gravity Regression Results, Non-commodity Trade: RoOs

Estimator	OLS (within)	OLS (within)	OLS (within)
Sample	All a/	All a/	Manufacturing
Dependent variable: ln(trade value)	(1)	(2)	(3)
Rules of origin			
CC		-0.205	-0.204
		(5.35)***	(3.97)***
CTH		-0.101	-0.067
		(1.26)	(0.75)
RVC		-0.062	-0.063
		(4.02)***	(3.89)***
RVC at 35% (ASEAN-India)		-0.443	-0.519
		(19.69)***	(22.17)***
Wholly obtained		-0.459	-0.136
		(10.42)***	(1.16)
CTC & exception		-0.177	-0.193
		(6.40)***	(6.80)***
CTC & RVC		0.542	0.841
		(1.71)*	(1.69)*
CTC or TR		-0.533	-0.528
		(8.33)***	(8.19)***
CTC or (TR & RVC)		-0.314	-0.340
		(1.64)	(1.78)*
RVC or CC		-0.149	-0.036
		(6.08)***	(1.16)
RVC or CTH		0.059	0.047
		(5.76)***	(4.48)***
RVC or CTSH		-0.170	-0.222
		(8.71)***	(11.06)***
RVC or TR		-0.459	-0.563
		(11.19)***	(13.76)***
RVC or (CTC & exception)		-0.286	-0.347
		(15.94)***	(19.07)***
Constant	6.525	6.600	6.518
	(138.18)***	(138.45)***	(128.62)***
Observations	4411362	4411362	3959384
R-squared	0.26	0.26	0.28

Note: Parameter estimates on standard gravity controls are as expected. Note that the trading countries' GDPs are not included because they are absorbed by exporter and importer fixed effects. This formulation is superior to one with GDPs as fixed effects control adequately for "multilateral resistance terms".

The elasticity of trade to distance is -0.442, implying that a doubling in bilateral distance reduces trade by 25 percent.[6] A common land border raises trade by 50 percent ($e^{0.420}-1$). Note by comparison between columns 1 and 2 that parameter estimates are not affected by the introduction of RoO dummies, which confirms that the specification and baseline results are robust.

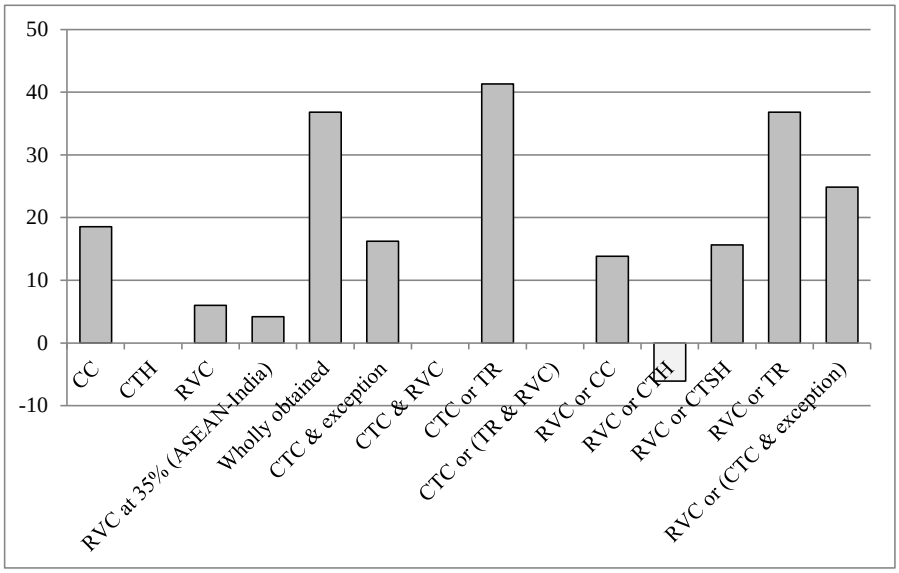
The second part of Parameter estimates on standard gravity controls are as expected. Note that the trading countries' GDPs are not included because they are absorbed by exporter and importer fixed effects. This formulation is superior to one with GDPs as fixed effects control adequately for "multilateral resistance terms".

Table 2 shows parameter estimates for the effect of RoOs, with different types consolidated into 14 main rules. Twelve out of 14 are higly significant (at the 1 percent level), and all except two are negative. Out of the two positive ones, only one, on RVC or CTH, is strongly significant.

Parameter estimates are displayed graphically in **Figure 15**. It can be seen that the most trade-inhibiting instruments are wholly obtained (-36.81 percent) and the Textile Rule, even when offered on choice with either a change of tariff classification (CTC or TR) or a regional value content (RVC or TR). This is somewhat of a puzzle, since RVCs do not appear very restrictive when used alone (-6.01) while change of chapter (CC), the most restrictive of CTCs, has an AVE of 18.54 percent, already high but much lower than when offered as a choice with the textile rule.

[6] Note that distance is a continuous variable, not a binary one; so formula (6) does not apply. Instead, the coefficient can be read directly as an elasticity, as both value and distance are in logs.

Figure 15: Ad-valorem Equivalents of RoOs, All Sample



Source: Authors calculations using BACI.

The apparent puzzle of the Textile Rule's very strong effect suggests that the restrictiveness of RoOs should be assessed by section in order to better filter out heterogeneity of effects across sectors. Our estimation method with product fixed effects filtered out the effect of product heterogeneity on trade values, but not on "treatment effects" (the effect of RoOs on trade). Section-by-section estimates allow for different effects across sectors.

Across the board, RoOs appear heavily restrictive. However estimation on the whole sample may capture confounding influences that artificially inflate their estimated effect on trade flows. We now turn to estimation section by section.

3.3. Results by Section

We now report the results of 21 regressions run on sub-samples restricted to products within one section. Averages across all instruments are shown in Table 3, together with weights used to calculate the trade-weighted average. Following Leamer (1974), in order to avoid the endogeneity of trade flows from biasing the weights used in calculated weighted averages, we use world trade weights rather than ASEAN trade weights.

Table 3: Average AVEs for All RoO Instruments, by Section

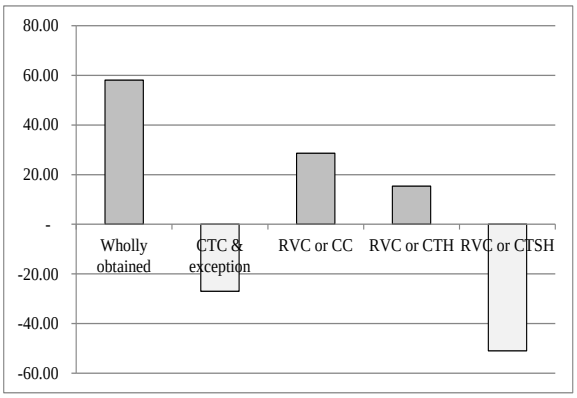
Section	Summary description	Average AVE (%)	Trade weights a/
1	Live animals; animal products	-	
2	Vegetable products	1.91	2.61
3	Animal or vegetable fats	6.67	0.58
4	Food, beverages and tobacco	1.73	3.05
5	Mineral products	1.52	19.59
6	Products of the chemical or allied industries	3.50	9.70
7	Plastics and articles thereof; rubber and articles thereof	1.87	4.63
8	Leather and leather products	9.05	0.60
9	Wood and articles of wood	-3.20	0.77
10	Pulp and paper	4.98	1.75
11	Textiles and apparel	8.29	4.06
12	Footwear	12.67	0.77
13	Cement, glass and stone	2.42	0.93
14	Precious metals and stones	3.81	2.97
15	Base metals and articles of base metal	-0.46	7.77
16	Machinery and electrical equipment	-0.36	25.89
17	Vehicles	6.89	8.99
18	Precision instruments, optics, watchmaking	3.34	3.33
19	Arms and ammunition; parts and accessories thereof	-	-
20	Miscellaneous manufactured articles	-3.37	1.99
21	Works of art, collectors' pieces and antiques	-	
Average (%)			
Simple		***3.40***	
Trade-weighted			***2.09***

Note: Trade weights calculated using world trade, following Leamer (1974), averaged over 2010-11. Only sections where RoO AVEs are significant used in their calculations; Section 1 omitted because entirely covered by "wholly obtained" rule.
Source: Authors calculations using BACI.

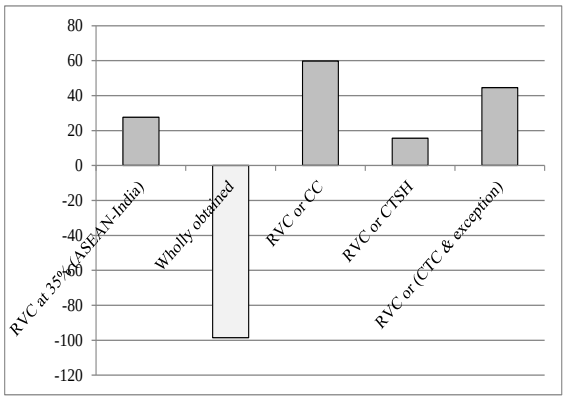
Figure 16 further decomposes the AVEs of RoOs by section and by instrument, keeping only statistically significant estimates. For brevity, we display only a few sections selected for their importance in ASEAN trade. Results for other sections are available from the authors upon request.

Figure 16: Ad-valorem Equivalents of RoOs (%), Selected Sectors

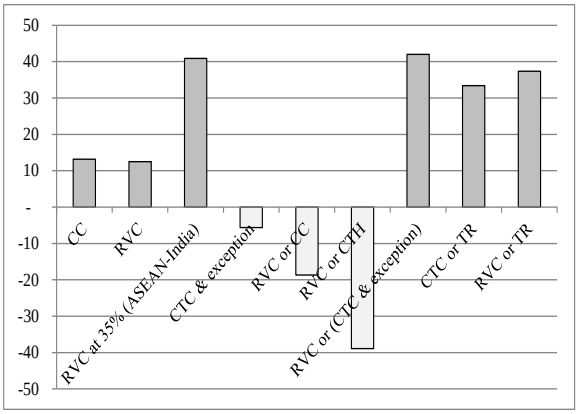
Section 4 (food, beverage & tobacco)



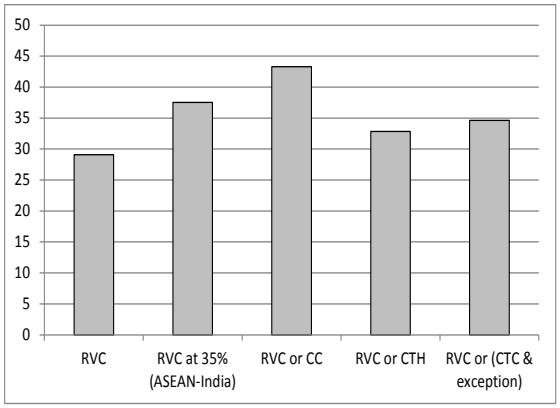
Section 6 (chemicals)



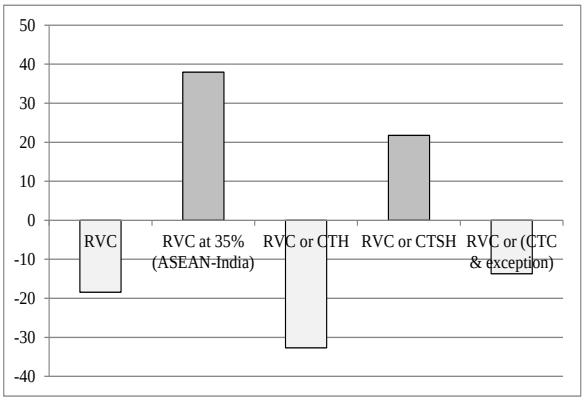
Section 11 (textile & apparel)



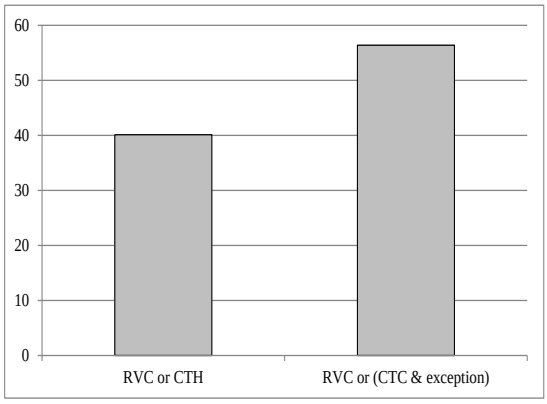
Section 12 (footwear)



Section 16 (machinery & electronics)



Section 17 (transportation equipment)



Source: Authors' calculations.

Although results are, unsurprisingly, less stable at the sector level than at the aggregate level, a few observations come out of the analysis. First, the wholly obtained

criterion appears to have a restrictive effect on preferential trade in the food, beverage & tobacco sector, which is to be expected since it essentially prevents foreign sourcing of any sort. Section 6 (chemicals) is one of the few where the RVC seems to have a strong trade-inhibiting effect. In Section 11 (textile and apparel), unsurprisingly the Textile Rule appears restrictive, while in Section 12 (footwear) all rules appear restrictive. This parallels results obtained for NAFTA and PANEURO. In Section 16 (machinery and equipment, including electronics), the results are very unstable, which is to be expected given the presence of the WTO's IT agreement already discussed. Finally, in the all-important section 17 (transportation equipment) strong trade-inhibiting effects are observed for regional value contents, even when offered on choice with other rules (change of tariff heading or change of tariff classification other than heading but with an exception). These rules appear tailor-made to stifle, to some extent, automobile trade in the region.

4. Concluding Remarks

This paper reviewed the evidence on the effect of ASEAN's rules of origin (RoO) on preferential trade. While the first-best approach to measure the effect of RoOs would be to use preference utilization rates as the dependent variable, in the absence of utilization-rate data, we based our identification strategy on the variation in trade flows across country pairs, controlling for product and country heterogeneity with product, exporter and importer fixed effects in a disaggregated (HS6) cross-section gravity framework.

Prima facie, ASEAN's RoOs have a relatively simple and transparent structure, with a large chunk of trade flows subject to a 40 percent regional value content or a change of tariff classification. In many cases, the importers can choose which rule they claim, which makes the system less penalizing.

However, the econometric analysis of trade flows uncovers evidence of moderately restrictive effects, with an average tariff equivalent, across all measures and products, of 3.40 percent (2.09 percent using trade-weighting). That is, ASEAN's RoOs "deny preferences" by an amount roughly comparable to one fourth of the tariff-

preference margins. Although moderate, this may contribute to low take-up rates that have been observed on the basis of fragmentary evidence.

Overall, ASEAN's relatively restrictive RoOs may not have a huge impact on trade flows as a large proportion of international trade in the Asia-Pacific area is in the electronics and capital equipment sector where MFN tariffs are low and the attractiveness of preferences is (with or without RoO) limited anyway. Thus, low take-up rates may simply reflect the fact that most trade is in product lines that do not stand to benefit very much from tariff reductions.

However, there may be gains to reap from the simplification of RoOs in sectors like textile & apparel or footwear, which currently represent a low proportion of Asia-Pacific trade but may represent substantial opportunities for export-led growth and thus poverty reduction in some of the region's poorest countries. The same applies to prepared foods. Automobiles also stand out as a sector where the relaxation of RoOs might be considered, or at least carefully coordinated with plans to build up "deep" value chains within the region.

Thus, the simplification and streamlining of RoOs should prioritize light industries like textile and apparel, footwear, and prepared foods (in particular fats) and this should be seen as part of ASEAN's internal development and poverty-reduction strategy. Future research should be carried out to assess the specific gains that ASEAN's poorer member states would reap from less stringent RoOs.

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Appendix 1

This appendix derives the estimation equation at the product level from the gravity equation using the Anderson-van Wincoop (2004) framework but relaxing key symmetry assumptions on production costs and trade costs. Suppose that country *i* exports n_i varieties to country *j* and let x_{ijk} be the quantity of variety *k* exported from *i* to *j* (in tons), p_{ijk} its CIF price, E_j the total expenditure in country *j*, and s_{ijk} its share in country *j*'s expenditure. We have

$$p_{ijk}x_{ijk} = s_{ijk}E_j \tag{6}$$

With CES preferences, P_j being composite price index in *j* and σ elasticity of substitution between varieties, it can be shown that

$$s_{ijk} = \left(\frac{p_{ijk}}{P_j}\right)^{1-\sigma} \tag{7}$$

Let τ_{ijk} be the bilateral trade cost between *i* and *j* for variety *k*, including all of its components (tariffs, RoOs, and other barriers). Let p_{ik} be the producer price of variety *k* in country *i*; we will assume that it is affected by an idiosyncratic shock φ_{ik} representing comparative advantage; i.e.

$$p_{ik} = \frac{p_i}{\varphi_{ik}} \tag{8}$$

The consumer price of variety *k* in country *j* is then

$$p_{ijk} = \tau_{ijk}p_{ik} \tag{9}$$

Let V_{ij} be the total value of exports from *i* to *j*. Bilateral trade between *i* and *j* is given by

$$V_{ij} = \sum_k p_{ijk} x_{ijk} = \sum_k s_{ijk} E_j = \sum_k \left(\frac{p_{ijk}}{P_j} \right)^{1-\sigma} E_j$$

$$= \sum_k \left(\frac{\tau_{ijk} p_{ik}}{P_j} \right)^{1-\sigma} E_j$$

(10)

Country *i*'s GDP is the sum of its sales to all destinations, including itself:

$$Y_i = \sum_{j=1}^{m} V_{ij} = \sum_{j=1}^{m} \sum_k \left(\frac{\tau_{ijk} p_{ik}}{P_j} \right)^{1-\sigma} E_j = \sum_k \left[p_{ik}^{1-\sigma} \sum_{j=1}^{m} \left(\frac{\tau_{ijk}}{P_j} \right)^{1-\sigma} E_j \right] \quad (11)$$

Let us define a product-specific remoteness term Ω_{ik} (the product-specificity comes here only from the fact that trade costs τ_{ijk} vary across products):

$$\Omega_{ik} = \sum_{j=1}^{m} \tau_{ijk}^{1-\sigma} \left(\frac{E_j}{P_j^{1-\sigma}} \right) \quad (12)$$

and write

$$Y_i = \sum_k p_{ik}^{1-\sigma} \Omega_{ik} = p_i \sum_k \left(\frac{1}{\varphi_{ik}} \right)^{1-\sigma} \Omega_{ik} \,. \quad (13)$$

Let

$$\tilde{\Omega}_i = \sum_k \left(\frac{1}{\varphi_{ik}} \right)^{1-\sigma} \Omega_{ik} \quad (14)$$

be a remoteness term adjusted for comparative advantage. Inverting (13) gives

$$p_i = \frac{Y_i}{\tilde{\Omega}_i}. \tag{15}$$

Writing (10) in terms of p_i gives

$$V_{ij} = p_i \sum_k \left(\frac{\tau_{ijk}}{\varphi_{ik} P_j} \right)^{1-\sigma} E_j = \frac{Y_i}{\tilde{\Omega}_i} \sum_k \tau_{ijk}^{1-\sigma} \frac{E_j}{P_j^{1-\sigma}} = \sum_k \tau_{ijk}^{1-\sigma} \frac{Y_i E_j}{\tilde{\Omega}_i P_j^{1-\sigma}} \tag{16}$$

Noting finally that $E_j = Y_j$ (income equals expenditure) and letting $\overline{\tau}_{ij} = \sum_k \tau_{ijk}^{1-\sigma}$ be the average trade cost from *i* to *j* across all varieties gives a modified gravity equation holding at the aggregate level in the absence of symmetry:

$$V_{ij} = \overline{\tau}_{ij} \frac{Y_i Y_j}{\tilde{\Omega}_i P_j^{1-\sigma}} \tag{17}$$

We are here interested in estimating this equation at the product level. Let v_{ijk} be the value of the flow of variety *k* from country *i* to country *j*. Using (7)

$$\begin{aligned} v_{ijk} = s_{ijk} V_{ij} &= \left(\frac{p_{ijk}}{P_j} \right)^{1-\sigma} V_{ij} \\ &= \left(\frac{p_i \tau_{ijk}}{\varphi_{ik} P_j} \right)^{1-\sigma} \overline{\tau}_{ij} \frac{Y_i Y_j}{\tilde{\Omega}_i P_j^{1-\sigma}} \end{aligned}. \tag{18}$$

How does expression (18) differ from an ordinary gravity expression? The two key differences are the presence of an exporter-product term φ_{ik} correcting for comparative advantage and of a dyad-product term τ_{ijk} correcting for product-specific trade costs, which are what we are interested here (product-specific tariffs and RoOs). Letting δ_j and δ_{ik} be respectively importer and exporter-product fixed effects, we can write (18) after log-linearization as

$$\ln v_{ijk} = \beta_1 \ln \tau_{ijk} + \beta_2 \ln \tau_{ij} + \delta_{ik} + \delta_j + u_{ij} \quad (19)$$

where

$$\tau_{ijk} = e^{\gamma_1 t_{ijk} + \gamma_2 r_{ijk}}, \quad (20)$$

t_{ijk} and r_{ijk} being respectively the tariff and RoO applying to good *k* between countries *i* and *j*, and τ_{ij} is the usual array of gravity controls (distance, common border, common language, and so on).

Appendix 2

This appendix details the classification of RoOs used in regression analysis. The large number of instrument combinations used in the various trade agreements involving ASEAN required consolidation for regression analysis. We have consolidated all types into 15 broader types, preserving special categories for instruments combined with additional requirements and for cases of instrument choice. Frequency numbers shown in Table A2 are the numbers of HS6 lines concerned by the instrument on all ASEAN trade. Thus, the numbers add up to substantially more than the notional number of HS6 lines (about 5'000). Consolidation choices were made on the basis of frequency ratios (the consolidation concerned instruments or combinations of instruments with low frequency).

Table A2: RoO Types

Raw	Consolidated	Frequency, all ASEAN imports	Frequency ratio, all ASEAN imports
RVC	rvc	5,149	16.52
RVC + CC	rvc+ctc	2	0.01
RVC + CTH	rvc+ctc	5	0.02
RVC + CTSH	rvc+ctc	3	0.01
RVC + Textile Rule or CC	(rvc+tr)_or_ctc	218	0.7
RVC + Textile Rule or CTH	(rvc+tr)_or_ctc	6	0.02
RVC or CC	rvc_or_cc	1,323	4.24
RVC or CC + Textile Rule	rvc_or_ctc+x	2	0.01
RVC or CC or SPR	rvc_or_ctc+x	89	0.29
RVC or CC or Textile Rule	rvc_or_ctc+x	463	1.49
RVC or CC with exception	rvc_or_ctc+x	86	0.28
RVC or CTH	rvc_or_cth	11,764	37.74
RVC or CTH + CTSH	rvc_or_ctc+x	195	0.63
RVC or CTH or CTSH	rvc_or_ctc+x	136	0.44
RVC or CTH or SPR	rvc_or_ctc+x	24	0.08
RVC or CTH or Textile Rule	rvc_or_ctc+x	347	1.11
RVC or CTH with exception	rvc_or_ctc+x	194	0.62
RVC or CTSH	rvc_or_ctsh	1,877	6.02
RVC or CTSH with additional reqt	rvc_or_ctsh	4	0.01
RVC or CTSH with exception	rvc_or_ctsh	41	0.13
RVC or Textile Rule	rvc_or_tr	428	1.37
RVC with additional reqt	rvc	5	0.02
RVC35+CTSH	rvc_35	5,224	16.76

Table A2 (continued)

Raw	Consolidated	Frequency, all ASEAN imports	Frequency ratio, all ASEAN imports
CC	cc	987	3.17
CC + Textile Rule	cc+x	40	0.13
CC or Textile Rule	ctc_or_tr	15	0.05
CC with additional reqt	cc+x	348	1.12
CC with exception	cc+x	261	0.84
CTH	cth	230	0.74
CTH or Textile Rule	ctc_or_tr	91	0.29
CTH with additional reqt	ctc+x	615	1.97
CTH with exception	ctc+x	32	0.1
CTSH	cth	8	0.03
WO	wo	963	3.09

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