Preferential Rules of Origin: Deflection or Protection?

Dillon Laaker*

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Abstract

What determines the restrictiveness of rules of origin (RoO) in preferential trade agreements (PTAs)? Previous research suggests that external tariffs drive restrictive RoO. Scholars highlight two explanations for this relationship: trade deflection and protection. On the one hand, when external tariffs are high, restrictive rules may be necessary to prevent arbitrage by non-member countries. On the other hand, strict rules may also be used to mitigate the liberalizing effect of a PTA. Each explanation suggests a drastically different purpose for RoO in PTAs. This article formalizes the incentives for each explanation and shows that they are not theoretically equivalent. The preferential margin drives the protectionist incentives for restrictive RoO while the difference between members' external tariffs and transportation costs drive the functional need for strict rules. To test these explanations, I construct a novel measure of the restrictiveness of RoO for ten US PTAs that accounts for the vertical linkages between goods. The evidence indicates that restrictive RoO are primarily used to mitigate the degree of liberalization in a PTA rather than to prevent trade deflection. Contrary to recent literature, the results suggest that protectionist industries have adapted to the contemporary era of trade policy and have pursued restrictive RoO as an alternative form of protection.

*Ph.D. Candidate in Political Science, University of Wisconsin-Madison. Email: laaker@wisc.edu. Previous versions of this article were presented at APSA (2019), the IR Colloquium at the University of Wisconsin (2019), and IPES (2019). Thank you to Evan Dove, Katie McGlasson, and Cleo Rank for research assistance. A special thank you to Mark Copelovitch, Caileigh Glenn, Lisa Martin, Andrew (RoO) McWard, Jon Pevehouse, Dennis Quinn, Cassidy Reller, and Matt Shor for extensive feedback. Remaining errors are my own.

Recent decades have witnessed a rapid proliferation of preferential trade agreements (PTAs), which has substantially altered the substance and purpose of trade policy. While the World Trade Organization (WTO) has experienced gridlock since the 1994 Uruguay Round, the number of PTAs has dramatically increased. In 1990 there were only a little more than 100 agreements in force, while in 2010 there were more than 700. As Baccini (2019, 76) notes, an emerging consensus is that "PTAs serve the interests of large, productive firms involved in offshoring activities... Such firms are the key actors behind the proliferation of PTAs. In this regard, preferential liberalization moves hand in hand with the growing importance of foreign direct investment and global value chains." Indeed, Osgood (2018) argues that the proliferation of PTAs and the emergence of global value chains have fragmented traditional protectionist industries and privileged a new pro-trade coalition of highly competitive firms. Rather than the traditional "protection for sale" framework, scholars suggest it is now "globalization for sale" (Blanga-Gubbay et al., 2018).

In this article, I demonstrate that PTAs have not fragmented protectionist industries, but rather have simply altered the type of protection these industries pursue. I provide support for this argument by focusing on preferential rules of origin (RoO), a policy provision that is included in all trade agreements. A key difference between PTAs and most favored nation (MFN) status is that PTAs are preferential, meaning they must discriminate against non-members. In other words, only a good that originates from a PTA member should benefit from the lower preferential tariff rate. To identify when a good originates in a member country, PTAs use RoO, which specify the amount and/or third-party materials that can be used to produce a good while still qualifying for the preferential tariff rate. These rules are often highly detailed. For instance, US trade agreements typically contain over 1,000 separate rules for about 5,000 products that span hundreds of pages.

RoO are at the core of PTAs because they prevent trade deflection (the transshipment of goods).[1] Simply stated, PTAs need to prevent non-members from shipping goods through a

[1]This article uses trade deflection, the transshipment of goods, and arbitrage interchangeably.

low-tariff PTA member to a high-tariff partner. In this sense, RoO serve a functional purpose: to prevent access from non-members and to ensure the benefits of preferential liberalization are only granted to member countries. Preventing trade deflection is often how firms justify the need for restrictive RoO. However, while these rules may serve a functional purpose to deter deflection, they are also a powerful and particularly useful tool for trade protection since they constrain the sourcing options of firms (Krueger, 1993). Further, given their legal and technical complexity, these rules have obscure distributional consequences, which satisfies the "principle of optimal obfuscation" proposed by Magee et al. (1989) and suggests that firms can exert significant influence over their design.

RoO are largely ignored in the political economy literature because of their esoteric nature. For example, a recent article in the *Annual Review of Political Science* on the politics of PTAs (Baccini, 2019), does not even mention RoO. This is surprising given RoO largely determine the degree of liberalization that results from a trade agreement. Furthermore, these rules are consistently cited as the most problematic non-tariff barrier by manufacturing firms in developing countries (ITC, 2015). The nascent literature on the politics of RoO suggests that the level of external protection (MFN tariff) should influence the restrictiveness of RoO. For example, when analyzing the rules in the North American Free Trade Agreement (NAFTA), Chase (2008) finds that US industries with higher MFN tariffs have more restrictive RoO. Though, the underlying explanation that drives this relationship is less than clear. Chase (2008) argues that industries protected by high external tariffs have an incentive to seek restrictive RoO because it prevents trade deflection. When external protection of a member country is high, foreign firms have a larger incentive to enter the protected market through a member country and, thus, RoO need to be more restrictive to decrease these incentives.[2] In addition, these producers also "may be eager for as much protection as they can get, so prohibitive rules of origin are better than ones that merely restrict transshipment" (Chase, 2008, 512). Simply stated, protected industries may also

[2]External protection refers to the MFN tariff of a country.

seek restrictive RoO to mitigate the liberalizing effect of a PTA.

Previous studies suggest that the MFN tariff of a country is correlated with the restrictiveness of RoO because it decreases the incentives for trade deflection and because it serves as substitute for external tariffs by mitigating the liberalizing effect of a PTA. However, each explanation suggests a drastically different purpose for RoO, which affects how scholars and policymakers should think about these rules and PTAs in general. If restrictive rules are used to prevent trade deflection, then they are a necessary tool for preferential liberalization to even function and, thus, merit little attention from political economists. Alternatively, if RoO are used as a substitute for external tariffs, then these rules are a political device that have evaded the attention of scholars and are essential to understanding the broader politics and distributional consequences of PTAs. Specifically, the emerging consensus in the literature is that PTAs have fragmented traditional protectionist industries and privileged a new pro-trade coalition of highly competitive firms. However, these studies implicitly ignore the potential for restrictive RoO as a form of hidden protection within PTAs. In other words, protectionist industries may have simply adapted to the contemporary era of trade policy and pursued restrictive RoO as an alternative form of protection.[3]

In this article, I formalize the incentives for each of these explanations and show that they are not theoretically equivalent. In other words, the incentive structures for each are unique. On the one hand, the incentive to use restrictive RoO as a substitute for external protection is driven by the preferential margin (the difference between the MFN and preferential tariff). In essence, when the benefits of the PTA increase for a particular good, protected industries use RoO to increase the costs to access those benefits. On the other hand, the functional need for strict rules is determined by the difference between members' external tariffs and transportation costs. Only when the difference between members' external tariffs is high and transportation costs are sufficiently low is trade deflection an actual concern.

To test how the incentives for protection and trade deflection affect RoO, I construct

[3]While the literature often conflates the two, PTAs and "free trade" are not equivalent (Rodrik, 2018).

a novel measure of the restrictiveness of these rules that accounts for the vertical linkages between goods for ten US trade agreements. The evidence indicates that rather than serving a functional purpose to deter arbitrage by non-member firms, RoO are primarily used as a substitute for tariffs to mitigate the liberalizing effect of PTAs. In other words, as the preferential margin for a good increases, the restrictiveness of RoO also increases. These results raise critical questions about the broader politics of PTAs and their distributional consequences. Further, these results also help explain why the US textile industry and other protected industries are supporters of PTAs: because they secure highly restrictive RoO.

This article provides several notable contributions. First, it adds to the nascent literature on the politics and economics of RoO. By distinguishing the motivations to prevent arbitrage from those with protectionist intent, scholars and policymakers can identify when strict rules are necessary for a trade agreement to function and when they are used to hinder trade liberalization. This is particularly important when considering protectionist industries often use the potential for trade deflection to justify the need for strict rules.

This article also provides an important empirical contribution. A key reason why scholars have ignored RoO is because of their technical and legal complexity, which makes it difficult to conceptualize and measure the restrictiveness of these rules. The previous literature on RoO largely relies on a synthetic index that measures the general restrictiveness of the rule. However, this index fails to capture the vertical linkages between goods. This article introduces a tractable and flexible empirical framework that allows scholars to investigate the politics and economics of RoO from several theoretical angles.[4] Further, because of the difficulty to code these rules, previous studies typically focus on the RoO in a single PTA (Chase, 2008; Conconi et al., 2018). By leveraging the common syntax across the rules, this article streamlines the process and partially automates this task.

Finally, this article contributes to the broader trade politics literature. Specifically, the results challenge the emerging consensus that suggests PTAs and global value chains have

[4]See conclusion for a full discussion.

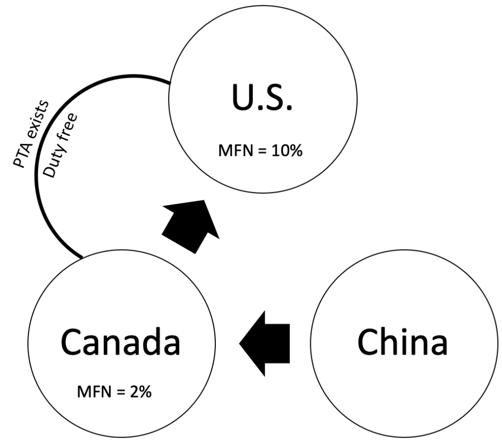
fragmented traditional protectionist forces (Osgood, 2018). While trade agreements have certainly decreased preferential tariff rates, these industries have adapted to this new environment and pursued restrictive RoO as an alternative form of protection. Further, by focusing on RoO, this article highlights the critical differences between the principle of "free trade" and preferential trade agreements (Rodrik, 2018).

1 The (Dual) Purpose of Rules of Origin

RoO are at the very heart of PTAs because they ensure preferential market access is only granted to goods that "originate" from member countries. Unlike a customs union, where members share the same external tariff, PTAs allow members to maintain different external trade barriers for non-member countries. This creates the potential for arbitrage or what is often referred to as trade deflection. Non-members can initially ship a good to the member with the lowest external tariff and then transship the good across the now duty-free border to the partner country with a higher MFN tariff. Figure 1 illustrates this dynamic. Consider a good that receives duty free access under a PTA between the US and Canada where the MFN tariff rate is 10 percent in the US and 2 percent in Canada. If RoO did not exist, a non-member country, such as China, can ship the good to Canada at the 2 percent tariff and then ship the good to the US under the lower preferential tariff. Without RoO and with minimal transportation costs, a PTA is highly liberalizing because it is a de facto customs union where the lowest MFN tariff among members is the new external tariff. However, as Krueger (1993) notes, these rules can also be a powerful and particularly useful tool for trade protection since they constrain the sourcing options of firms.[5] Intuitively, as the cost to comply with RoO increases, trade creation decreases. Thus, strict rules can dramatically decrease the liberalizing effect of a PTA if the costs to comply are greater than the benefits of preferential access.

[5]RoO as a form of protection is consistent with theoretical evidence that these rules can increase the viability of a PTA (Duttagupta and Panagariya, 2007).

Figure 1: The Potential for Trade Deflection



The literature suggests that a country's external protection (MFN tariff) should drive the restrictiveness of RoO. When analyzing the RoO in NAFTA, Chase (2008) finds that industries in the US with higher MFN tariffs have more restrictive rules. Though, the underlying explanation that drives this relationship is less than clear. As Chase (2008, 512) notes, "the benefits of restrictive rules of origin to block trade deflection are greater the higher the tariff." In addition, these producers also "may be eager for as much protection as they can get, so prohibitive rules of origin are better than ones that merely restrict transshipment" (Chase, 2008, 512). This suggests that when the external tariff in a country is high, there are two potential motivations for restrictive RoO: trade deflection and protection. However, each motivation drastically affects how scholars and policy makers should think about RoO. If restrictive rules are used to prevent trade deflection, then they simply serve a functional purpose. However, if they are used as a substitute for tariffs, then they are a protectionist device that has evaded the attention of scholars and have critical implications for the broader politics and distributional consequences of PTAs.[6]

To distinguish between these motivations, I formalize the incentives for both explanations to identify when restrictive rules are necessary to deter arbitrage and when they are used as protectionist devices.[7] I follow Felbermayr et al. (2019) and focus on how RoO affect the

[6]Restrictive RoO may also cause PTAs to reduce aggregate welfare (Demidova et al., 2012).
[7]I start by formalizing the incentives for protectionist interests because the intuition is more straightforward.

prices of goods.[8] To preview, I show that the preferential margin drives the protectionist incentives for restrictive RoO while the difference between members' external tariffs and transportation costs drive the functional need for strict rules.[9] Importantly, this analysis is not meant to characterize the entire political economy of RoO, but rather to simply distinguish between the incentives for trade deflection and protection (substitution for external tariffs).

While the underlying motivations for trade deflection and protection have distinct empirical implications, they are often conflated when discussing RoO. Protectionist industries use the potential for arbitrage by foreign firms as a justification for restrictive rules. Since RoO are essential for PTAs to function, it provides industries and politicians with a rhetorical device that hides their protectionist intent. Those who oppose strict rules can then be accused of advocating for unfair trade practices that serve to benefit non-members. This allows proponents of restrictive RoO to claim the moral high ground in trade policy. By formalizing the incentives for trade deflection and protection, one can distinguish between firms that simply use this rhetoric to hide their protectionist intent from those with legitimate concerns about arbitrage.

The Incentives for Trade Protection

By constraining the sourcing options of firms, RoO raise the production costs of a good that complies with the specific rule. In other words, if RoO are binding, then the input mix used in the production process of the good differs from the unconstrained input mix. Thus, an increase in the restrictiveness of RoO raises the minimum cost of production. In this sense, highly restrictive RoO are beneficial for the uncompetitive industries and firms who oppose trade liberalization. To understand this logic, consider countries a and b, where a firm in b

[8]Felbermayr et al. (2019) suggest that the scope for trade deflection is generally low. In the Appendix, I discuss the key differences between this article and Felbermayr et al. (2019).

[9]The following analysis assumes a market structure where 1) consumers bare all costs and with 2) perfect competition or monopolistic competition with CES preferences.

exports some good to a. With no PTA in place, the price for the good that is imported from b is $p_{ab} = p_b(t_a \tau_{ab})$, where $t_a \geq 1$ is the ad-valorem MFN tariff rate, $\tau_{ab} \geq 1$ is the ad-valorem transportation costs from b to a, and p_b is the price of the good in b. Suppose a and b enter into a PTA. After the agreement is implemented the cost is dependent on whether the exporter invokes preferences or not. Specifically, when invoking preferences under the agreement, the cost for the exporter is $p^*_{ab} = p_b(t_a(\lambda\theta)\tau_{ab})$, where $\lambda \in [\frac{1}{t_a}, 1]$ is the share of tariff t_a that the firm can escape paying and $\theta \geq 1$ is the additional cost of complying with RoO. Exporters will invoke preferences and comply with RoO if and only if

$$p_{ab} - p^*_{ab} = p_b(t_a \tau_{ab}) - p_b(t_a(\lambda\theta)\tau_{ab}) \geq 0 \tag{1}$$

Simply stated, the exporter in b invokes preferences when doing so results in a more competitive (lower) price compared to exporting under the MFN tariff. In other words, they do so when the benefits of the lower preferential tariff outweigh the costs of compliance.[10] To see this, let $\lambda = \frac{t^*_a}{t_a}$, where $t^*_a \geq 1$ is the preferential tariff rate. Equation (1) simplifies to:

$$\theta \leq \frac{t_a}{t^*_a}. \tag{2}$$

The intuition is straightforward. The right hand side of the inequality represents the benefits derived from invoking preferences, which increase as the MFN rate increases and the preferential tariff decreases, while the left-hand side represents the additional costs to comply with RoO. The exporter only invokes preferences when the benefits of doing so are greater than the costs. When $t_a = 1$, there is no incentive to ever pay the additional costs to comply with the specific rules. Therefore, there is no need for restrictive RoO. However,

[10]The discount rate (and preferential tariff) always refers to the lowest tariff set for the product in the PTA. In most circumstances, this equals 1. For the trade agreements included in the empirical analysis, t^*_a for a particular good either always goes to 1 or is excluded and stays at the MFN tariff rate. In other words, it is never the case that $1 < t^*_a < t_a$. Thus, in this instance, equation (2) simplifies to $\theta \leq t_a$. Since this is not necessarily the case for all trade agreements, I still refer to the right-hand side of equation (2) as the preferential margin.

when t_a is large and t_a^* is near 1, the benefits from invoking preferences are significant. Thus, the industry in a that is protected by a high external tariff rate has strong incentives to seek restrictive RoO to generate a large enough value of θ to offset the potential benefits of invoking preferences at the border. In this view, RoO serve as a substitute for external protection and can mitigate the degree of liberalization that results from a trade agreement. This leads to the following hypothesis:

Hypothesis 1 (Substitution): *As the preferential margin increases, the restrictiveness of rules of origin increases.*

There is also anecdotal evidence that suggests industries protected by high external tariffs pursue restrictive RoO as an alternative form of protection. For example, in the late 1980s and early 1990s, there was an emerging consensus in Washington on the need to secure export opportunities for competitive and capital intensive industries (Destler, 2006). The textile industry, a highly protected sector, correctly anticipated that negotiators would be willing to trade away protections on labor-intensive and declining industries to achieve that objective. In other words, the textile industry saw the writing on the wall. This became apparent with NAFTA. However, rather than fighting NAFTA, the textile industry worked to influence the design of RoO to secure protection by other means. As Fairbrother (2019) notes, the industry associations were ultimately supportive of the final agreement, but only because they were able to secure a highly restrictive RoO.[11] The industry worked to include similar rules in all subsequent US trade agreements. While tariffs were eliminated, the costs to access the benefits were large and, at least partially, offset the liberalizing effect of the PTA. A similar story emerges in the negotiations over RoO in the Transpacific Partnership (TPP). The US textile industry sought highly restrictive RoO to block textile imports from Vietnam that depend on Chinese suppliers (Ikenson, 2013). In both cases, the textile

[11]See also Destler (2006).

industry used the potential for trade deflection to justify the need for restrictive RoO.

Why do governments use RoO to provide firms with trade protection? Because they can. These rules have largely avoided any meaningful oversight. While the WTO has bounded the use of tariffs and some non-tariff barriers, there are minimal constraints on preferential RoO. The absence of a clear and binding multilateral regime has allowed governments to use these rules as an instrument for trade protection. The legal and technical complexity of these rules is a key reason why they have evaded WTO scrutiny and public attention.

The Incentives for Trade Deflection

When is trade deflection profitable? Building off the example above, consider a non-member c that exports the same good to a, where the price equals $p_{ac} = p_c(t_a \tau_{ca})$. Further, assume $t_b \leq t_a$. The price of the good that a firm in c transships through b and then to a to access the lower preferencial tariff rate is $p^D_{ac} = p_c t_b \tau_{cb} t_a(\lambda\theta)\tau_{ab}$. It is only profitable for c to engage in trade deflection if the price of the good when exporting from c directly to a is more than the price of the good when exporting from c to b and then from b to a. Specifically, the following inequality must hold:

$$p_{ac} - p^D_{cb} = p_c t_a \tau_{ca} - p_c t_b \tau_{cb} t_a(\lambda\theta)\tau_{ab} \geq 0. \tag{3}$$

This can be simplified to:

$$\tau \frac{t_a}{t^*_a t_b} \geq \theta, \tag{4}$$

where $\tau = \frac{\tau_{ca}}{\tau_{cb}\tau_{ab}}$. Importantly, by construction $\tau \leq 1$ since $\tau_{ca} \leq \tau_{cb}\tau_{ab}$.[12] To understand the basic intuition of the motivations for trade deflection, consider three simplifying cases. First, if τ approaches zero, there is no need for restrictive RoO. This is because the additional transportation costs outweigh any benefits derived from accessing the preferential tariff rate. Second, if $t_a = t_b$, there is also no need for RoO to prevent trade deflection. Intuitively, when the tariff rates are equal, the PTA is a de facto customs union for that specific good and the firm in c will always pay the same external tariff. Third, when $\tau = 1$ (the additional transportation costs for transshipment are minimal) and $t^*_a = 1$, the level of restrictiveness of RoO necessary to prevent trade deflection depends solely on the difference in the external tariffs. When the difference is large, more restrictive rules are necessary than when the difference is small.

The key insight is that arbitrage by firms in non-member countries is only profitable when additional transportation costs are low and the difference between members' external tariff rates is high. This leads to the following hypothesis:

Hypothesis 2 (Deflection): *As the difference between members' external tariff rates increase and transportation costs decrease, the restrictiveness of rules of origin increases.*

Overall, while previous studies argue RoO can be used as a protectionist device to mitigate the liberalizing effect of PTAs (Krueger, 1993), research often conflates these incentives with the functional purpose of RoO. Simply stated, it is not clear when restrictive rules are designed to deter arbitrage by non-member firms and when they are used to protect domestic

[12] This analysis assumes that c exports to b under the MFN tariff rate and does not invoke trade preferences under an agreement between c and b. If a trade agreement exists between c and b, equation (3) becomes $p_{ac} - p^D_{cb} = p_c t_a \tau_{ca} - p_c(t_b \tau_{cb} \lambda_c \theta_c)(t_a \lambda_{ab} \theta_{ab} \tau_{ab}) \geq 0$, where $\lambda_c \leq 1$ is the discount rate from the MFN tariff and $\theta_c \geq 1$ is the additional cost generated from complying with RoO. In essence, I assume that $\lambda_c \theta_c = 1$ or $\frac{t_b}{t^*_{bc}} = \theta_c$. It is unlikely that this type of trade deflection will occur. Invoking preferences often requires firms to prove origin, which limits the potential for circumvention. Further, while negotiators can predict potential preferential tariff rates, it seems implausible. To alleviate potential concerns, I provide an alternative measure to capture this possibility.

industries. Distinguishing between these motivations is particularly important since the potential for trade deflection is often used to justify the need for restrictive RoO. Further, this confusion is partly to blame for why scholars largely ignore these rules. By designating RoO as a purely functional and arcane policy provision, recent studies have failed to recognize the shift in strategies pursued by protectionist industries. In other words, differentiating between these motivations has large implications for the broader literature on the political economy trade policy.

2 Research Design

To test whether the restrictiveness of RoO is driven by concerns for trade deflection and/or by protectionist interests, I focus on RoO in US trade agreements.[13] This is for several reasons. First, the US frequently publishes input-output tables, which are necessary to account for the vertical linkages between goods. Second, the US is one of the only countries that provides detailed data on transportation costs. Third, the strategy toward RoO used by the US was quickly adopted by countries across the world (Inama, 2009). The specific agreements included are Australia, the Central American Free Trade Agreement (CAFTA),[14] Chile, Colombia, NAFTA,[15] Panama, Peru, Singapore, South Korea, and the Transpacific Partnership[16] (TPP).[17] Table 1 indicates when negotiations started, when the initial agree-

[13] Variation in political institutions may allow some countries to design RoO with minimal political influence. Thus, the results may be limited to only a subset of countries beyond the US. However, by focusing on the US, the results provide a direct comparison to recent studies analyzing the preferences and lobbying of US firms over trade policy.

[14] CAFTA includes the US, Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua, and the Dominican Republic.

[15] NAFTA includes the US, Canada, and Mexico.

[16] The TPP includes the US, Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, and Vietnam. Though, the US withdrew from the agreement in January 2017.

[17] I exclude PTAs with Jordan, Israel, Bahrain, Oman, and Morocco. This is for two reasons. First, these PTAs largely were developed to reward key allies critical to advancing foreign policy objectives. This is evident when examining the number of firms and associations that took public positions on these PTAs compared to others (Osgood, 2017). For example, only 7 firms stated a public position on the PTA with Jordan while 305 firms stated a position for the PTA with South Korea. Second, and relatedly, these PTAs primarily use value content rules applied across all goods, which prevents a direct comparison with the other US PTAs and provides minimal or no variation on the restrictiveness of RoO.

Table 1: Key Dates of US Trade Agreements

Agreement	Negotations Started	Signed by Members	Signed into US Law	Implemented
NAFTA	June 1990	December 1992	December 1993	January 1994
Singapore	December 2000	May 2003	September 2003	January 2004
Chile	August 2002	June 2003	September 2003	January 2004
CAFTA	January 2003	May 2004	August 2005	January 2006
Australia	April 2003	May 2004	August 2004	January 2005
Colombia	May 2004	November 2006	October 2011	May 2012
Peru	May 2004	April 2006	January 2009	February 2009
Panama	November 2005	June 2007	October 2012	October 2012
South Korea	February 2006	December 2010	October 2011	March 2012
TPP	February 2008	February 2016	N/A	N/A

ment was signed by the member countries, when the agreement was passed in the US, and when each agreement was implemented. Finally, it is important to highlight that previous studies examining the politics and economics of RoO have focused on a single PTA (NAFTA) (Chase, 2008; Conconi et al., 2018). This article extends the analysis to ten trade agreements.

Measuring the Restrictiveness of Rules of Origin

RoO are based on the harmonized system, which is a hierarchical internationally standardized system used to classify traded products. It is standardized across countries at the 6-digit (or subheading) level. The first 2 digits of a product identify the chapter, the first 4 digits identify the heading, and the first 6 digits identify the subheading.[18] RoO are predominately defined using changes in tariff classifications (CTCs), which specify the change in the harmonized system that an input must undergo for the product to qualify for preferential treatment.[19] For example, a rule may require that inputs undergo a change in chapter, heading, and/or subheading for the product to qualify for preferential access. To capture the restrictiveness of RoO, the ideal measure would calculate the ad-valorem tax that specific rules impose on firms. However, due to data constraints on firms' sourcing decisions, this is not possible.

[18]Countries can use additional digits to further distinguish between products.

[19]For an in-depth description of the harmonized system, RoO, and previous measures see the Appendix.

Previous research examining RoO has largely relied on a synthetic index, originally developed by Estevadeordal (2000), that measures the general restrictiveness of the rule. The index ranges from 1 (least restrictive) to 7 (most restrictive). A critical assumption of this index is that a CTC at the chapter level is at least as restrictive as a CTC at the heading level, which is at least as restrictive as a CTC at the subheading level. Several scholars have made various modifications to this index (e.g. see Harris (2007)), but all adopt a similar approach.

Importantly, the harmonized system was not designed to administer RoO. It follows that for some products the required inputs are mostly in the same heading while for others the key inputs come from different chapters. Further, due to the imperfect nature of the harmonized system, there are some inputs that are restricted but are not vertically related to the output. Therefore, it is not necessarily valid that a rule requiring a change in chapter is more restrictive than a rule that requires a change in heading. Rather, it depends on the specific inputs that are required. On the one hand, if the inputs of a product come primarily from a different chapter, then a chapter CTC is not that restrictive. For example, consider orange juice (subheading 2009.19), which uses fresh oranges (subheading 0805.10) as a key input. A rule that requires a change in chapter is not that restrictive because the key ingredient is classified in a different chapter. On the other hand, if the key inputs come from the same heading, then a heading CTC can be highly restrictive. For instance, consider chocolate (subheading 1806.31), which uses cocoa powder (1806.10) as a main ingredient. Since chocolate and cocoa powder are classified in the same heading (18.06), a rule that requires a change in heading is highly restrictive. When accounting for the vertical linkages between goods, it is clear that in this example requiring a heading CTC for chocolate is more restrictive than requiring a chapter CTC for orange juice. However, the index developed by (Estevadeordal, 2000) would reach the opposite conclusion, which indicates a clear violation in a core assumption. Additionally, and relatedly, this index does not capture the importance of an input in the production process of a good. For instance, restricting an input that only accounts for 0.05 percent of a good's value is, on average, less costly than restricting an input that accounts for 15 percent.

In general, the key limitation of this index is that it ignores the vertical linkages between goods. Thus, it is inappropriate to use this measure to compare the restrictiveness of rules across different products within an agreement. How then should one measure the restrictiveness of RoO? I propose an alternative method that accounts for the vertical linkages between goods and the importance of the input in the production process of the good. To measure the restrictiveness of RoO, I proceed in three steps. Throughout this discussion, output and input refer to the subheading level (6-digit level in the harmonized system).

First, using input-output tables provided by the US Bureau of Economic Analysis, I match output k with every input j that is required in the production process.[20] Input j is required for the production of output k if the direct requirement coefficient (DR_{kj}) from the input-output table is positive. This creates a general population of potential inputs for each output that can be restricted in a trade agreement. Further, for each pair, it provides the value that the specific input adds to the output.

Second, using the specific rules in each agreement, I identify whether input j is restricted for output k and create a variable, $Restricted_{kj}$, which equals 1 if input j is restricted for output k and 0 if it is not restricted. I do this by leveraging the unique structure of how RoO are defined. Specifically, RoO are predominately defined using CTCs, which identify the change in tariff classification that non-member inputs must undergo for the specific output to "originate" in a member country. For example, consider the RoO for peanut butter (subheading 2008.11) in the PTA between the US and Colombia. In order to confer origin, it must satisfy the following: *"A change to subheading 2008.11 from any other chapter, except from heading 12.02."* Simply stated, the inputs from Chapter 20 and heading 12.02 are restricted and must be sourced from PTA members for peanut butter to receive preferential treatment at the border. Importantly, heading 12.02 includes peanuts, which indicates that

[20] I follow a similar approach used in Conconi et al. (2018) who study the effects of restrictive RoO on trade in intermediate goods for Mexico under NAFTA. Specifically, they convert the IO BEA tables to the HS 6-digit level. See their article for a description of this procedure.

in order to receive preferential access at the border peanut butter must use peanuts sourced from the US or Colombia.

Coding these rules is no easy task. The sections on product-specific RoO in trade agreements are often lengthy and contain hundreds of specific rules. For instance, NAFTA contains over 1,200 separate rules for about 5,000 subheadings that span 274 pages. This is perhaps why previous studies limit the analysis to a single trade agreement. To minimize the difficulty of this task, I leverage the common syntax across rules to partially automate this process. For example, rules are typically structured in the following way: *"A change to [subheading/heading] [X1] through [X2] from any other [subheading/heading/chapter]."* From this, one can automate the process to extract the range of products and the specific CTC requirement. However, while this approach can be extended to a variety of different rules, the syntax of some rules are very unique, which prevents full automation.[21] For example, in NAFTA, it is not possible to automate the coding of about 300 rules. I code these rules by hand. Importantly, this process can be adapted for alternative approaches to measuring the restrictiveness of RoO, which drastically reduces the difficulty of studying RoO. To the best of my knowledge, this article is the first to automate the coding process of the restrictiveness of RoO.

In essence, the first two steps provide for each output all vertically related inputs, their degree of importance in the production process, and identify the inputs that are restricted. Finally, to calculate the restrictiveness of the rule for each output k, I calculate the following equation:

$$AvgRestrict_k = \frac{\sum_j Restricted_{kj} * DR_{kj}}{\sum_j DR_{kj}}. \tag{5}$$

This represents the weighted percent of required inputs that are restricted for each output

[21] This is especially important given the technical and legal complexity of these rules. Small changes in word order can greatly effect the restrictiveness of any given rule. Further, countries often use different phrasing, which limits the potential for machine learning techniques.

Table 2: Summary statistics for the weighted percentage of required inputs that are restricted.

Section	**Mean**	**SD**	**Min**	**Max**	**N**
01-05 animal products	0.31	0.22	0.00	0.84	1486
06-15 vegetables	0.13	0.13	0.00	0.79	3191
16-24 foodstuffs	0.10	0.11	0.00	0.91	1878
25-27 mineral products	0.05	0.08	0.00	0.67	1363
28-38 chemicals	0.07	0.20	0.00	0.90	7867
39-40 plastics/rubbers	0.01	0.01	0.00	0.12	2019
41-43 raw hides, skins, leathers	0.04	0.05	0.00	0.21	720
44-49 wood products	0.06	0.10	0.00	0.91	2291
50-63 textiles	0.51	0.27	0.00	0.90	8131
64-67 footwear/headgear	0.02	0.02	0.00	0.07	533
68-71 stone/glass	0.05	0.08	0.00	0.41	1795
72-83 metals	0.07	0.12	0.00	0.73	5502
84-85 machinery/electrical	0.01	0.02	0.00	0.36	7557
86-89 transportation	0.03	0.04	0.00	0.16	1115
90-97 miscellaneous	0.04	0.07	0.00	0.67	3719
Overall	0.14	0.24	0.00	0.91	49167

This table reports the descriptive statistics for the dependent variable, which is the percentage of inputs restricted (weighted by the direct requirement coefficients), across sections.

k and must be sourced from inside the PTA region.[22]

Table 2 provides the descriptive statistics for the dependent variable across sections.[23] On average, RoO for textiles are the most restrictive with 51 percent of the required inputs restricted. Animal products are also highly restrictive with an average of 31 percent of the required inputs restricted. Plastic and rubber products have the least restrictive rules on average with only 1 percent of the required inputs restricted. There is also substantial variation within each section. For example, 9 of the 15 sections have products where over 50 percent of the required inputs are restricted. For the final dependent variable, I take the ln(x+1) transformation.

[22]Ideally the DR coefficients sum to 1. However, given the imperfect nature of the concordance tables, this is not always the case.

[23]It is incorrect to think of the DV as the value of the output that must be produced in the PTA region.

Measuring the Incentives for Protection

I collect tariff data from several sources. First, for the US and partner countries, I use the ad-valorem tariff rate from the TRAINS dataset. To reduce the number of subheadings that are missing, I use the average ad-valorem tariff across 3 years of data. Specifically, I use data from the year the negotiations for each PTA started (see Table 1) and also data from two years before that date. For example, for the PTA between the US and Australia, I use data from 2001, 2002, and 2003. Second, for the final preferential tariff rates, I scrape the tariff schedules directly from the text of the trade agreements. Based on equation (2), I then calculate the preferential margin (log differences) for the US and each partner across PTAs.[24] When the PTA includes more than one partner, I use the highest tariff level across the partners. The left panel of Figure 2 shows the cumulative distribution function of the preferential margin for the US and partners. On average, the preferential margin for the US is lower than partner countries. Thus, the partner country should usually be the one concerned about trade deflection.

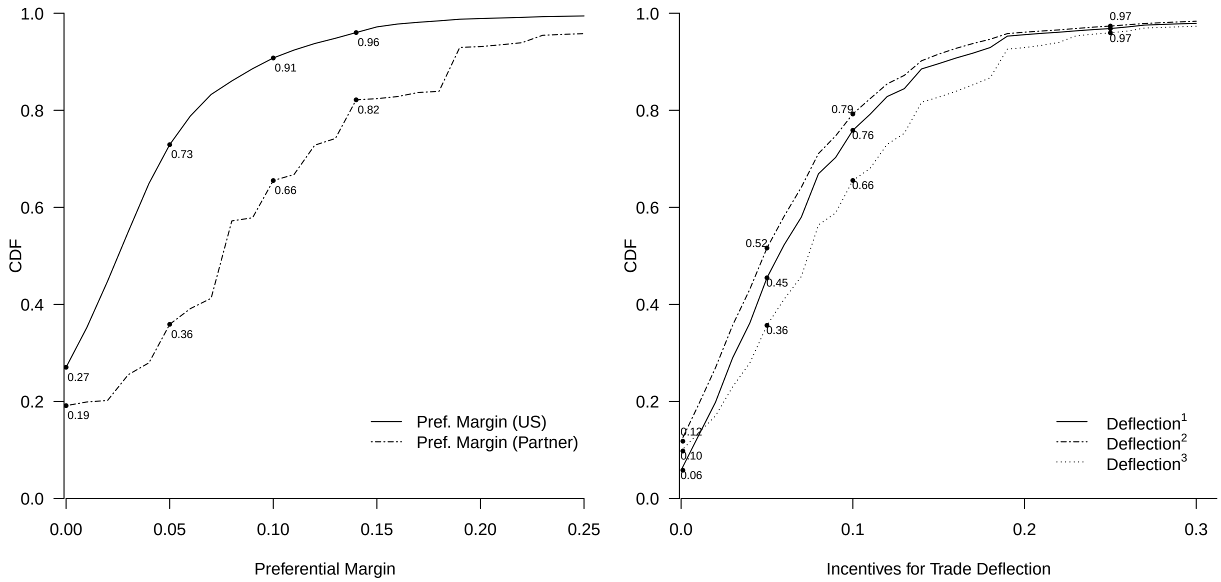
Measuring the Incentives for Deflection

To measure the incentives for trade deflection, I broadly follow Felbermayr et al. (2019) and rely on equation (4). I create three separate measures for the incentives of trade deflection that vary in their underlying assumptions.[25] For an in-depth discussion of the construction of these variables and the mathematical notation see the Appendix. For brevity, here I simply focus on the intuition behind each measure. Specifically, the first measure, $Deflection^1$, assumes that transportation costs are zero. This assumption is realistic if negotiators use the difference in MFN tariff rates as a simple proxy for the potential of arbitrage by non-member firms. The second measure, $Deflection^2$, incorporates transportation costs and selects coun-

[24] The ad-valorem preferential tariff either goes to one or is excluded from the agreement. Only a handful of products are excluded. Thus, the calculation simply reduces the log of the MFN tariff.

[25] For PTAs with more than two partners, I use the pair of partners that has the largest incentive for trade deflection.

Figure 2: The cumulative distributions functions of the preferential margin and incentives for trade deflection.



Left panel shows the CDF of the preferential tariff rates for the US and partner countries across PTAs. The right panel shows the CDFs for the three measures of trade deflection.

try c that has largest incentive for arbitrage. Finally, the third measure, $Deflection^3$, assumes that c has preferential access to the member country with the lowest external tariff rate with RoO that impose no additional costs. Simply stated, this measure represents a scenario where countries take a conservative approach when setting RoO to deter trade deflection. The right panel of Figure 2 shows the cumulative distribution function of the three measures of trade deflection. The distribution of these measures appear to indicate that the potential of trade deflection at the time of negotiation is very real. When considering the first measure ($Deflection^1$), trade deflection is not profitable for 6 percent of the observations. This increases to 12 percent when incorporating transportation costs ($Deflection^2$).

3 Empirical Strategy and Results

For the main analysis, I use ordinary least squares regression with standard errors clustered at the subheading level and estimate the following equation:

$$AvgRestrict_{pk} = \beta_0 + \beta_1 A_{pk} + \Pi X_{pk} + \delta_p + \eta_{hs2} + \epsilon_{pk} \quad (6)$$

where A is either the preferential margins or a measure for trade deflection; X is the vector of control variables;[26] δ_p are agreement fixed effects; η_{hs2} are chapter (2-digit level in the harmonized system) fixed effects; ϵ_{pk} is the error term; p and k index agreements and subheadings; and β_0, β_1, and Π are parameters to be estimated. I opt to test the hypotheses separately since both measures include MFN tariff rates, and thus, are partially correlated.[27]

Are Rules of Origin a Substitute for Tariffs?

Hypothesis 1 indicates that protectionist interests seek restrictive RoO to mitigate the liberalizing effect of a PTA, which suggests that the preferential margin should be positively correlated with the restrictiveness of RoO. Table 3 reports the results. Across the models, the estimated coefficients for the US preferential margin are positive and statistically significant ($p < 0.01$). The results indicate that protectionist interests in the US strongly influence the restrictiveness of RoO. Substantively, the estimates from Model 1 (bivariate) imply increasing the US preferential margin from its fifth (0.00) to ninety-fifth (0.147) percentile increases the restrictiveness of RoO from 0.06 to 0.28. This represents about a 28.4 percent increase, which is about a full standard deviation. The adjusted R^2 for the bivariate model is also quite large (0.171), which suggests that protectionist interests in the US

[26] I include the number of subheadings in each chapter, the number of required inputs for each subheading, whether there is an alternative rule, whether a specific item within a subheading has an alternative rule, whether there is an additional value requirement, and whether the rule has a technical component.

[27] In the Appendix, I perform a number of additional robustness checks: alternative definitions of the dependent variable; excluding products with alternative rules or additional value requirements; including additional control variables; and separately testing the components of trade deflection. Across the robustness checks, the substantive results do not change.

Table 3: The effect of external protection on the restrictiveness of rules of origin in US trade agreements.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Pref. Margin (U.S.)	1.416		1.331	0.893	0.200
	(0.109)		(0.108)	(0.084)	(0.030)
Pref. Margin (Partner)		0.333	0.192	0.130	0.036
		(0.019)	(0.016)	(0.014)	(0.005)
Control Variables	No	No	No	Yes	Yes
PTA FEs	No	No	No	Yes	Yes
HS Chapter FEs	No	No	No	No	Yes
Adj. R-Sq.	0.171	0.041	0.184	0.364	0.762
N	48555	49127	48517	48517	48517

Standard errors clustered at the subheading level are reported in parentheses. The dependent variable is the log transformation of the weighted percentage of required inputs that are restricted.

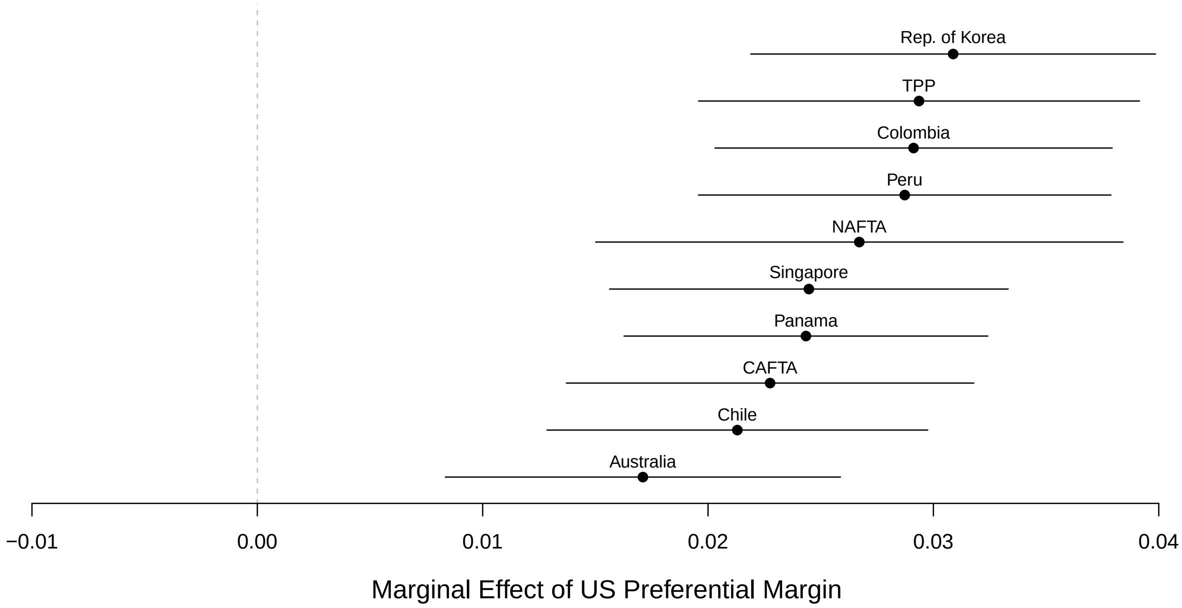
explain a substantial amount of variation in the restrictiveness of RoO. There is also some evidence that protectionist interests in the partner countries influence the restrictiveness of these rules. However, it is clear, that US interests dominate.[28] The estimates from Model 2 suggest that increasing the partner preferential margin from its fifth to ninety-fifth percentile causes an 11.5 percent increase in the restrictiveness of RoO.

Models 4 and 5 move beyond the baseline bivariate regressions and include the control variables, PTA fixed effects, and HS chapter fixed effects. The results appear robust to these specifications. While the estimates are smaller, they still indicate protectionist interests have a meaningful effect on RoO. Specifically, for Model 5, a shift from the fifth to ninety-fifth percentile for the US preferential margin causes about a 4.0 percent increase in the restrictiveness of RoO. Again, the results imply the protectionist interests in the US dominate compared to partner countries. A similar shift in the partner preferential margin only causes a 1.2 percent increase, which is over three times smaller than the effect of the US margin.

Some may wonder how the effect of protectionist interests vary across agreements. Figure 3 shows the marginal effect of increasing the US preferential margin from the fifth to ninety-

[28]This aligns with the typical narrative of US trade agreements.

Figure 3: Marginal effect of the US preferential margin across PTAs.



The figure shows the marginal effect of a shift from the 5th to 95th percentile in the US preferential margin on the restrictiveness of RoO across PTAs. Control variables and HS Chapter fixed effects are included in all models. Lines are 95% confidence intervals.

fifth percentile using the specification from Model 5 across partners. The estimated effects are positive and statistically significant ($p < 0.01$) for all PTAs. The marginal effect is largest for the PTA with South Korea and smallest for Australia. The estimated effects for South Korea (Australia), imply a 4.8 (2.7) percent increase in the restrictiveness of RoO.

Overall, the results provide strong support for hypothesis 1: as the preferential margin increases, the restrictiveness of RoO increases. In other words, as the benefits of the PTA increase, the costs to access those benefits also increase, which suggests that RoO serve as a substitute for protection and mitigate the liberalizing effect of a PTA. This has critical implications for the broader politics of trade policy. Recent studies argue that PTAs and global supply chains have fragmented traditional protectionist forces and privileged a new pro-trade coalition (Osgood, 2018). These results suggest that protectionist firms have simply adapted to this new environment and pursued strict RoO as an alternative form of protection.

Table 4: The effect of trade deflection on the restrictiveness of rules of origin in US trade agreements.

	(1)	(2)	(3)	(4)	(5)	(6)
$Deflection^1$	0.160	0.031				
	(0.012)	(0.005)				
$Deflection^2$			0.154	0.029		
			(0.012)	(0.005)		
$Deflection^3$					0.381	0.048
					(0.023)	(0.006)
Control Variables	No	Yes	No	Yes	No	Yes
PTA FEs	No	Yes	No	Yes	No	Yes
HS Chapter FEs	No	Yes	No	Yes	No	Yes
Adj. R-Sq.	0.008	0.760	0.007	0.760	0.053	0.760
N	48517	48517	48300	48300	48300	48300

Standard errors clustered at the subheading level are reported in parentheses. The dependent variable is the log transformation of the weighted percentage of required inputs that are restricted.

Are Rules of Origin Used to Deter Trade Deflection?

The second hypothesis argues that the potential for arbitrage by foreign firms drives the restrictiveness of RoO in PTAs. Table 4 reports the results when using the three different measures of trade deflection. Models 1, 3, and 5 report the results from bivariate regressions. Models 2, 4, and 6 report the results when including the control variables, PTA fixed effects, and chapter fixed effects. To preview, the evidence suggests that the potential for trade deflection is positively correlated with the restrictiveness of RoO. However, the estimated effects are relatively small and inconsistent. Models 1 and 2 report the estimates for the first measure of trade deflection ($Deflection^1$), which assumes that there are no transportation costs. The results from Model 1 imply that increasing the incentives for trade deflection from its fifth to ninety-fifth percentile will increase the restrictiveness of RoO by 4.6 percent. For the more demanding specification (Model 2), the estimated effect for a similar shift is only 0.90 percent. The results are similar for the second measure of trade deflection ($Deflection^2$), which uses country c with the lowest transportation costs.

Models 5 and 6 report the estimates for the third measure of trade deflection ($Deflection^3$), which assumes that c has preferential access to b and the lowest transportation costs. Recall, this measure serves as the upper bound to the potential for trade deflection. Substantively, the results from Model 5 suggest that increasing the potential for trade deflection from its fifth to ninety-fifth percentile will increase the restrictiveness of RoO by 13.1 percent. For Model 6, this effect decreases to 1.7 percent.

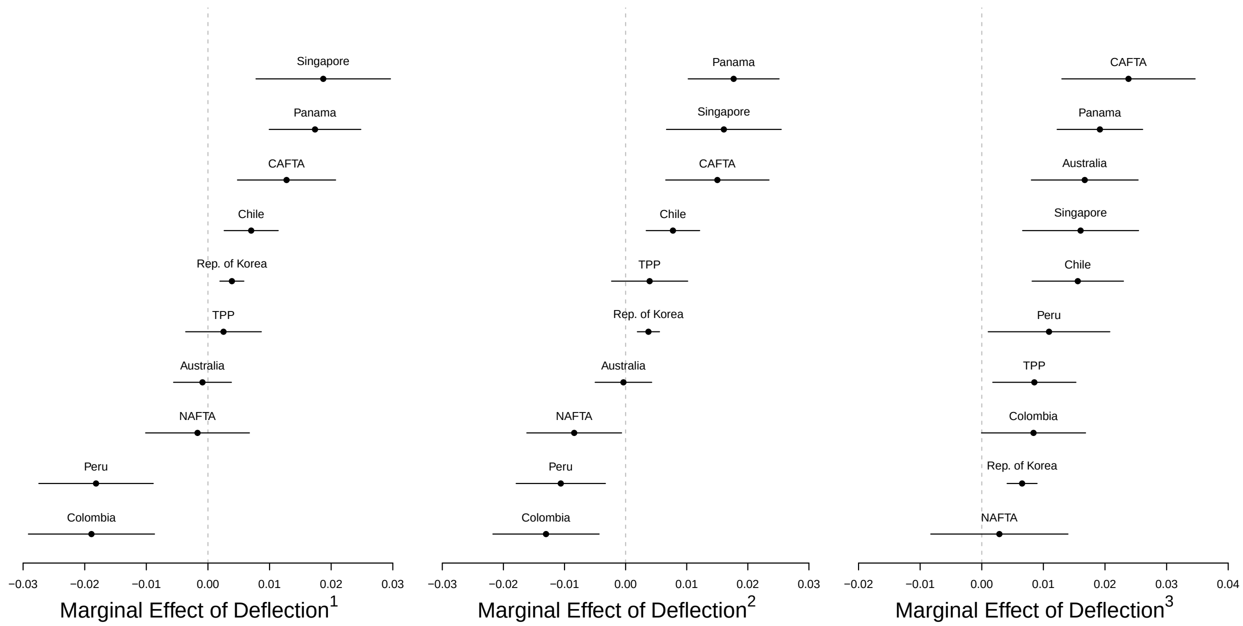
To further examine the effect of trade deflection on the restrictiveness of RoO, Figure 4 shows the marginal effect of increasing each measure of trade deflection from its fifth to ninety-fifth percentile across PTAs. In general, the results suggest that the incentives for trade deflection have a limited effect on the restrictiveness of RoO. Specifically, for the first measure of trade deflection (the left panel of Figure 4), the estimated effects are only positive and significant ($p < 0.05$) for CAFTA, Chile, Panama, Singapore, and South Korea. Further, the estimated effects for two of the PTAs are in the wrong direction. The results are similar when using the second measure of trade deflection (center panel of Figure 4). The right panel in Figure 4 reports the results when using the third measure of trade deflection. The estimated effects are positive for all of the PTAs and statistically significant ($p < 0.05$) for eight of the agreements. However, the estimated effects are relatively small.

One might wonder how the results differ when including the incentives for trade deflection and protection in a single model. Recall, the main analysis tested the hypotheses separately because the measures are partially correlated. To further demonstrate the robustness of the main results, I estimate models when including measures for trade deflection and the US preferential margin.[29] The results are reported in Table 5.[30] In general, the substantive conclusions do not change: the design of RoO is largely determined by protectionist interests in the US. However, the results provide additional evidence that trade deflection has a minimal effect on the restrictiveness of RoO. Across the models, the estimated coefficients

[29]For these tests I do not include the partner preferential margin because it is highly correlated with the measures for trade deflection. This makes sense since given left panel in Figure 2.

[30]There is no reason to believe that either protectionist interests or trade deflection are causally prior to one another.

Figure 4: The marginal effect of trade deflection for each measure across PTAs.



The figures show the marginal effect of a shift from the 5th to 95th percentile for the three measures of trade deflection on the restrictiveness of RoO across PTAs. Control variables and HS Chapter fixed effects are included in all models. Lines are 95% confidence intervals.

for trade deflection are substantially smaller than the main analysis. For example, the estimated coefficient for $Deflection^3$ when including the control variables, PTA fixed effects, and chapter fixed effects decreases from 0.048 to 0.024. Substantively, the effect of a shift from the fifth to the ninety-fifth percentile decreases from a 1.7 to a 0.83 percent increase in the restrictiveness of RoO. Importantly, the estimated coefficients for the US preferential margin across the models are similar to the main analysis.

Overall, the results provide minimal support for hypothesis 2. Trade deflection does not appear to have a substantial effect on the restrictiveness of RoO in US trade agreements. In other words, relative to protectionist interests, the incentive for arbitrage by non-member firms has a limited and inconsistent role in the design of RoO.[31]

[31] A potential criticism of these results is that measurement error in the estimation of transportation costs is attenuating the effect of trade deflection on the restrictiveness of RoO toward zero. In the Appendix, I explain why measurement error should not effect the substantive conclusions.

Table 5: The effect of protectionist interests and trade deflection on the restrictiveness of rules of origin in US trade agreements.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Pref. Margin (US)	1.405	0.201	1.411	0.201	1.316	0.190
	(0.106)	(0.031)	(0.106)	(0.031)	(0.107)	(0.031)
Deflection^1	0.034	0.021				
	(0.018)	(0.005)				
Deflection^2			0.018	0.018		
			(0.019)	(0.005)		
Deflection^3					0.121	0.024
					(0.014)	(0.005)
Control Variables	No	Yes	No	Yes	No	Yes
PTA FEs	No	Yes	No	Yes	No	Yes
HS Chapter FEs	No	Yes	No	Yes	No	Yes
Adj. R-Sq.	0.171	0.762	0.171	0.761	0.176	0.761
N	48517	48517	48300	48300	48300	48300

Standard errors clustered at the subheading level are reported in parentheses. The dependent variable is the log transformation of the weighted percentage of required inputs that are restricted.

4 Conclusion

What determines the restrictiveness of RoO in PTAs? The previous literature suggests that the external tariff rate drives the restrictiveness of these rules and highlights two underlying mechanisms: trade deflection and protection. However, each explanation suggests a different purpose for RoO and drastically affects how scholars should think about these rules. In this article, I formalize the analytical conditions for each explanation and show that they are not theoretically equivalent. Specifically, the preferential margin drives the protectionist incentives for restrictive RoO while the difference between members' external tariffs and transportation costs drive the functional need for restrictive rules. To test these explanations, I construct a novel measure of the restrictiveness of RoO in US trade agreements that overcomes several limitations in previous approaches. The evidence suggests that restrictive RoO are largely driven by protectionist interests rather than concerns for trade deflection.

In other words, as the benefits of a PTA for a particular good increase, the costs to access those benefits also increase.

While the political economy literature has largely ignored RoO, they are essential to understanding the broader politics and distributional consequences of PTAs. For example, an emerging consensus in the trade politics literature suggests that PTAs and global supply chains have fragmented traditional protectionist industries and privileged a new pro-trade coalition of highly competitive firms. Specifically, Osgood (2018) argues that a few politically influential firms engaged in global supply networks likely fragment efforts by protectionist industries. Rather than the traditional "Protection for Sale" framework, scholars suggest it is now "Globalization for Sale" (Blanga-Gubbay et al., 2018; Osgood, 2018). The results in this article provide compelling evidence that this is not the case. Firms seeking protection have adapted to the contemporary era of trade policy and pursued restrictive RoO as an alternative form of protection.

The measurement strategy for RoO introduced in this article allows scholars to further investigate the political economy of these rules. This article analyzes the general preferences of downstream producers; however, since RoO are predominately defined at the input-output level, there are two alternative theoretical approaches.[32] First, as Conconi et al. (2018) note, RoO have a "cascade effect," shifting protection to the upstream input from the downstream good. While this finding has been a key theoretical insight from the economics literature, no study examines the general preferences of upstream suppliers over RoO due to the difficulties in measuring the restrictiveness of these rules. Previous indices ignore the inputs entirely and simply characterize the general restrictiveness of the rule for each output. The framework introduced in this article provides an approach that can account for this dynamic. Specifically, rather than calculating the weighted percentage of inputs restricted for each output, one can easily calculate the weighted percentage of outputs where a specific input is required and restricted. Simple stated, the measure captures how effective the upstream supplier is

[32] RoO are predominately defined using CTCs, which identify the exact input mix that is restricted for each output. This is a highly specific form of protection that provides several unique theoretical insights.

at restricting the input for downstream goods that require it in their production processes.

Second, since RoO are defined at the input-output level, a downstream firm's preferences may vary depending on the characteristics of the specific input. In other words, a firm may favor that one required input is restricted while another is not. By identifying the specific inputs that are restricted for each output, the measurement strategy in this article also allows researchers to examine these questions. Importantly, I do not mention these alternative approaches to discredit the theoretical insights of this article. Rather, this discussion illustrates the complexity of RoO and highlights the flexibility of the empirical framework.

Overall, this article underscores the political importance of RoO in PTAs and broader trade policy. Further, it develops a tractable framework that allows researchers to further investigate the political economy of RoO. Considering the rapid proliferation of PTAs and emergence of global supply networks, RoO are at the center of international trade and are critical to understand the broader politics of trade policy.

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Appendix: Preferential Rules of Origin: Deflection or Protection?

Dillon Laaker*

Contents

*Ph.D. Candidate in Political Science, University of Wisconsin-Madison. Email: laaker@wisc.edu.

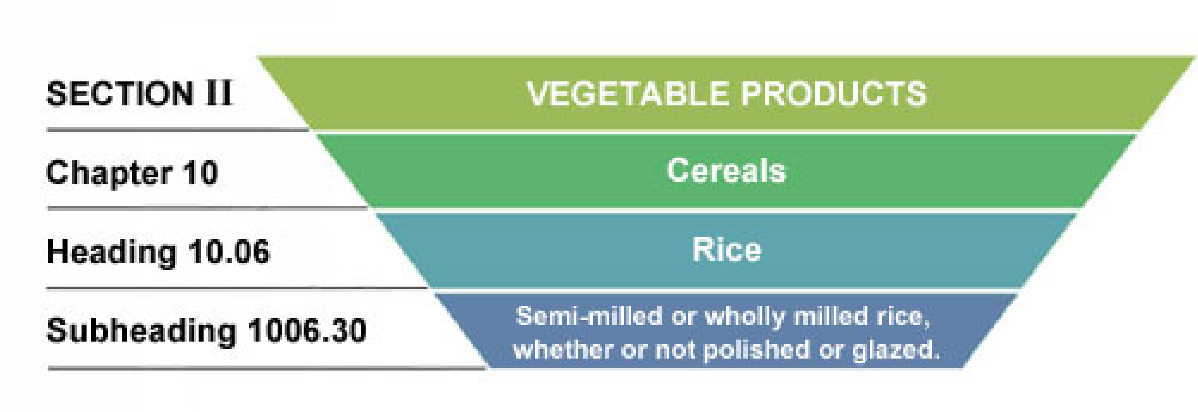
1 Differences with Felbermayr et al. (2019)

Recent evidence suggests that the scope for trade deflection is low. Specifically, Felbermayr et al. (2019) find that arbitrage is only profitable in 14 percent of cases. The approach in this article differs in three critical ways. First, Felbermayr et al. (2019) are broadly interested in the economic justification for RoO and give little attention to their political determinants, which affects their empirical strategy. Specifically, they look at preferential tariff rates each year after a trade agreement is implemented. This is likely not consistent with how countries think about the potential for trade deflection. While PTAs phase-in trade liberalization, tariffs still go zero and in most cases this occurs a few years after implementation.[1] At the very least, it is realistic to assume that countries think of the lowest preferential tariff rate for a product under a PTA when considering the potential for trade deflection. Further, countries may take a conservative approach since members can alter their external tariff rates. Second, they look at the potential for trade deflection for each country, not trade agreement, which ignores the dyadic nature of how RoO are defined. In other words, trade deflection is only a concern for a specific country when the the external tariff rate is larger than a partner country. Thus, how trade deflection affects the design of RoO in a PTA depends on which tariff is higher. Finally, Felbermayr et al. (2019) explicitly ignore RoO in their theoretical and empirical analysis.[2] They also do not analyze the incentives to use RoO as a substitute for trade protection. Simply stated, this article explicitly incorporates RoO into the theoretical analysis, formalizes the incentives for protection, and empirically tests the relationship for both explanations.

[1]For example, on average, in the dataset for Baccini et al. (2018), only 6 out of 50 countries take longer than 5 years to reduce preferential tariffs to zero.

[2]Ignoring RoO decreases the actual costs of trade deflection, which works in their favor. Though, incorporating RoO into the theoretical analysis is still an important exercise and empirically testing this relationship is essential to determine the underlying purpose of RoO.

Figure A1: Structure of the Harmonized System



2 The Design of Rules of Origin

In this section, I provide background on the basic characteristics of RoO. While RoO are certainly technical and legally complex, this is the very characteristic that make the politics behind them so fascinating. The goal is to provide enough of a background on their technical details to understand how these rules affect trade flows and to generate insights into firms' preferences over RoO.

RoO are defined using the Harmonized System. Before discussing the specific characteristics of RoO, I provide a brief overview of this system because it is essential to understand how RoO function. The Harmonized System is designed to classify goods for international trade and is based on a hierarchical structure, which includes sections, chapters, headings, and subheadings. At the most disaggregated level, the harmonized system classifies goods into six-digit codes. These six digits identify the specific section, chapter, heading, and subheading that a good is classified within. Specifically, the first two digits identify the chapter, the first four digits identify the heading, and the first six digits identify the subheading. Figure A1 provides an example. Subheading 1006.30 includes semi-milled or wholly milled rice. This subheading is classified within Heading 10.06, which includes all rice products. This heading is classified in Chapter 10, which contains all Cereals. This chapter is contained in Section II, which includes all vegetable products. Countries can use additional digits, but the international system is only harmonized up to the 6th digit.

The Kyoto Convention identifies two criteria to determine the origin of the good: wholly obtained (or produced) and substantial transformation. First, under the wholly obtained criteria, a good originates from a specific country if the commodity or related products are entirely grown, harvested, or extracted from the territory, or if the good is manufactured from any of these inputs. Wholly obtained indicates that only domestically sourced inputs can be used in the product. Thus, as an alternative definition, countries use a substantial transformation criteria, which is more complex and includes three types of product-specific RoO: changes in tariff classification (CTC), value content, and technical rules.

2.1 Change in Tariff Classification Rules

Rules based on CTCs specify the required change in the Harmonized System classification that foreign-sourced inputs must undergo for the output to confer origin. In other words, these rules may require a change in chapter, heading, subheading, or item. For example, consider the NAFTA rule applied to all products in Chapter 01, which states: *"A change to heading 01.01 through 01.06 from any other chapter."* What this rule indicates is that for a product classified in Chapter 01 to confer origin, all inputs must come from any other chapter. In essence, this rule indicates that no foreign-sourced inputs used in the production process can be from Chapter 01.

There are two additional components when RoO are based on CTCs: exceptions and additions. A rule can include an exception to the specified CTC, which increases the restrictiveness of the specific rule. For instance, for Orange Juice to confer origin under NAFTA, it must satisfy the following rule: *"A change to subheading 2009.11 through 2009.30 from any other chapter except from heading 08.05."* This rule indicates that inputs from Chapter 20 and heading 08.05 are restricted and must be sourced from PTA members for the good to confer origin. Rules can also allow for additions, which decrease the restrictiveness of the rule by allowing additional inputs in the production of a final good that would otherwise be excluded. In other words, additions expand the potential inputs that may be sourced from non-member countries. Exceptions and additions are important because the Harmonized System was not designed to define RoO. Thus, exceptions and additions are only used when they are meaningful to the production process of a specific good.

2.2 Value Content Rules

Value content rules specify the required value of a product that must be added in the PTA region for that specific product to confer origin. For example, value content rules are used for the automotive industry under NAFTA. These rules received significant attention during recent renegotiation when the value that must be added in the NAFTA region for automobiles increased from 62.5 percent to 75 percent. These rules vary in the value of the good that must added in the PTA region. Rules can also vary the procedure used to calculate the value added. The simplest approach would be the value on the customs declaration; however, PTAs often adopt a more complex accounting standard. The variation in accounting standards is usually across PTAs and not across products within a specific PTA.

2.3 Technical Criterion

Finally, rules can be based on technical requirements, which specify the origin of particular intermediate goods and/or identify specific steps in the production process that must take place in a member country. For example, consider the rule for subheading 6203.42 (men's or boys' trousers, made of cotton) in NAFTA. For this product to confer origin it must satisify the following rule: *"Change[s] to subheadings 6203.41 through 6203.49 from any other chapter, except from headings 5106 through 5113, 5204 through 5212, 5307 through 5308 or 5310 through 5311, chapter 54, or heading 5508 through 5516, 5801 through 5802 or 6001 through 6002, provided that the good is both cut and sewn or otherwise assembled in the territory of one or more of the NAFTA parties."* This rule includes several parts. First, there are inputs from several chapters and headings that are restricted. The second part provides an example of a technical rule. It indicates that the trousers must be cut and sewn in a NAFTA member.

2.4 Variation in the Type of Rule

PTAs primarily define rules based on CTCs or value content requirements. Though, CTCs are the most common type.[3] Sometimes agreements will pair CTCs with value content rules as an additional requirement or as an alternative.[4] Technical rules can also be paired with CTCs as in the example of men's trousers described above. However, increasingly, RoO are based only on CTCs. For example, the trade agreement between Australia and New Zealand (ANZCERTA) signed in 1983 relied on a 50 percent value content rule across all products (Palmeter 1993). However, in 2004 Australia and New Zealand agreed to reform the RoO to use a CTC approach. As the two countries noted, "The CTC approach in ANZCERTA reflects a global trend to use this type of RoO in bilateral free trade agreements."[5]

One reason why PTAs predominately rely on CTCs is because they specify the exact input mix that can be used in order for a good to confer origin. In other words, CTC requirements identify the specific inputs that are restricted and must be sourced from PTA members and the specific inputs that are not restricted and can be sourced from third-parties. Rules that specify a minimum value content requirement can be satisfied with a variety of different input mixes. Thus, RoO based on CTCs, while still technically and legally complex, provide clearer distributional consequences and a more specific form of protection compared to rules based on value content requirements. Luckily, the reliance on CTCs provides a more tractable framework to study the politics of RoO. Unlike with value content rules, the winners and losers are easily defined.

[3]Perhaps surprisingly, most of the literature on the economics of RoO is based on value content rules, which complicates studying distributional consequences.

[4]When the value content requirement is an alternative rule, the good confer origin either by satisfying the CTC requirements or the value content requirement. When the value content requirement is in addition to the CTC, both must be satisfied to confer origin.

[5]See ANZCERTA 2004.

3 Measuring the Restrictiveness of Rules of Origin

In this section, I provide a description of the previous attempts to measure the restrictiveness of RoO and comparisons of this new measure to previous indices.

3.1 Previous Attempts Measuring the Restrictiveness of Rules of Origin

I focus on two previous indices included in Estevadeordal et al. (2009): the Estevadeordal Index and the Harris Index.

Estevadeordal Index. First, Estevadeordal (2000) provides the first attempt at measuring the restrictiveness of RoO. Estevadeordal (2000) develops an ordinal index that ranges from 1 (least restrictive) to 7 (most restrictive). The approach requires two assumptions to hold: 1) a change at the chapter level is more restrictive than a change at the heading, subheading, or item level and 2) value content technical requirements attached to changes in tariff classifications add to the restrictiveness of the rule.

Harris Index. Harris (2007) provides the most substantial transformation of the index originally developed by Estevadeordal (2000). There are two main modifications. First, Estevadeordal (2000) ignores exceptions and additions. As Harris (2007) notes, exceptions are important for two reasons. First, exceptions decrease the number of inputs that can be sourced from non-members. Second, since the harmonized system was not originally designed to define rules of origin, exceptions are only used when they are meaningful to the production process of a specific good. Rules can also allow for additions, which decreases the restrictiveness of the rule by allowing additional inputs in the production of a final good that would otherwise be excluded. In other words, additions expand the potential inputs that may be sourced from non-member countries and still qualify for preferential treatment at the border.

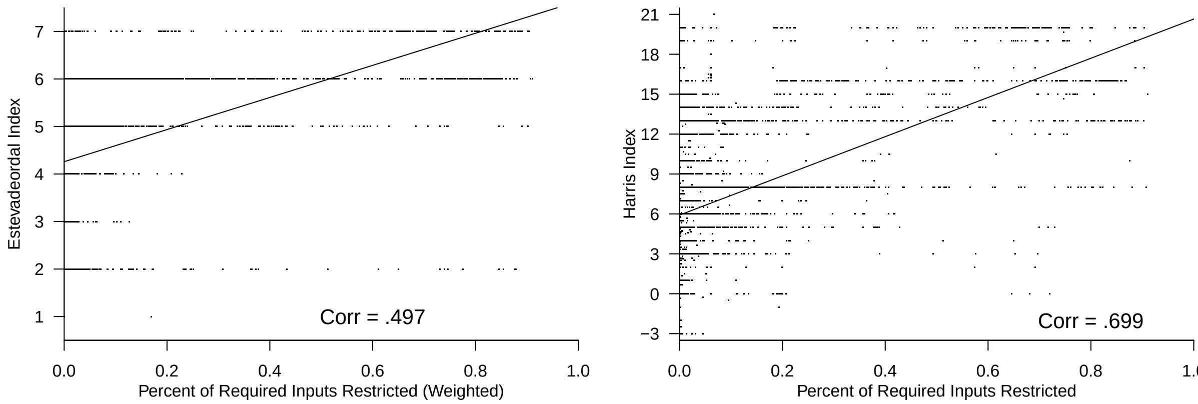
Second, Estevadeordal (2000) assumes that rules that include alternatives are more restrictive. Harris (2007) argues that the opposite is true given variation across firms. Specifically, larger and smaller firms may find different rules appealing. For example, larger firms may prefer a value content rule because they have better inventory controls and accounting systems to easily measure and report the value added in each stage of production whereas smaller firms may find CTC criterion easier to demonstrate. When variation exists in the type of rule wanted across firms within an industry, alternative rules can be added to satisfy all demands. In practice, the alternative is usually between a CTC or value content criterion. As Harris (2007, 54) notes "The administrative burdens of qualifying for the tariff preference can be significantly different for these two types of PSRO, and the mere fact that both alternatives are permitted indicates a belief on the part of the negotiators that some traders would suffer less burden under one or the other alternative." Thus, when alternative rules exists, it suggests the environment is less restrictive compared to if either rule existed alone.

Harris (2007) alters the original index developed by Estevadeordal (2000) to incorporate these modifications. Incorporating exceptions and additions are straightforward. However, incorporating alternative rules presents a more challenging requirement because comparing VC rules to CTCs rules is not straightforward. In other words, when does the restrictiveness of a value content rule equal the restrictiveness of a CTC rule? Harris (2007) develops a method that assumes when alternative rules are used for specific products, it is at least somewhat similar in the level of restrictiveness to main rule for the product.

3.2 Relationship Between New and Previous Measures

How does this new measure compare to previous indices? The left (right) panel of Figure A2 plots the Estevadeordal (Harris) index against the weighted percentage of inputs restricted. For both indices, it appears that there is a positive correlation with the new measure. For the Estevadeordal index, the simple correlation equals 0.497 and equals 0.699 for the Harris index. While the measures are capturing some of the same variation, it appears there are

Figure A2: Relationship between previous indices and the new measure



Left panel plots the Estevadeordal index against the weighted percentage of inputs restricted. Right panel plots the Harris index against the weighted percentage of inputs restricted.

substantial differences between the measures. Further, it is important to emphasize the theoretical flexibility provided by accounting for the vertical linkages. First, previous indices ignore the required inputs entirely and simply characterize the general restrictiveness of the rule for each output. The framework introduced in this article provides an approach that can identify how effective upstream suppliers are at restricting their intermediate inputs for downstream goods. This is a key theoretical insight from the economics literature that is largely unexplored because of the difficulty of measuring RoO. Second, since RoO are predominately defined at the input-output level, a downstream firm's preferences may vary depending on the characteristics of the specific input. In other words, a firm may favor that one required input is restricted while another is not. By identifying the specific inputs that are restricted for each output, the measurement strategy in this article also allows researchers to examine these questions.

4 Measuring Transportation Costs

To measure the incentives for trade deflection, I broadly follow Felbermayr et al. (2019). I rely on equation (4) from the main article and estimate the following:

$$\begin{aligned} Deflection_{abck} &= Max\{0,\, D_{ack} - T^{b}_{ack}\}, \\ D_{ack} &= ln(\tau_{cak}) + ln(t_{ak}); \\ T^{b}_{ack} &= ln(\tau_{cbk}) + ln(t_{bk}) + ln(\tau_{abk}) + ln(t^{*}_{ak}) \end{aligned} \tag{1}$$

where $t_a > t_b$, D_{ack} equals the cost to directly ship product k from c to b, and T^{b}_{ack} equals the cost to transship product k from c to b and then to a.[6] I define the population of c as members of the WTO at the time when the agreement is signed by PTA members.[7] From this, I derive three separate measures, based on various assumptions, to capture the incentives for trade deflection for every product k in each agreement p. First, I assume transportation costs are zero, which simplifies equation (6) to the following:

$$Deflection^{1}_{pk} = ln(t_{ak}) - ln(t_{bk}) - ln(t^{*}_{ak}). \tag{2}$$

This assumption is realistic if negotiators use the difference in MFN tariff rates as a simple proxy for the potential of arbitrage by non-member firms.

There are several challenges to including transportation costs when directly estimating equation (6). A key issue is how to select country c. Even when restricting the population of c, there are hundreds of potential combinations for each product. For the second measure, I address this dimension problem by selecting c with the largest incentives for arbitrage for

[6] For US PTAs, this the ad-valorem preferential tariff rates always go to 1. Either the product is excluded or the tariff is eliminated for members.

[7] Since the MFN tariff is lower than the tariff applied to non-WTO members and these countries are less developed (which suggests higher transportation costs), this decision should not affect the analysis. In other words, for firms in these countries, the incentives for arbitrage is minimal compared to WTO members who have access to lower MFN tariffs.

each product:

$$Deflection^2_{pk} = Max\{Max\{0,\ D_{ack} - T^b_{ack}\}\}. \tag{3}$$

The theoretical analysis assumes that c exports to b under the MFN tariff rate. Though, c and b may also have a PTA. While it is unlikely (see footnote 9), it is possible that c exports to b under a lower preferential tariff rate when RoO for that agreement are minimal. Under these conditions, the previous measures underestimate the incentives for trade deflection. To alleviate potential concerns, I create a third measure assuming that c has preferential access to b where the RoO for the PTA between c and b impose no additional costs. In essence, t_{bk} drops out of equation (6). Similar to the second measure, I then select c that maximizes the potential for trade deflection:

$$Deflection^3_{pk} = Max\{Max\{0,\ [ln(\tau_{cak}) + ln(t_{ak}) - ln(\tau_{cbk}) - ln(\tau_{abk}) - ln(t^*_{ak})]\}\}. \tag{4}$$

This measure arguably serves as the upper-bound for the incentives of trade deflection. In other words, the measure best represents a scenario where countries take a conservative approach when setting RoO to deter arbitrage.

5 Estimating Transportation Costs

This section provides details on the estimation of transportation costs. A key challenge is the availability of transportation costs for these countries. I infer transportation costs using the share of customs, insurance and freight (cif) charges per import value with data from Schott (2008).[8] The data provided by Schott (2008) includes information on the cif and import value by exporter country and entry-district at the 10-digit HS level from 1989-2017. Unfortunately, this data is only available for the United States, which means directly estimating transportation costs for goods shipped between the PTA partner and non-members is not feasible. I follow Felbermayr et al. (2019) and proceed in three steps.

First, I estimate bilateral transportation costs directly for the US by exporter and product (product-country pair (HS 6-digit level)). Second, I use the US trade data to predict transportation costs for each product-pair.[9] Specifically, assume that transportation costs are a function of the distance $D_{US,b}$ between the US and the trading country, such that $\tau^k_{US,b} = \alpha^k (D_{US,b})^{\delta^k}$ where $\delta^k \in (0,1)$. Taking the logs makes OLS a feasible estimator for the parameters α^k and δ^k for every product k ($ln(\tau^k_{US,b}) = ln(\alpha^k) + \delta^k ln(D_{US,b}) + \epsilon^k$). In other words, I estimate these parameters for each subheading level to allow for product-specific constraints.[10] Third, using these estimates, I predict transportation costs for each US PTA parter to country c at the subheading level ($\tau^k_{p,c} = exp(\hat{\alpha}^k + \hat{\delta}^k ln(D_{p,c})$ where p is the partner country.[11] α^k is the product-specific component that does not vary across country pairs and δ^k is country-specific component.

The left (right) panel of Figure A3 shows the mean values of α^k (δ^k) by section. The lines are the 5th and 95th percentile. As Felbermayr et al. (2019) note, for sensible estimates of

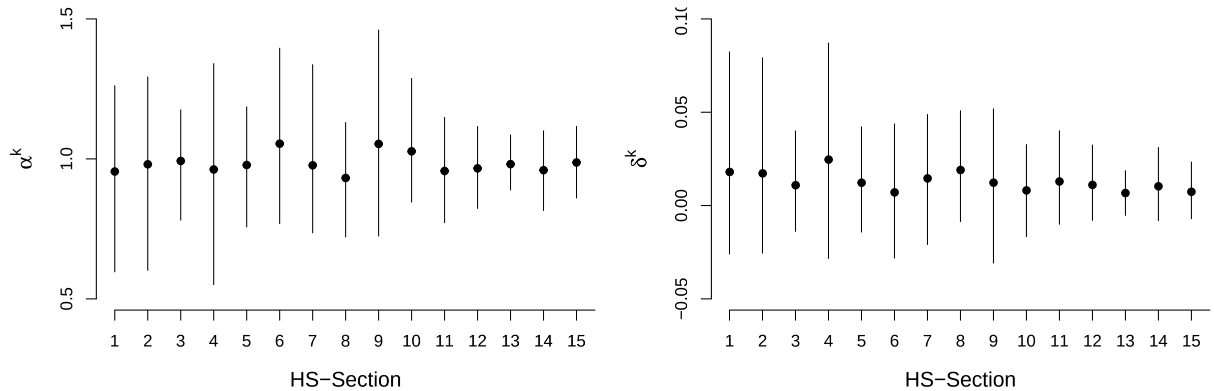
[8]This measure is common in the transportation cost literature. Theoretically, this value is equivalent to transportation costs and will be greater than 1.

[9]Rather than treat the U.S. a single port of entry, I use estimate transportation costs at the product-exporter-district entry level.

[10]Following Felbermayr et al. (2019), I also include the weight/value ratios as a control variable in the estimations similar.

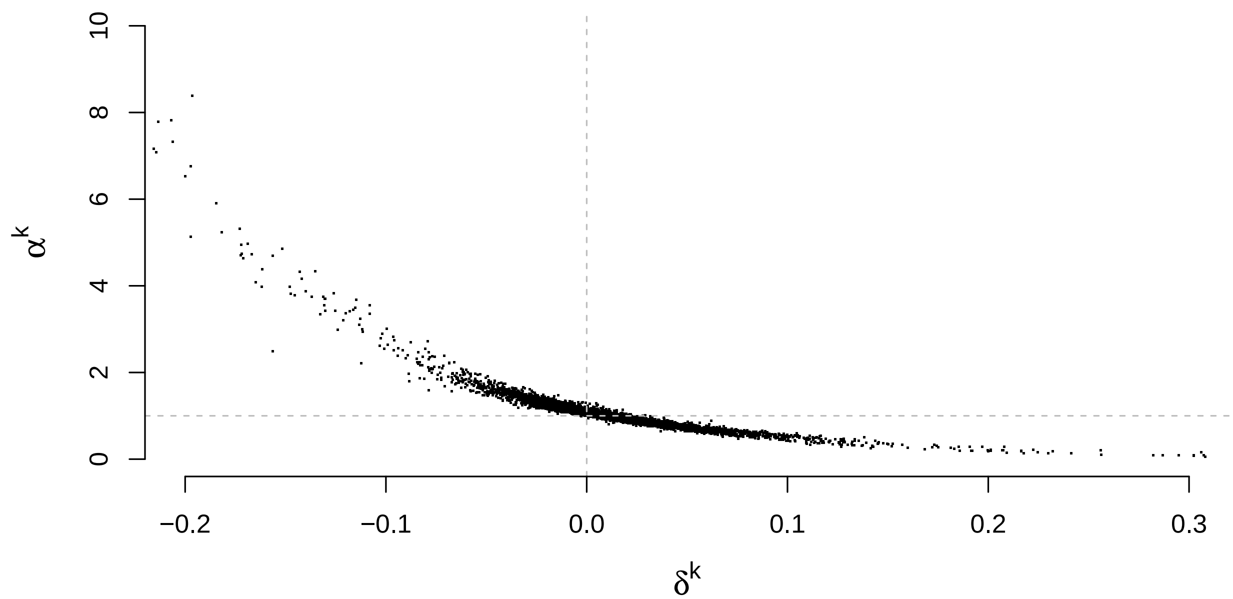
[11]I also use these predictions to estimate any products that are missing between the US and the partner country to reduce the number of missing products.

Figure A3: Descriptive Statistics of α^k and δ^k across HS sections.



Left panel shows the mean of α^k by HS sections. Right panel shows the mean of δ^k by HS sections. Lines are the 5th and 95th percentile.

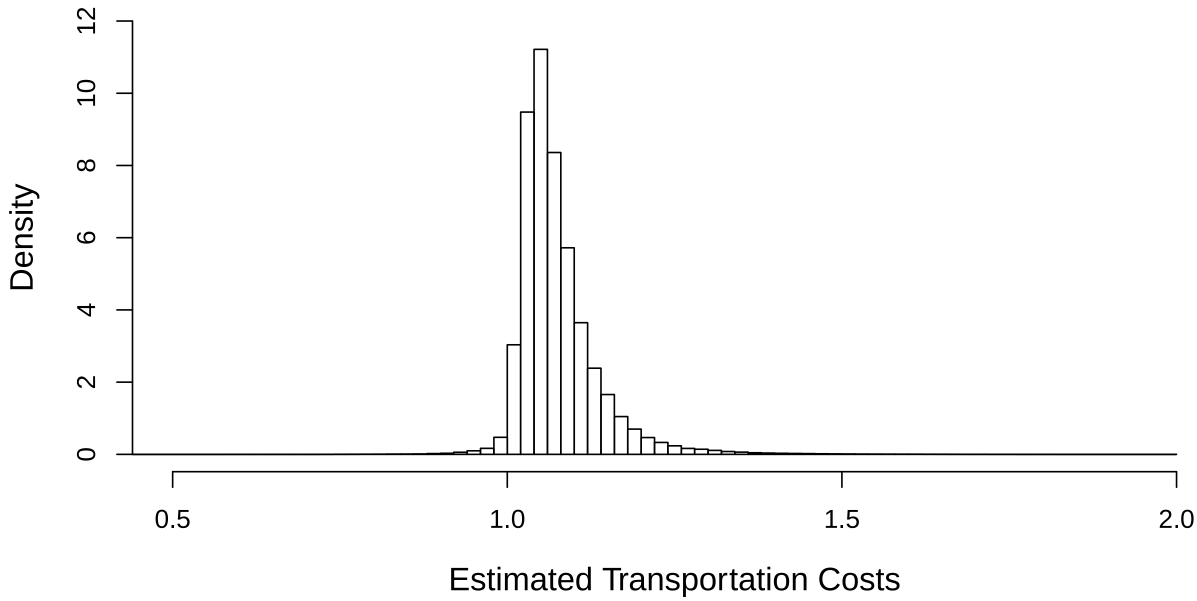
FigureA4: Relationship between α^k and δ^k



Shows the relationship between α^k and δ^k.

transportation costs ($\tau \geq 1$) it cannot be the case that both $\hat{\alpha}^k < 1$ and $\hat{\delta}^k < 0$. Figure A4 shows the relationship between α^k and δ^k. There is a clear negative relationship ($\rho = -.99$). Further, no case violates the necessary condition. Figure A5 shows the distribution of the estimated transportation costs from the partner country to c. Only 1.5 percent of the total estimates are below 1. The mean equals 1.07 and the standard deviation equal 0.06.

FigureA5: Distribution of $\hat{\tau}_{part,c}$



Shows the distribution of the estimated transportation costs between partner countries and c.

6 Measurement Error and Transportation Costs

One may wonder whether the results are simply caused by a bad measure of trade deflection because of data limiations on transportation costs. In other words, measurement error in the transportation cost estimates is attentuating the coefficients toward zero. While this is certainly a potential concern, there are several reasons why even a perfect measurement of transportation costs would not change the substantive results. First, even when ignoring the transportation costs and simply using the difference between external tariffs, the results still suggest a minimal effect of trade deflection on the design of RoO. This measure arguably serves as a strong proxy for how trade negotiators estimate the potential for trade deflection when designing RoO given the difficulty of incorporating transportation costs into the calculation.

Second, when examining the differences between members' tariff rates, it is clear that US should have little influence on the design of RoO if they used as a purely functional tool. This is because a majority of the US tariffs are lower than the tariffs in the partner countries and, thus have little concern of trade deflection. In other words, if trade deflection were to occur, it would happen through the US to the partner country. For example, out of 51,246 observations where tariff data for both countries is available, there are only 11,018 products where the US tariff is higher than the tariff in the partner country while there are 36,965 observations where the tariff in the partner country is higher than the tariff in the US. If trade deflection was an actual concern, the results should also show a strong effect of the preferential margin in the partner country. However, the opposite occurs. There is a small effect of protectionist interests in the partner country and a larger effect of US protectionist interests.

While the results for trade deflection should be interpreted with caution due to measurement error, there are strong reasons to believe that the substantive conclusions would not change even if we had a perfect measure of transportation costs.

7 Alternative DVs for the Restrictiveness of Rules of Origin

The following analysis shows that alternative definitions of the dependent variable produce similar results to the main analysis. I use four alternative approaches. First, I use the percent of required inputs that are restricted, but do not weight by the direct requirement coefficient. Second, I create dependent variables that use threshold cutoffs in the direct requirement coefficient. Third, I use the index created by Estevadeordal (2000). Finally, I use the index created by Harris (2007).

7.1 Not Weighting by Direct Requirement Coefficients

The dependent variable in the main analysis created a measure that weighted the percent of required inputs that were restricted by the direct requirement coefficient. This accounts for the degree of importance of the input. In other words, it is more costly to restrict an input that accounts for 15 percent of the value of some good than restricting an input that only accounts for 1 percent of the value. However, in this section, I show that weighting does not drastically alter the substantive results. Tables A2 and A3 report the results for protectionist interests and the incentives for trade deflection, respectively. For protectionist interests, the estimated coefficients are statistically significant, but smaller than the main analysis. Specifically, for column 1, a shift from the fifth to ninety-fifth percentile in the US preferential margin causes about a 16 percent increase in the restrictiveness of RoO. The estimated effects for trade deflection are also smaller than main analysis. For column 5 (Table A3), a shift from the fifth to ninety-fifth percentile in the incentives for trade deflection leads to about a 7.3 percent increase the restrictiveness of RoO.

Table A2: The effect of external protection on the restrictiveness of rules of origin in US trade agreements when not weighting by DR coefficients.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Pref. Margin (U.S.)	0.562		0.533	0.287	0.046
	(0.049)		(0.048)	(0.030)	(0.008)
Pref. Margin (Partner)		0.125	0.067	0.031	0.018
		(0.008)	(0.006)	(0.004)	(0.001)
Control Variables	No	No	No	Yes	Yes
PTA FEs	No	No	No	Yes	Yes
HS Chapter FEs	No	No	No	No	Yes
Adj. R-Sq.	0.158	0.033	0.168	0.493	0.791
N	48555	49127	48517	48517	48517

Standard errors clustered at the subheading level are reported in parentheses. The table reports the results for protectionist interests when not weighting required inputs by the direct requirement coefficients.

Table A3: The effect of trade deflection on the restrictiveness of rules of origin in US trade agreements when not weighting by DR coefficients.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
$Deflection^1$	0.038	0.016				
	(0.004)	(0.001)				
$Deflection^2$			0.040	0.014		
			(0.004)	(0.001)		
$Deflection^3$					0.143	0.019
					(0.010)	(0.001)
Control Variables	No	Yes	No	Yes	No	Yes
PTA FEs	No	Yes	No	Yes	No	Yes
HS Chapter FEs	No	Yes	No	Yes	No	Yes
Adj. R-Sq.	0.003	0.790	0.003	0.790	0.043	0.790
N	48517	48517	48300	48300	48300	48300

Standard errors clustered at the subheading level are reported in parentheses. The table reports the results for the incentives of trade deflection when not weighting required inputs by the direct requirement coefficients.

7.2 Threshold Cutoffs for the Direct Requirement Coefficients

In this section, I test whether the substantive results change when using cutoff thresholds for the direct requirement coefficients. In other words, inputs that add little value to the good are not likely to be restricted and are reducing the actual percent of required inputs that are restricted. I use two separate cutoffs: 0.005 and 0.01. Tables A4 report the descriptive statistics for these two measures. Using the threshold cutoffs increases the average restrictiveness of RoO. This aligns with the expectation that an input is more likely to be restricted when it has a larger direct requirement coefficient.

Tables A5 and A6 report the results when using the 0.005 threshold. Overall, the substantive results do not change. The restrictiveness of RoO is still predominately determined by protectionist interests rather than to deter arbitrage by foreign firms. The estimated coefficients for both protectionist interests and the incentives for trade deflection are slightly larger than the main analysis. Tables A7 and A8 report the results when using the 0.01 threshold. Again, the results the estimated coefficients are slightly larger than the main analysis.

Table A4: Summary statistics for the weighted percentage of required inputs that are restricted when using 0.005 cutoff threshold for the direction requirement coefficient.

Section	Mean	SD	Min	Max	N
0.005 Threshold					
01-05 animal products	0.34	0.23	0.00	0.85	1486
06-15 vegetables	0.16	0.15	0.00	0.81	3191
16-24 foodstuffs	0.12	0.13	0.00	0.92	1878
25-27 mineral products	0.06	0.10	0.00	0.79	1363
28-38 chemicals	0.07	0.21	0.00	0.93	7867
39-40 plastics/rubbers	0.01	0.01	0.00	0.12	2019
41-43 raw hides, skins, leathers	0.04	0.05	0.00	0.22	720
44-49 wood products	0.07	0.12	0.00	0.98	2291
50-63 textiles	0.52	0.28	0.00	0.91	8131
64-67 footwear/headgear	0.03	0.03	0.00	0.07	533
68-71 stone/glass	0.06	0.09	0.00	0.53	1795
72-83 metals	0.08	0.13	0.00	0.80	5502
84-85 machinery/electrical	0.02	0.03	0.00	0.49	7557
86-89 transportation	0.03	0.04	0.00	0.17	1115
90-97 miscellaneous	0.04	0.08	0.00	0.68	3719
Overall	0.15	0.24	0.00	0.98	49167
Section	**Mean**	**SD**	**Min**	**Max**	**N**
0.01 Threshold					
01-05 animal products	0.35	0.23	0.00	0.85	1486
06-15 vegetables	0.16	0.16	0.00	0.83	3191
16-24 foodstuffs	0.13	0.14	0.00	0.92	1878
25-27 mineral products	0.11	0.17	0.00	0.93	1363
28-38 chemicals	0.07	0.21	0.00	0.94	7867
39-40 plastics/rubbers	0.01	0.01	0.00	0.14	2019
41-43 raw hides, skins, leathers	0.04	0.05	0.00	0.23	720
44-49 wood products	0.08	0.14	0.00	1.00	2291
50-63 textiles	0.53	0.28	0.00	0.92	8131
64-67 footwear/headgear	0.03	0.03	0.00	0.08	533
68-71 stone/glass	0.07	0.12	0.00	0.58	1795
72-83 metals	0.08	0.13	0.00	0.81	5502
84-85 machinery/electrical	0.02	0.03	0.00	0.54	7557
86-89 transportation	0.03	0.04	0.00	0.18	1115
90-97 miscellaneous	0.04	0.09	0.00	0.71	3719
Overall	0.15	0.25	0.00	1.00	49167

The table reports the descriptive statistics for the dependent variable across sections when using a cutoff threshold for the direct requirement coefficients.

Table A5: The effect of external protection on the restrictiveness of rules of origin in US trade agreements when using 0.005 cutoff thresholds for the direct requirement coefficients.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Pref. Margin (U.S.)	1.463		1.371	0.931	0.218
	(0.107)		(0.106)	(0.080)	(0.032)
Pref. Margin (Partner)		0.350	0.205	0.142	0.040
		(0.019)	(0.016)	(0.014)	(0.005)
Control Variables	No	No	No	Yes	Yes
PTA FEs	No	No	No	Yes	Yes
HS Chapter FEs	No	No	No	No	Yes
Adj. R-Sq.	0.173	0.043	0.187	0.365	0.741
N	48555	49127	48517	48517	48517

Standard errors clustered at the subheading level are reported in parentheses. The table reports the results for protectionist interests when using a 0.005 cutoff threshold for the direct requirement coefficient.

Table A6: The effect of trade deflection on the restrictiveness of rules of origin in US trade agreements when using 0.005 cutoff threshold for the direct requirement coefficients.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Deflection[1]	0.181	0.039				
	(0.013)	(0.005)				
Deflection[2]			0.173	0.037		
			(0.013)	(0.005)		
Deflection[3]					0.401	0.056
					(0.023)	(0.007)
Control Variables	No	Yes	No	Yes	No	Yes
PTA FEs	No	Yes	No	Yes	No	Yes
HS Chapter FEs	No	Yes	No	Yes	No	Yes
Adj. R-Sq.	0.010	0.749	0.009	0.738	0.055	0.739
N	48517	48517	48300	48300	48300	48300

Standard errors clustered at the subheading level are reported in parentheses. The table reports the results for the incentives of trade deflection when using a 0.005 cutoff threshold for the direct requirement coefficient.

Table A7: The effect of external protection on the restrictiveness of rules of origin in US trade agreements when using 0.01 cutoff threshold for the direct requirement coefficients.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Pref. Margin (U.S.)	1.477		1.385	0.938	0.224
	(0.108)		(0.106)	(0.081)	(0.033)
Pref. Margin (Partner)		0.351	0.204	0.137	0.041
		(0.019)	(0.016)	(0.014)	(0.006)
Control Variables	No	No	No	Yes	Yes
PTA FEs	No	No	No	Yes	Yes
HS Chapter FEs	No	No	No	No	Yes
Adj. R-Sq.	0.168	0.041	0.182	0.355	0.726
N	48555	49127	48517	48517	48517

Standard errors clustered at the subheading level are reported in parentheses. The table reports the results for protectionist interests when using a 0.01 cutoff threshold for the direct requirement coefficient.

Table A8: The effect of trade deflection on the restrictiveness of rules of origin in US trade agreements when using 0.01 cutoff threshold for the direct requirement coefficients.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
$Deflection^1$	0.181	0.039				
	(0.013)	(0.005)				
$Deflection^2$			0.173	0.038		
			(0.013)	(0.005)		
$Deflection^3$					0.403	0.057
					(0.023)	(0.007)
Control Variables	No	Yes	No	Yes	No	Yes
PTA FEs	No	Yes	No	Yes	No	Yes
HS Chapter FEs	No	Yes	No	Yes	No	Yes
Adj. R-Sq.	0.010	0.749	0.008	0.724	0.053	0.724
N	48517	48517	48300	48300	48300	48300

Standard errors clustered at the subheading level are reported in parentheses. The table reports the results for the incentives of trade deflection when using a 0.01 cutoff threshold for the direct requirement coefficient.

7.3 Using the Estevadeordal and Harris Indices

Some may wonder if the results change when using previous measures. In this section, I report the results when using the indices developed by Estevadeordal (2000) and Harris (2007). The underlying data for 9 agreements was provided directly by Estevadeordal (2000) and Harris (2007). Data for the indices is not available for the TPP. For easier interpretation, I rescale the variables to have a range from 0 to 1 and then take the $log(x+1)$ transformation. Tables A9 and A10 report the results when using the Estevadeordal index. In general, the results are substantively similar to the main analysis. However, the estimated coefficients across the models are smaller. The explanatory power of the preferential margin and incentives for trade deflection also decrease. One interpretation of this result is that the course measurement of the restrictiveness of RoO increases the noise in the dependent variable, which biases the coefficients toward zero. The contrast highlights the advantages of the measure used in the main analysis. Specifically, by accounting for vertical linkages between goods and the degree of importance of each input, the new approach can more accurately measure the restrictiveness of RoO.

Tables A11 and A12 report the results when using the Harris Index. Recall, Harris (2007) makes several improvements to the approach originally developed by Estevadeordal (2000). Consistent with this improvement in measurement, the results are more consistent with the main analysis. Specifically, the estimated coefficients are significant, even in the most demanding specification. Further, the explanatory power of the preferential margin is much higher when using the Harris index compared to the Estevadeordal index.

Table A9: The effect of external protection on the restrictiveness of rules of origin in US trade agreements when using the Estevadeordal index.

	(1)	(2)	(3)	(4)	(5)
Pref. Margin (U.S.)	0.834		0.696	0.324	0.044
	(0.051)		(0.046)	(0.030)	(0.017)
Pref. Margin (Partner)		0.476	0.387	0.192	0.015
		(0.025)	(0.021)	(0.014)	(0.005)
Control Variables	No	No	No	Yes	Yes
PTA FEs	No	No	No	Yes	Yes
HS Chapter FEs	No	No	No	No	Yes
Adj. R-Sq.	0.057	0.054	0.091	0.346	0.606
N	45781	46322	45764	43437	43437

Standard errors clustered at the subheading level are reported in parentheses. The table reports the results for protectionist interests when using the Estevadeordal index.

Table A10: The effect of trade deflection on the restrictiveness of rules of origin in US trade agreements when using the Estevadeordal index.

	(1)	(2)	(3)	(4)	(5)	(6)
Deflection[1]	0.351	0.014				
	(0.020)	(0.005)				
Deflection[2]			0.316	0.010		
			(0.018)	(0.005)		
Deflection[3]					0.472	0.008
					(0.024)	(0.005)
Control Variables	No	Yes	No	Yes	No	Yes
PTA FEs	No	Yes	No	Yes	No	Yes
HS Chapter FEs	No	Yes	No	Yes	No	Yes
Adj. R-Sq.	0.025	0.606	0.019	0.606	0.054	0.606
N	45764	43437	45574	43281	45574	43281

Standard errors clustered at the subheading level are reported in parentheses. The table reports the results for the incentives of trade deflection when using the Estevadeordal index.

Table 11: The effect of external protection on the restrictiveness of rules of origin in US trade agreements when using the Harris index.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Pref. Margin (U.S.)	0.847		0.775	0.485	0.129
	(0.069)		(0.068)	(0.051)	(0.016)
Pref. Margin (Partner)		0.302	0.201	0.139	0.036
		(0.018)	(0.014)	(0.011)	(0.004)
Control Variables	No	No	No	Yes	Yes
PTA FEs	No	No	No	Yes	Yes
HS Chapter FEs	No	No	No	No	Yes
Adj. R-Sq.	0.155	0.056	0.178	0.419	0.740
N	45926	46469	45909	43582	43582

Standard errors clustered at the subheading level are reported in parentheses. The table reports the results for protectionist interests when using the Harris Index.

Table A12: The effect of trade deflection on the restrictiveness of rules of origin in US trade agreements when using the Harris index.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Deflection^1	0.143	0.032				
	(0.011)	(0.004)				
Deflection^2			0.136	0.030		
			(0.011)	(0.004)		
Deflection^3					0.328	0.044
					(0.021)	(0.004)
Control Variables	No	Yes	No	Yes	No	Yes
PTA FEs	No	Yes	No	Yes	No	Yes
HS Chapter FEs	No	Yes	No	Yes	No	Yes
Adj. R-Sq.	0.011	0.738	0.009	0.738	0.069	0.738
N	45909	43582	45719	43426	45719	43426

Standard errors clustered at the subheading level are reported in parentheses. The table reports the results for the incentives of trade deflection when using the Harris Index.

8 Additional Model Specifications

This section reports models from several additional analyses to demonstrate the robustness of the main results. First, I estimate models when excluding goods that can satisfy origin requirements through an alternative rule. Second, I estimate models when excluding goods that have additional value content requirements. Third, I report the results when including a variety of additional control variables.

8.1 Excluding Products with Alternative Rules

While the analysis controls for products that can satisfy origin through an alternative rule, including these products likely introduces some form of measurement error. This section reports the results when excluding these products. About 12% of products in the dataset can satisfy origin requirements through an alternative rule. A large portion of these rules are from NAFTA and the TPP. This is consistent with the idea that alternative rules provide greater flexibility for firms to demonstrate origin, which is necessary when there are many countries and input mixes being used. The results are reported in Tables A13 and A14. In general, the estimated coefficients across the models increase compared to the main analysis. Two exceptions are worth noting. First, the estimated coefficients for the preferential margin of the partner country decrease. Second, the estimated coefficient for the $Deflection^3$ decreases when including agreement fixed effects, chapter fixed effects, and additional control variables.

Table A13: The effect of external protection on the restrictiveness of rules of origin in US trade agreements when excluding products that can satisfy origin through an alternative rule.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Pref. Margin (U.S.)	1.630		1.537	1.048	0.244
	(0.103)		(0.102)	(0.085)	(0.034)
Pref. Margin (Partner)		0.348	0.177	0.124	0.012
		(0.021)	(0.015)	(0.014)	(0.005)
Control Variables	No	No	No	Yes	Yes
PTA FEs	No	No	No	Yes	Yes
HS Chapter FEs	No	No	No	No	Yes
Adj. R-Sq.	0.210	0.046	0.222	0.411	0.823
N	42795	43150	42767	42767	42767

Standard errors clustered at the subheading level are reported in parentheses. The table reports the results for protectionist interests when excluding products that can satisfy origin through an alternative rule.

Table A14: The effect of trade deflection on the restrictiveness of rules of origin in US trade agreements when excluding products that can satisfy origin through an alternative rule.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Deflection[1]	0.181	0.014				
	(0.014)	(0.004)				
Deflection[2]			0.175	0.015		
			(0.014)	(0.005)		
Deflection[3]					0.405	0.032
					(0.026)	(0.006)
Control Variables	No	Yes	No	Yes	No	Yes
PTA FEs	No	Yes	No	Yes	No	Yes
HS Chapter FEs	No	Yes	No	Yes	No	Yes
Adj. R-Sq.	0.011	0.821	0.010	0.820	0.061	0.821
N	42767	42767	42588	42588	42588	42588

Standard errors clustered at the subheading level are reported in parentheses. The table reports the results for the incentives of trade deflection when excluding products that can satisfy origin through an alternative rule.

8.2 Excluding Products with Value Content Requirements

Second, I test the results when excluding products that have additional value content requirements. This is important given the dependent variable cannot capture this additional requirement and, thus, underestimates the actual restrictiveness of the rules. Though, only about 2% of products in the dataset have additional value content requirements. The results are reported in Tables A15 and A16. In general, across the models, the estimated coefficients are larger compared to the main analysis.

Table A15: The effect of external protection on the restrictiveness of rules of origin in US trade agreements when excluding products that have additional value content requirements.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Pref. Margin (U.S.)	1.466		1.382	0.922	0.214
	(0.114)		(0.113)	(0.086)	(0.031)
Pref. Margin (Partner)		0.332	0.186	0.127	0.041
		(0.019)	(0.016)	(0.014)	(0.005)
Control Variables	No	No	No	Yes	Yes
PTA FEs	No	No	No	Yes	Yes
HS Chapter FEs	No	No	No	No	Yes
Adj. R-Sq.	0.179	0.040	0.191	0.370	0.751
N	47519	48072	47481	47481	47481

Standard errors clustered at the subheading level are reported in parentheses. The table reports the results for protectionist interests when excluding products that have additional value content requirements.

Table A16: The effect of trade deflection on the restrictiveness of rules of origin in US trade agreements when excluding products that have additional value content requirements.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Deflection^1	0.157	0.040				
	(0.012)	(0.005)				
Deflection^2			0.151	0.038		
			(0.012)	(0.005)		
Deflection^3					0.381	0.056
					(0.023)	(0.006)
Control Variables	No	Yes	No	Yes	No	Yes
PTA FEs	No	Yes	No	Yes	No	Yes
HS Chapter FEs	No	Yes	No	Yes	No	Yes
Adj. R-Sq.	0.008	0.749	0.007	0.749	0.053	0.749
N	47481	47481	47264	47264	47264	47264

Standard errors clustered at the subheading level are reported in parentheses. The table reports the results for the incentives of trade deflection when excluding products that have additional value content requirements.

8.3 Including Additional Control Variables

In this section, I report the results when including a variety of additional control variables. While the main analysis includes control variables that account for the construction of the dependent variable, I do not include standard controls often used in the trade literature. This is because these controls are likely post-treatment to the MFN tariff rate. In other words, the MFN tariff rate likely affects trade flows, which are used to construct measures for product differentiation and comparative advantage. However, this section demonstrates that the results are robust when including these additional controls. For simplicity, all control variables are constructed only using US data. Specifically, for each good across agreements, I include measures for product differentiation, comparative advantage, the geographic concentration of exports,[12] total imports and exports, and imports and exports for the partner countries. These variables are measured using three years of data starting from the year negotiations begin and using the next two previous years.

The results are reported in Table A17. For brevity, and because this article is only concerned with the effect of trade deflection and traditional protectionist interests, I exclude the results for the control variables. The estimated coefficients are similar to the main analysis.

[12] To construct this variable, I take the largest percentage of total exports for each good from a single US port. In other words, using data from Schott (2008), I calculate the percentage of exports that that are from each port and take the largest value. This serves as a reasonable proxy for the geographic concentration of exporters.

Table A17: The effect of protectionist interests and trade deflection on the restrictiveness of rules of origin in US trade agreements when including additional control variables.

	(1)	**(2)**	**(3)**	**(4)**
Pref. Margin (U.S.)	0.208			
	(0.030)			
Pref. Margin (Partner)	0.036			
	(0.005)			
Deflection[1]		0.031		
		(0.004)		
Deflection[2]			0.029	
			(0.005)	
Deflection[3]				0.049
				(0.006)
Trade Control Variables	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes
PTA FEs	Yes	Yes	Yes	Yes
HS Chapter FEs	Yes	Yes	Yes	Yes
Adj. R-Sq.	0.763	0.761	0.761	0.761
N	48172	48172	47974	47974

Standard errors clustered at the subheading level are reported in parentheses. The table reports the results when including additional control variables.

8.4 Separately testing transportation costs and differences in members' external tariffs

The theory for trade deflection suggests that as transportation costs decrease and the difference between members' external tariffs increase, the restrictiveness of RoO should increase. In this section, I separately test each of these factors. The expectation is that the estimated coefficient for transportation costs should be negative while the estimated coefficient for the difference in members' external tariffs should be positive. The results are reported in Table A18. In Column 1, the estimated effects are significant and in the expected directions. Though, when including the additional control variables, PTA fixed effects, and Chapter fixed effects, the estimated coefficient for transportation costs is not significant at conventional levels.

Table A18: Results when separately testing transportation costs and the difference in members' external tariffs.

	(1)	**(2)**
Transportation Costs	-0.029	-0.007
	(0.019)	(0.008)
Diff. in External Tariffs	0.160	0.032
	(0.012)	(0.005)
Control Variables	No	Yes
PTA FEs	No	Yes
HS Chapter FEs	No	Yes
Adj. R-Sq.	0.008	0.760
N	48277	48277

Standard errors clustered at the subheading level are reported in parentheses.

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