Regional Content Requirements and Market Power: Lessons from CUSFTA*

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Abstract

Focusing on the 1989 Canada-United States Free Trade Agreement (CUSFTA), we examine how regional content requirements in Free Trade Areas (FTAs) affect competition and prices in intermediate goods markets. Content requirements in FTAs shelter firms from competition more than an equivalent trade-protection tariff would. We document patterns in US industry-level census data and Canadian product-level export data that align with theoretical predictions: stricter and binding content requirements are linked to higher prices and more firm entry. These results underscore the role of content requirements in shaping market structure and market power, with implications for the choice of preferential trade arrangements.

KEY WORDS: Free Trade Areas, Content Requirements, Rules of Origin, Market Power

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1 Introduction

Free Trade Areas (FTAs) typically impose origin requirements as a condition for goods originating in a member country to be exported to another member country without incurring a tariff. These rules of origin (RoOs) are meant to prevent importers of goods originating outside the FTA from using trans-shipments within the FTA as a way of minimizing payments of customs duties. In practice, however, these rules can translate into protection for regional producers of intermediate goods.[1] This has been well documented both theoretically (Krishna and Krueger, 1995; Falvey and Reed, 2002; Krishna, 2005; Bombarda and Gamberoni, 2013) and empirically (Conconi et al., 2018).[2] Although the effects of RoOs have been studied before (albeit mainly from a theoretical perspective), the role played by RoOs in the trading system has not diminished; on the contrary, it has significantly increased in recent years following a proliferation of preferential FTA agreements, the 2020 EU-UK Trade and Cooperation Agreement (TCA) being one of the latest examples.

This paper focuses on a comparatively less studied implication of domestic content requirements in FTAs, namely how they affect competition and prices in intermediate goods markets. As first shown by Krishna and Itoh (1986) for a duopoly, regional content requirements can generate effects on competition that go beyond their effects on trade flows. They effectively amount to a hybrid between a price-based trade barrier (a tariff) and a quantity-based barriers (a quota) that induces partial market segmentation, lowering the elasticity of demand for domestic intermediates produced within the FTA. When the market for intermediate inputs is oligopolistic (rather than monopolistically competitive), the lower demand elasticity gives rise to higher price markups. In turn, absent barriers to entry, higher markups encourage inefficient entry. These effects on prices and market structure go beyond those that would be implied by an equivalent tariff barrier—a tariff that has the same effect on the volume of intermediate goods imports—because a tariff does not fundamentally change the elasticity of demand faced by suppliers of intermediate inputs.

Our contribution is twofold. First, in a model of oligopolistic competition amongst producers of differentiated intermediate goods, we show that binding and stricter content requirements are associated with higher markups and more firm entry. These effects could dampen the well-documented pro-competitive effects of preferential trade liberalization, and should therefore be factored in when assessing the pros and cons of alterna-

[1]This effect is independent of whether or not trade deflection could be profitable in the absence of RoOs (Felbermayr et al., 2019).

[2]For welfare implications, see Krueger (1997) for a survey on FTAs with RoOs versus Customs Union; and Brenton and Manchin (2003) for a discussion of implications for small developing countries such as the Balkans' FTAs with the EU. Lloyd (1993) also argues that using a tariff on value added produced outside the FTA would be more efficient than using RoOs.

tive preferential trade arrangements.[3] Second, with a focus on the 1989 Canada-United States Free Trade Agreement (CUSFTA), we construct a novel RoO index that systematically measures the stringency of CUSFTA's content requirements and we empirically verify our theoretical predictions using both US Census data and Canadian trade data.

The theory generates two main testable predictions. The first is that regional goods prices for intermediate goods should be higher when content requirements are binding for final goods that use those goods as inputs. This is more likely to be the case the larger is the required level of domestic content, the smaller are Most Favoured Nation (MFN) tariffs on inputs, and the larger are MFN tariffs on final goods. To see why, assume there is free trade between FTA partners while there are non-zero MFN tariffs applied to non-FTA trading partners. High MFN input tariffs would induce final good producers to opt for inputs of FTA origin irrespective of input requirements, making the input requirement less likely to be binding. On the other hand, if MFN tariffs on final goods are non-negligible, obtaining origin status for final goods to be able to export them to other FTA regions at zero tariff has positive value for FTA producers. Intuitively, a more binding content requirement makes FTA producers of final goods more willing to pay a premium for intermediate inputs originating within the FTA, translating into greater pricing power for oligopolistic producers of intermediate inputs operating within the FTA.

The second theoretical prediction is that content requirements further encourage inefficient entry in intermediate goods markets. The role that origin requirements play in support of oligopolistic markups limits the pro-competitive effects of preferential trade liberalization: with binding RoOs, and absent barriers to entry/exit, the number of intermediate goods producers remains inefficiently higher, and their size remains inefficiently smaller, than would be the case if RoOs were not binding—or, equivalently, if preferential liberalization takes the form of a Customs Union (CU), which does not incorporate RoOs. These results imply that a move from a CU to a FTA arrangement, such as the change that occurred following the 2020 EU-UK TCA, should then also affect market power and market structure in intermediate goods markets, undoing some of the pro-competitive effects of the CU.

To test these predictions empirically, we rely on evidence from the 1989 CUSFTA.[4] Our choice of CUSFTA over its successor, the North American Free Trade Agreement (NAFTA), is motivated by the fact that over 95% of NAFTA's rules of origin were already in place in CUSFTA (Conconi et al., 2018). There are two main reasons why CUSFTA's RoOs are well-suited for studying our question. First, the rules exhibit significant variation across goods and industries, as they consist of product-specific lists of intermediate inputs that must be fully sourced within the FTA to obtain origin status.[5] Second, the

[3]See Krueger (1999) for a review of the relevant literature.

[4]CUSFTA came into force in January 1989 and was superseded by the North American Free Trade Agreement (NAFTA) in 1994 with the addition of Mexico.

[5]Although CUSFTA's origin criteria are unique and differ from those in other FTAs, the latter also ex-

examination of the earlier CUSFTA allows us to make a clearer distinction between preferential and external Most Favored Nation (MFN) tariff rates. Throughout our sample period, Canada and the US had no other Free Trade Agreement (FTA) partners, the only exception being the 1985 US-Israel agreement. These features enable us to study how effects vary based on the stringency of regional requirements and trade barriers.

The new RoO index we construct to empirically relate CUSFTA's RoOs to variation in regional prices and entry within the FTA is based on the input-output linkages in CUSFTA's rules of origin detailed by Conconi et al. (2018), and encompasses both the coverage of rules for a given input and the stringency of the list-based rule. We also demonstrate how our RoO index aligns with a more commonly understood value-based rule, such as the regional content value share.

To test the theoretical predictions, we apply this measure to two distinct datasets. The first dataset includes annual US PPI data for manufacturing industries from the US Bureau of Labor Statistics, matched with US Census data from the Economic Census for the years 1987 (pre-CUSFTA) and 1992 (post-CUSFTA). This Census data allows us to identify the number of firms and industry market structure measures (specifically, Herfindahl-Hirschman Index, HHI). In difference-in-difference specifications, we find strong industry-level support for our theoretical predictions that more binding content requirements are associated with higher price changes and more firm entry in US intermediate goods markets between 1987 and 1992, and show that these findings apply only to oligopoly industries, consistent with our theoretical setup. Estimated effects on prices and firm numbers are sizable. Notably, industries positioned at the 75th RoO index percentile experience approximately 18.5 percentage points higher PPI changes on average than industries at the 25th percentile RoO index. Similarly, only 19.4% of industries at the 25th RoO index percentile see an increase in firm numbers but this figure significantly rises to 84.4% for industries at the 75th RoO index percentile.

In our analysis of regional prices, we also incorporate Canadian export data from Statistics Canada spanning the period 1988-2000 to offer product-level evidence of our theoretical predictions relating to the prices of traded goods. Through triple-difference regressions, we demonstrate that more binding and stricter content requirements are linked to higher export unit values for Canadian exports to the US by comparison with exports of similar products to other non-FTA destinations, a price gap that can be interpreted as indicative of a differential markup applied by Canadian intermediate goods exporters on sales to FTA producers (who face origin requirements).[6]

hibit considerable variation in the stringency of content requirements across sectors, typically employing a mix of rules. For instance, the EU-UK TCA involves four different categories of RoOs: (i) *change in tariff classification rule*; (ii) *value added rule*; (iii) *specific production processes rule*; (iv) *"any heading" rule*. These rules apply differentially across various goods, and often a combination of rules is used. Ayele et al. (2021) document significant variation in coverage across production sectors. For instance, 82% of all chemicals require meeting at least three of the four types of rules, while textiles adhere to a single type of rule.

[6]Although Canada's economy is much smaller than that of the US, it is the largest export market for US producers as well as one of the largest suppliers to the US. Therefore, CUSFTA content requirements

Our findings have direct policy implications, as they show that origin requirements in FTAs can generate efficiency costs that go beyond those associated with the substitution of domestic intermediates for imported intermediates by domestic producers (as measured by the trade-barrier equivalent effect of RoOs). These additional efficiency costs should be borne in mind not only when considering the choice between a CU and a FTA arrangement in preferential trade areas but also when contemplating a move from a CU to a FTA arrangement.

This paper builds on and contributes to the literature that examines how different trade policies can influence market power and firm entry. A large body of literature has documented a pro-competitive effect under imperfectly competitive market structures and showed that trade liberalization reduces markups, both theoretically (Melitz and Ottaviano, 2008) and empirically (Levinsohn, 1993; Harrison, 1994; Feenstra and Weinstein, 2017).[7] It has also been well-documented that trade liberalization can lead to exit by the least productive firms: see Pavcnik (2002) for the case of Chile, and Trefler (2004) for the case of CUSFTA.[8] Our contribution here is in showing that binding rules of origin under oligopolistic competition generate the opposite effects in terms of markups and firm entry.

Our theoretical analysis in the first part of the paper builds on Krishna and Itoh (1986) and Cherkashin et al. (2015), which also focus on RoOs and pricing. Other related papers are Ju and Krishna (2002) and Ju and Krishna (2005), which, in a framework with inelastic supply and perfect substitution between FTA and non-FTA inputs describe non-monotonic effects of RoOs due to demand shifts for FTA inputs, depending on whether heterogeneous firms choose to comply with RoOs. Our paper focuses on how RoOs affect regional prices via changes in market power and markups, rather than through decreasing returns in production.

Empirical attempts to measure the restrictiveness of RoOs in different industries and evidence of their trade effects have been scarce. One notable example is Conconi et al. (2018) who provide a mapping of input-output product linkages of RoOs in NAFTA and CUSFTA, upon which our RoO measures are based.[9] Their focus, however, is on how NAFTA RoOs lead to significant reductions in imports of intermediate goods from third countries relative to NAFTA trading partners, rather than on the effects of RoOs on prices or entry. A study that examines effects on both trade volumes and prices is

do matter to both Canadian and US producers of final goods. US exports to Canada account for 21.52% of total US exports in 1989, with the share remaining steady at around 20% throughout our sample period, and US imports from Canada account for roughly 18% of annual total US imports from 1989 to 2000 (data source: US Census Bureau).

[7] Other studies that have contributed to this debate are Cox and Harris (1985), Head and Ries (1999), and Caliendo and Parro (2015).

[8] For a survey of both theory and empirics on heterogeneous firms and trade, see Melitz and Redding (2014).

[9] See also Estevadeordal (2000) for a categorization of the restrictiveness of RoOs coded from 1 (least restrictive) to 7 (most restrictive).

Romalis (2007), which documents a substantial boost in trade between NAFTA partners but only a modest increase in relative output prices of traded goods between NAFTA members versus the rest of the world for very protected sectors with high MFN tariffs. His structural estimations, however, do not account for RoOs. Our paper supplements these studies by presenting evidence on the impact of RoOs on regional prices for intermediates and on entry in intermediate goods markets using a novel measure of RoO tightness that accommodates variation in the levels of protection across traded goods under CUSFTA.[10]

The remainder of the paper is organized as follows. Sections 2 discusses how content requirements in RoOs result in partial market segmentation and lower the elasticity of demand facing domestic producers of intermediates. Section 3 examines the implications of RoOs for oligopolistic competition, prices, and market competitiveness. Section 4 describes our data and presents empirical findings. Section 5 concludes. Proofs of theoretical results are in the appendix.

2 Content requirements and input choice

We develop our arguments for a scenario with a regional value content (RVC) requirement, which is by far the most widely adopted form of RoOs across the FTAs we observe, and consider a setting with two identical trading regions.

Producers of final goods in each region use symmetrically differentiated varieties of intermediate inputs, some of which are produced by domestic suppliers and some of which are produced by foreign suppliers. There is an equal number, N, of these suppliers in each region. Production takes place via CES technologies:

$$y(q) = \left(\sum_{i=1}^{2N} q_i^{(\sigma-1)/\sigma} \right)^{\sigma/(\sigma-1)}, \tag{1}$$

where q_i is input of the intermediate good produced by supplier i. The corresponding unit cost is

$$e(p) = \left(\sum_{i=1}^{2N} p_i^{1-\sigma} \right)^{1/(1-\sigma)}, \tag{2}$$

where the p_i's are unit prices for each of the symmetrically differentiated inputs and $\sigma > 1$ is the elasticity of substitution between them.

Consider first a scenario where $N = 1$, i.e., there is a single supplier of intermediates in each region. Let p_D denote the price of domestically produced intermediates for a

[10]Our study is also related to work on pricing to market and markup adjustments using customs data (Knetter, 1989; Corsetti et al., 2019). Although our empirical analysis has a different focus, it addresses similar issues in controlling for observable marginal costs with trade prices derived from customs data.

representative producer in one of the two regions, and p_M the price of imported intermediates (inclusive of any trade costs). Absent any constraint, unit cost can be written as

$$e(p_D, p_M) = \left({p_D}^{1-\sigma} + {p_M}^{1-\sigma}\right)^{1/(1-\sigma)}. \tag{3}$$

This is the minimum cost, at prices p_D and p_M, of a combination of inputs such that

$$\left({q_D}^{(\sigma-1)/\sigma} + {q_M}^{(\sigma-1)/\sigma}\right)^{\sigma/(\sigma-1)} = 1. \tag{4}$$

The conditional demand for a representative domestic intermediate and a representative imported intermediate, using Shephard's Lemma, can then be expressed as

$$q_D(p_D, p_M) = e(p_D, p_M)^{\sigma} {p_D}^{-\sigma}, \quad q_M(p_D, p_M) = e(p_D, p_M)^{\sigma} {p_M}^{-\sigma}. \tag{5}$$

Suppose now that domestic producers face an RVC requirement: a certain proportion, r, of the *value* of their input must be sourced within the FTA region for their output to be sold to FTA buyers at zero tariff; if this requirement is not met, then they must also incur the same trade costs internally as they do for sales to non-FTA buyers. Satisfying an RVC requirement of r implies that, to produce a unit of the final good, the final good producers must choose a combination of intermediate inputs that achieves the required output target for the given technology *and* such that, at the given prices, an input value share of at least r consists of intermediate inputs produced within the FTA. As we shall show, this is equivalent to employing a technology featuring less substitutability between domestically sourced and foreign sourced intermediates than the elasticity of substitution that is implied by technology only.

Assume first that the domestic content requirement is *unconditional*, i.e., that it must be met whether or not the producer wishes to be able to sell its output without facing a tariff. If this is binding, we can write

$$\frac{p_D\, q_D}{p_D q_D + p_M q_M} = r \quad \Rightarrow \quad q_D = \frac{r}{1-r}\frac{p_M}{p_D} q_M. \tag{6}$$

We can substitute this expression into (4), solve for $q_M = \hat{q}_M(p_D, p_M, r)$, and then substitute again into (6) to derive an expression for $q_D = \hat{q}_D(p_D, p_M, r)$. We obtain conditional demands under a binding RVC constraint as

$$\hat{q}_D(p_D, p_M, r) = r\, {p_D}^{-1}\, \hat{e}(p_D, p_M, r), \quad \hat{q}_M(p_D, p_M, r) = (1-r)\; {p_M}^{-1}\, \hat{e}(p_D, p_M, r), \tag{7}$$

where

$$\hat{e}(p_D, p_M, r) = \left(\left(\frac{p_D}{r}\right)^{(1-\sigma)/\sigma} + \left(\frac{p_M}{1-r}\right)^{(1-\sigma)/\sigma}\right)^{\sigma/(1-\sigma)} \tag{8}$$

is unit cost under a binding RVC constraint. Comparing equation (8) with the expression for unconstrained unit cost in (3), we can see the $1-\sigma$ in the first expression being replaced by $(1-\sigma)/\sigma$ in the other (which also features share parameters). Expression (7) forces constant expenditure shares as under Cobb-Douglas technologies. However, the expression for unit expenditure that enters (7) involves σ rather than a unit elasticity of substitution, because the quantity of output that can be produced for given inputs—and thus the expenditure required to produce one unit of output while meeting content requirements—depends on the underlying technology.[11]

Next, we turn to developing conditions for the RVC requirement to be binding. Consider a conditional requirement for sales of final goods to FTA destinations: an ad valorem tariff at rate t_I is levied on intermediates that are traded across regions, and an ad valorem tariff at rate t_F is levied on final goods that are traded within regions but are produced without satisfying the domestic content requirement. Also, let $\tau_I = 1 + t_I$, $\tau_F = 1 + t_F$, and $p_M = \tau_I p_W$, where p_W is the net-of-tariff price charged by foreign exporters of intermediates.

Absent an RVC constraint, regional value content would be $p_D q_D / e(p_D, p_M)$, which using (5), equals $\left(1 + (p_M/p_D)^{1-\sigma}\right)^{-1}$, and so the constraint is only binding if r is above this minimum threshold value, i.e., if

$$r > \left(1 + (p_M/p_D)^{1-\sigma}\right)^{-1} \equiv \underline{r}(p_D, p_M). \tag{9}$$

For $r = \underline{r}(p_D, p_M)$, RVC-constrained unit cost, $\hat{e}(p_D, p_M, r)$, equals unconstrained unit cost, $e(p_D, p_M)$; for $r > \underline{r}(p_D, p_M)$, we have $\hat{e}(p_D, p_M, r) > e(p_D, p_M)$, and the gap between them increases with r. The binding condition $r \geq \underline{r}(p_D, p_M)$ can then be expressed as an upper bound on the input tariff for a given r and given domestic and world prices:

$$\tau_I \leq (p_D/p_W) \left(\frac{r}{1-r}\right)^{1/(\sigma-1)} \equiv \overline{\tau}_I(r). \tag{10}$$

Moreover, if satisfying the domestic content requirement is a condition for the producer to be able to sell its good without incurring an ad valorem tariff at rate t_F within the FTA region, then abiding by the content requirement should minimize overall unit cost. This condition can be expressed as a lower bound on the output tariff or a given input tariff and given domestic and world prices:

$$\hat{e}(p_D, p_M, r) < \tau_F \, e(p_D, p_M) \quad \Leftrightarrow \quad \tau_F \geq \frac{\hat{e}(p_D, \tau_I \, p_W, r)}{e(p_D, \tau_I \, p_W)} \equiv \underline{\tau}_F(r, t_I) \geq 1, \tag{11}$$

where the last inequality follows from $\hat{e}(p_D, \tau_I \, p_W, r) \geq e(p_D, \tau_I \, p_W)$. Otherwise, overall

[11] As result, Shephard's Lemma does not apply in this case (i.e., $\hat{q}_D(p_D, p_M, r) \neq \partial \hat{e}(p_D, p_M, r)/\partial p_D$ and $\hat{q}_M(p_D, p_M, r) \neq \partial \hat{e}(p_D, p_M, r)/\partial p_M$). This is because, under a binding constraint, firms effectively face (shadow) prices for their inputs that vary with the quantities of inputs they use.

unit cost will be minimized by producing the final goods ignoring the content requirement and incurring the tariff; in this case, while the conditionality requirement will formally still be binding, the RVC constraint as such will cease to be binding.[12]

Thus, a given regional content requirement, r, is only binding for producers of final goods (and thus affects their choice between domestic and imported inputs) if (10) and (11) are *both* binding, i.e., if tariffs on imported inputs are sufficiently low and if exported final goods that do not meet the content requirements face sufficiently high tariffs.[13]

3 Oligopolistic markups in intermediate goods markets

We now turn to the analysis of the effects of an RVC requirement under oligopoly in the context of a symmetric model with four countries and two FTAs. Agents in each country are endowed with a certain amount, $\bar{L}$, of labor (the same amount in all countries and immobile across countries). In a symmetric equilibrium the wage will be equalized across countries, and so we can normalize it at the outset to be unity everywhere. Two of these countries are members of a FTA and the remaining two are members of a separate FTA, each denoted by $h \in \{1, 2\}$.

Focusing on a single final goods industry, we assume that the total value of demand originating from any given country for final goods produced by this industry is equal to a fraction, $\theta \bar{L} \equiv Y$, $\theta \in (0, 1)$, of total income in each country. In a symmetric outcome, this will also equal the total value of demand for goods produced by this industry in each of the four countries.[14]

Producers of intermediate goods produce symmetrically differentiated inputs using only labor inputs at a constant marginal cost of c and incurring a fixed cost equal to F, and operate under conditions of oligopoly, each pricing its output non-cooperatively so as to maximize gross profits. Producers of final goods operate under conditions of perfect competition, and so the price they charge for their output equals their unit cost (i.e., they choose a zero markup).

3.1 Equilibrium markups

We first examine the case where there is a fixed number, $N/2$, of active intermediate goods producers in each country, i.e., N producers of intermediate goods in each FTA.

[12]Our analysis abstracts from any heterogeneity in choices across different exporters (arising, for example, from heterogeneity in their size or their exporting experience). See Krishna et al. (2021) for an empirical account.

[13]Over the full range of possible price combinations and tariff levels, unit cost equals $B(r, \tau_I, \tau_F)\, \hat{e}(p_D, \tau_I p_W, r) + (1 - B(r, \tau_I, \tau_F))\, e(p_D, \tau_I p_W) \equiv \tilde{e}(p_D, \tau_I p_W, r)$, where $B(r, \tau_I, \tau_F) \equiv \mathbb{1}_{\tau_F \geq \underline{\tau}_F(r, t_I)} \times \mathbb{1}_{\tau_I \leq \overline{\tau}_I(r)}$, with $\mathbb{1}$ denoting the indicator function.

[14]The implicit assumption here is that any profits or tariff revenues arising from this industry are not used to buy goods produced by this industry.

The implications of free entry are examined in the next section. Without loss of generality, we assume a constant marginal cost of $c = 1$.

Intermediate goods and final goods traded across the two regions of the FTA face ad valorem tariffs at rates respectively equal to t_I and t_F, the same for all economies. The same tariff applies to final goods traded between economies of a FTA if produced in a way that does not satisfy regional content requirements. Intermediate goods traded across countries of a FTA face no tariffs. Final goods meeting content requirements and traded across countries of a FTA face no tariffs. There are no other trade costs beyond tariffs. The requirement that producers of final goods must meet in order to be able to export their goods within a FTA at zero tariff is an RVC input requirement at level r.

Absent a binding content requirement, the unit cost of production for a representative producer of final goods in region h is $e(p_{Dh}, p_{Mh}) \equiv P_h$, where

$$p_{Dh} = \left(\sum_{i=1}^{N} \left(p_{ih}\right)^{1-\sigma} \right)^{1/(1-\sigma)}, \qquad p_{Mh} = \left(\sum_{i=1}^{N} \left(\tau_I p_{ih'}\right)^{1-\sigma} \right)^{1/(1-\sigma)}. \tag{12}$$

with $\tau_I = 1 + t_I$, and with p_{ih} and $p_{ih'}$ denoting the-net-of-tariff prices charged by each supplier of intermediates indexed by i in each of the two FTAs.[15]

Deriving the corresponding levels of demand and the associated profits, and examining the condition for profit maximization by oligopolistic producers of intermediate goods in a symmetric equilibrium yields the following equilibrium level of markup (ratio of price over marginal cost):

$$\mu^* = 1 + \frac{1}{\sigma - 1} \, \frac{N}{N - \Phi(\tau_I)}, \tag{13}$$

where

$$\Phi(\tau_I) \equiv \Big(1 + (1 + \tau_I)/({\tau_I}^{1-\sigma} + {\tau_I}^{\sigma})\Big)^{-1} < 1. \tag{14}$$

Full derivations are presented in Appendix A. The markup is increasing in τ_I. For $\tau_I = 1$ (i.e., with a zero tariff on imports of intermediates), $\Phi(\tau_I)$ equals $1/2$ and so the denominator of the second ratio in (13) equals $N - 1/2$. For τ_I approaching infinity and $\sigma > 1$, $\Phi(\tau_I)$ approaches unity and so the denominator of the second ratio in (13) equals $N - 1$.

Under a binding domestic content requirement, we can proceed in the same way and use (7) and (8) to derive expressions for the levels of demand and profits, and the level of markup for intermediate goods in a symmetric equilibrium:

$$\hat{\mu}^* = 1 + \frac{1}{\sigma - 1} \, \frac{N}{N - 1}. \tag{15}$$

[15]This implies horizontal input differentiation; i.e., $e(p_{Dh}, p_{Mh}) = \left(\sum_i \left(p_{ih}\right)^{1-\sigma} + \sum_i \left(\tau_I p_{ih'}\right)^{1-\sigma} \right)^{1/(1-\sigma)}$.

Comparing this expression with unconstrained markup in (13) gives us our first testable prediction:

Proposition 1 *Equilibrium markups are higher under a binding domestic content requirement than they are in its absence.*

(Proofs of theoretical results are in the appendix.)

This result is in agreement with the conclusions of Krishna and Itoh (1986), who study a general model of duopolistic competition between domestic and foreign intermediate goods producers under a content requirement that is "just binding" and show that content protection raises prices. Our analysis generalizes this result to a scenario with oligopolistic competition and a strictly binding content requirement, for the special case of symmetric input differentiation under CES substitution possibilities and $\sigma > 1$.

Since a larger r implies a tighter constraint, the constraint is more likely to be binding, and thus markups more likely to be higher, the larger is r. However, in order for the pricing behavior described by (15) to correspond to equilibrium behavior, it is not enough for the RVC constraint to be binding when all producers price in this way; it must also be the case that there are no gainful unilateral price deviations that can cause the constraint to become slack.[16] As shown in the proof of our next result, this latter condition is the one that defines the necessary lower bound on r, although the same conclusion applies: the larger r, the more likely the RVC constraint is to bind:[17]

Proposition 2 *Content protection is more likely to raise equilibrium markups for producers of intermediates the higher is the required level of domestic content.*

As previously discussed, for the RVC constraint to be binding, we must have $\tau_I \leq \overline{\tau}_I(r)$ (condition (10)), where

$$\overline{\tau}_I(r) = \left(\frac{r}{1-r}\right)^{1/(\sigma-1)}. \tag{16}$$

Moreover, satisfying the domestic content requirement is only cost-minimizing for producers of final goods (and thus to be binding for them) if $\tau_F \geq \underline{\tau}_F(r, t_I)$ (condition (11)),

[16] Intuitively, starting from a symmetric markup choice under which the constraint is binding, a single firm could in principle find it profitable to undercut the price charged by its competitors by an amount large enough that the resulting fall in the price of the intermediate input composite (p_D) induces final goods producers to willingly substitute towards intermediate goods originating in the FTA, thus relaxing the constraint.

[17] With reference to the duopoly case, Krishna and Itoh (1986) show that pure-strategy equilibria might not exist. The conditions described in the proof of the proposition ensures existence.

where

$$\underline{\tau}_F(r,\tau_I) = \left(\left(\frac{1}{r}\right)^{(1-\sigma)/\sigma} + \left(\frac{\tau_I}{1-r}\right)^{(1-\sigma)/\sigma} \right)^{\sigma/(1-\sigma)} \Big/ \left(1+\tau_I^{1-\sigma}\right)^{1/(1-\sigma)}. \tag{17}$$

The next result follows immediately from (16) and (17):

Proposition 3 *A given domestic content requirement is more likely to raise equilibrium markups for producers of intermediates the larger are tariffs on imports of non-FTA final goods, the smaller are tariffs on imports of non-FTA intermediate inputs, and the smaller is the number of intermediate goods producers.*

The last part of the result follows directly from the fact that , for $N \to \infty$, the expressions for μ^* and $\hat{\mu}^*$ from (13) and (15) both approach the monopolistically competitive markup, $\sigma/(\sigma-1)$, i.e., the effect of a binding content requirement on the equilibrium markup vanishes as the number of competing intermediate goods producers gets larger.

A testable implication of these results is that we should expect to see higher prices (through higher markups) when r is comparatively higher and, simultaneously, τ_I is comparatively lower, τ_F comparatively higher, and that the effect of a binding content requirement on equilibrium prices should be greater the smaller the number of competitors (i.e., the more the market structure for intermediate goods deviates from monopolistic competition).[18]

3.2 Domestic content requirements as an import barrier

It is easy to show that a domestic content requirement acts as a trade barrier on imports of intermediates: letting $\tau_I = 1$ (zero import tariffs) and comparing, for a representative firm, the net-of-tariff equilibrium values of trade in intermediate goods across FTA boundaries that obtain with and without a domestic content requirement, which are respectively equal to $\hat{p}\hat{q}_X = \hat{p}_{ih}\hat{q}_{Xh} = \hat{p}_{ih'}\hat{q}_{Xh'}$ and $pq_X = p_{ih}q_{Xh} = p_{ih'}q_{Xh'}$ $\forall i$. By using expressions (12)-(15), and defining $K \equiv (1/2)(1+1/\tau_F)$, we obtain

$$\hat{p}\hat{q}_X - pq_X = \frac{KY}{N}(1/2-r), \tag{18}$$

which is negative for $r > 1/2$.

However, this conclusion does not mean that introducing a domestic content requirement is fully equivalent to introducing a tariff, as the former produces different effects on markups and market structure:

[18] Since $\sigma > 1$, the gap between $\hat{\mu}^*$ and μ^* vanishes as τ_I approaches infinity (and trade in intermediate goods approaches zero); i.e., the level of markup under an origin requirement coincides with the level of markup under a prohibitive import tariff.

Proposition 4 *Under oligopolistic competition between suppliers of intermediate inputs, a binding domestic content requirement raises markups more than does an import tariff that, absent a content requirement, produces the same same effect on imports of intermediates.*

The effects of content requirements on the markups and profits of import-competing producers thus go beyond those of trade barriers that have comparable effects on trade flows. And, conversely, in order to generate effects on markups and profits that are comparable to those of a content requirement, a tariff must produce larger effects on trade flows. In particular, the same level of markups that would obtain under regional autarky (prohibitive trade barriers between the FTA and the rest of the world) can be supported by a binding domestic content requirement that does not fully restrict trade.

It is instructive to compare the effects of content protection with those of an import quota and those of a tariff on intermediate goods. If the number of domestic producers of intermediate goods is finite, a quota on intermediate goods imports would fully support an oligopolistic (or monopolistic) outcome in the residual domestic market, independently of market structure elsewhere. In contrast, a non-prohibitive tariff on intermediate inputs would force the domestic market structure for intermediate inputs to conform to that of the rest of the world—thus leading to perfect competition if international markets are perfectly competitive or to expanded oligopolistic competition if international markets are oligopolistic. Content protection operates differently because, unlike a quota, it exposes domestic intermediate inputs producers to *some* foreign competition while still sheltering them from foreign competitors via an import barrier that, unlike a tariff, is effectively quantity-responsive (under a binding content requirement, importers of intermediate inputs face a shadow price for imports that increases as demand increases). As a result, equilibrium markup and prices under content protection lie somewhere in between those under an import quota and those under a non-prohibitive import tariff.

3.3 Free entry

If entry and exit are free and costless, the number of active intermediate goods producers will adjust endogenously so that profits, net of the fixed operating cost, are zero in equilibrium, i.e.,

$$\Pi_{ih}\big|_{\mu_{ih}=\mu_{ih'}=\mu,\ \forall i} \equiv \Pi(\mu, N) = 0. \tag{19}$$

In conjunction with profit-maximization, this identifies an equilibrium number of firms, N^*:

$$N^* = \frac{(KY/F)\left(1+{\tau_I}^{\sigma}\right)^2 + (\sigma-1)\left(\tau_I + {\tau_I}^{2\sigma}\right)}{\sigma\left(1+{\tau_I}^{\sigma}\right)\left(\tau_I + {\tau_I}^{\sigma}\right)}. \tag{20}$$

The corresponding number of firms under a binding domestic content requirement is

$$\hat{N}^* = \frac{(KY/F)\left(1 + r(\tau_I - 1)\right) + (\sigma - 1)\,\tau_I}{\sigma\,\tau_I}, \tag{21}$$

which is increasing in r. Expressions for equilibrium markups, as a function of the number of firms, are as before.

The same ranking of markup levels that applies for an exogenously given N applies under conditions of free entry, but the equilibrium number of active firms is higher under binding content protection:

Proposition 5 *Under conditions of free entry, both the equilibrium level of markup and the equilibrium number of suppliers of intermediate inputs are higher under a binding domestic content requirement than they are in its absence.*

The results that we have first derived for an exogenous number of firms thus extend to a setting where the number of active firms varies with the size of markups. However, under free entry, the model additionally predicts that a domestic input requirement will encourage entry. A well-established result in the literature, which applies under fairly general conditions, is that oligopolistic competition produces excessive entry, translating into a sub-optimal firm size (Bresnahan and Reiss, 1991). By encouraging entry, a domestic input requirement will exacerbate this.[19] Put differently, when compared with a no-agreement scenario, preferential liberalization will boost competition amongst intermediate goods producers, lowering markups and triggering efficient exit, but this effect will be smaller under content protection.[20]

As noted in the introduction, the implications of preferential trade liberalization for market structure have been the subject of a large literature. The theoretical experiment considered in those studies is to characterize the effects of a move from a pre-agreement scenario to a zero bilateral-tariff scenario, an exercise that is typically carried out in a monopolistic competitive setting where, with symmetric firms, there are no scale effects if demand is derived from CES preferences or technologies. Under oligopolistic competition—the environment we focus on here—the elasticity of demand, and thus markups, vary with the number of firms even when preferences and technologies are of the CES type, and so preferential liberalization can generate positive scale effects and firm exit. On the other hand, Proposition 5 implies that RoOs in FTAs will tend to limit the pro-competitive effects of preferential trade liberalization.

[19] Both Propositions 4 and 5 are closely related to the results discussed in Cherkashin et al. (2015) with respect to the effects of rules or origin in a differentiated-products, heterogeneous-firm setting.

[20] See the proof of Proposition 5 in the appendix for details. Note that, in our stylized setting, a FTA where regional content requirements are not binding is also equivalent to a CU, so the above comparison can also be thought of as a comparison between the effects of a CU and those of a FTA where content protection is binding.

3.4 Testable predictions

We summarize the testable predictions from our theoretical analysis as follows:

I. *Regional intermediate goods prices*: The gross-of-markup domestic prices for intermediate inputs sold by oligopolistic FTA producers to FTA final good producers should be higher when content protection is binding for the final goods that use those goods as inputs (Proposition 1). This is more likely to be the case when the content requirements for those final goods are stricter (making r more likely to above be above threshold level defined by (9); Proposition 2) *and* when we observe for those intermediate and final goods a combination of low tariffs on competing non-FTA intermediate inputs for producers of final goods and high tariffs on non-qualifying imports of the final goods (making (10) and (11) more likely to be both binding; Proposition 3); they should also be higher the smaller is the number of regional intermediate goods producers (also Proposition 3).

II. *Entry in intermediate goods markets*: Other things equal, the equilibrium number of oligopolistic suppliers of intermediate inputs should be higher under a binding domestic content requirement than in its absence (Proposition 5).

In the next section, we test these predictions in the data.

4 Empirical analysis

We focus on the 1989 Canada-United States Free Trade Agreement (CUSFTA) and examine how variation in content requirements, tariffs, and market structure across goods and industries are empirically linked to variation in prices and entry. We begin our discussion by setting out, in Section 4.1, how we measure the stringency of CUSFTA's rules of origin. Section 4.2 provides an overview of our data and summary statistics. Sections 4.3 and 4.4 delve into the empirical evidence, testing the two main predictions derived from our theoretical framework as summarized in Section 3.4.

To study the effects of CUSFTA's RoOs on prices (Prediction 1) and firm entry (Prediction 2), it is crucial first to identify the markets under consideration. According to the theory, stricter and binding content requirements should have an impact on both US and Canadian intermediate goods markets, including: (i) domestic sales by US domestic intermediate good producers to US producers of final goods that export to Canada (the FTA partner); (ii) export sales by US intermediate good producers to Canadian producers of final goods that export to the US; (iii) domestic sales by Canadian intermediate good producers to Canadian producers of final goods that export to the US; and (iv) export sales by Canadian intermediate good producers to US producers of final goods that export to Canada.[21]

[21] This implies the simplifying assumption that intermediates are only used to produce goods that are

In the empirical analysis, we first turn to US Producer Price Indices (PPI) data for 1987 (pre-CUSFTA, in the absence of regional content requirements) and 1992 (post-CUSFTA, when regional content requirements were in place) in combination with US Census data on industry structure to provide industry-level evidence for Prediction I on domestic prices (in Section 4.3), and Prediction II on firm entry in domestic markets (in Section 4.4). These analyses correspond to cases (i) and (ii) described above, both of which can contribute to raise US producer prices and to encourage entry following CUSFTA, with these effects being predicted by the theory to vary with the stringency of content requirements and the size of Most Favored Nation (MFN) tariffs, and comparatively more so in oligopolistic industries.[22]

In Section 4.3, we further show that CUSFTA RoOs have effects not only on domestic prices but also on trade prices. We provide province-product level evidence for Canadian export prices spanning 1989-2000. This is achieved by comparing post-CUSFTA changes in unit values (relative to 1988) for Canadian exports to the US with corresponding changes for Canadian exports to other destinations, and examining how the gap between these changes varies with the stringency of content requirements and the size of MFN tariffs. This is a direct test of Prediction 1 for case (iv) above.[23]

4.1 CUSFTA RoO index

In our theoretical analysis, for simplicity, we consider a value-based content requirement where RoO stringency is represented in terms of a single parameter, r. When testing our theoretical predictions in relation to CUSFTA's RoOs, however, we need to account for the fact that these rules are list-based, with a unique feature: they prescribe, at the product level, 100% FTA origin for a list of named inputs.[24] This leads to substantial

sold to final users. In practice, some of the output is sold to other producers who use it as an input in production. Our arguments would continue to apply to a setting with an unrestricted input-output structure as long as producers of intermediates face incentives to meet CUSFTA's content requirements.

[22]The definition of US producer price indices covers the entire marketed output of US producers, including exported goods. In our empirical specification, we use US input-output data to account for different shares of intermediate goods versus final goods across industries.

[23]For trade prices, our choice of focusing on case (iv) rather than on (ii) is due to the availability of Canadian trade data at the province-product level, which allows us to account more precisely for variation in production costs across locations of origin. Case (iii) is not examined due to constraints in data availability.

[24]In a setup with multiple varieties of a single input category (the scenario we consider in Section 3), a 100% regional requirement under binding tariffs amounts to directly restricting competition to a subset of $N < 2N$ oligopolistic intermediate goods producers, resulting in a higher oligopolistic markup. In relation to specificity, with multiple input categories that are, to some extent, substitutes, there is an additional competitive margin that would need to be accounted for in deriving equilibrium markups and that is absent under the uniform requirement we study (in that case it would be optimal for users to modify their input mix uniformly across input categories). Still, theoretical predictions are unchanged in qualitative terms.

variation in content requirements across different goods and industries.

To obtain a systematic measure of this variation, we introduce a novel RoO index based on the mapping of CUSFTA's rules of origin as detailed by Conconi et al. (2018).[25] The mapping is at the HS 6-digit level, where for each final good, we can trace all listed inputs that are subject to content requirements. In total, the mapping pins down more than 700,000 input-output linkages, covering 4,850 HS 6-digit products, out of a total of 5,228 products in the 1988/92 HS classification.[26] While CUSFTA's RoOs require all the restricted inputs associated with a final good to be fully sourced within the FTA in order for the final product to qualify for preferential tariffs, it is important to note that each restricted input is also likely to have its own set of rules, contributing to overall complexity. This also means that each additional input that is individually listed in the rule constitutes an additional and distinct hurdle, as producers cannot readily source similar inputs from third countries and claim origin after making minor modifications.

For each HS 6-digit *intermediate* good i defined in CUSFTA's rules of origin, we derive an index, ROI_i, that accounts for both (i) the content requirement coverage for input i, defined as the total number, N_i^O, of listed final goods associated with i, and (ii) the stringency of content requirements of final goods associated with i, defined, for each output k listing i in the rules, as the total number, N_k^I, of listed inputs (including i itself) used to produce k.[27] Specifically:

$$ROI_i = N_i^O \times \sum_{k \in K_i} s_{ik}^x N_k^I, \tag{22}$$

where s_{ik}^x denotes the share of exports of output k to the FTA region in the total exports of all outputs associated with i, and K_i is the set of final goods for which i is a listed input.[28] In our empirical analysis, we use the trade share of US exports to Canada in total US exports for s_{ik}^x.[29] Therefore, the expression $\sum_{k \in K_i} s_{ik}^x N_k^I$ measures the weighted "average stringency" of content requirements for input i across all associated outputs

[25] See their paper for a detailed discussion of the process to obtain origin status, which is quite stringent and challenging to circumvent. Also note that the mapping does not account for the effects of cumulation rules (Bombarda and Gamberoni, 2019).

[26] All but one product are listed as both inputs and outputs. Each final good is associated with multiple intermediate inputs (median: 37) and each intermediate input can be listed under multiple final goods as well (median: 41).

[27] The identification of intermediate goods in the RoO index is derived directly from CUSFTA's content requirements, as defined in Conconi et al. (2018), specifically as input.

[28] Formally, $s_{ik}^x \equiv X_k^{\text{FTA}} / \sum_{k \in K_i} X_{ik}$, where X_k^{FTA} denotes exports of k to the FTA region and X_k denotes total exports of k. This expression can be decomposed and interpreted as $\frac{X_k}{\sum_{k \in K_i} X_{ik}} \times \frac{X_k^{\text{FTA}}}{X_k}$ where the first term captures output k's relative importance in the export market, and the second term captures the relative importance of exports to the FTA region.

[29] All aggregate trade data are from the World Integrated Trade Solution (WITS). The choice of trade shares relates to the most relevant cases (i) and (iv) as described in the beginning of this section, which focus on conditions that US final good exports to Canada must meet to qualify for preferential tariffs.

in the set K_i. The index is then standardized and normalized to fall between zero and one at the industry level, to account for the fact that some production processes require more inputs than others.[30]

Note that the quantity of input i used in producing k is immaterial, due to CUSFTA's list-based content requirements mandating all listed inputs to be entirely sourced from within the FTA region. Unlike value-based rules, where input share matters, under list-based rules, the input share is stipulated to be 100% for all listed inputs, thus holding no significance in determining the level of stringency in the index. In Appendix B, we provide a formal discussion and demonstrate how our index aligns with a value-based rule.

For our industry-level analysis, we aggregate the index in (22) at the the industry j level (4-digit SIC or 2-digit HS depending on the empirical specification considered) as

$$ROI_j = \sum_{\{i \text{ s.t. } j(i)=j\}} s_{ij}^x ROI_i, \tag{23}$$

where s_{ij}^x is the export share of input i in the total exports of industry j.[31] To understand how this index varies depending on the rules, consider the following hypothetical example with two outputs, cars and bottles, and suppose that content requirements dictate that the production of cars necessitates four specific inputs—glass, steel, rubber, and leather—to be entirely sourced within the FTA, whereas, for bottles, there are only two named inputs that must originate in the FTA: glass and plastic. For simplicity, suppose that the trade values for cars and bottles are equal. Let us specifically compare steel and glass. We would initially assign an index of 4 $(= 1 \times (4 \times 100\%))$ to steel with $N_i^O = 1$, $s_{ik}^x = 100\%$, $N_k^I = 4$ in (22), and an index of 6 $(= 2 \times (4 \times 50\% + 2 \times 50\%))$ to glass with four inputs all to be fully sourced within the FTA for cars and two inputs for bottles. These values would later be standardized and normalized into the final RoO index. In this example, glass attains a higher index, showcasing a scenario where coverage takes precedence over stringency. Our example illustrates that both coverage and stringency could contribute to determining the overall restrictiveness of RoOs. For instance, an input listed for only one output could potentially have a very high RoO index if a substantial number of other inputs are also listed, indicating that stringency dominates.

In general, the industry ranking for 2-digit HS categories based on the degree of restrictiveness in CUSFTA's content requirements (measured by average RoO index before standardization) is, from high to low: Chemicals, Textiles, Minerals, Animal & Animal Products, Metals, Stone/Glass, Wood, Miscellaneous, Vegetables, Plastics/Rubbers,

[30] The coefficient of variation (CV) of the RoO index within 2-digit HS industries has a mean of 0.18 and a median of 0.04. These statistics suggest that the RoO index does not exhibit substantial variation across products within industries.

[31] This aligns with the trade shares s_{ik}^x in (22). Using import shares does not alter the qualitative findings of our analysis.

Raw Hides/Skins/Leather, Foodstuffs, Footwear, Machinery, and Transportation.[32]

4.2 Data

To examine our theoretical predictions regarding the impact of binding content requirements on prices and firm entry, we utilize two distinct datasets: industry-level price and census data related to US manufacturing industries and product-level data on Canadian exports. We next delve into the specifics of each dataset and present summary statistics.

Our main price data comprises annual US PPI data for manufacturing industries sourced from the US Bureau of Labor Statistics. Additionally, we identify the number of firms in each US industry and industry-level concentration measures (specifically, the Herfindahl-Hirschman Index, HHI) extracted from the Census data for the years 1987 (pre-CUSFTA) and 1992 (post-CUSFTA). The Census data also contain other information such as values of shipments, which we use as controls. After dropping industries with no products defined in CUSFTA's RoOs, our full sample covers 334 industries at the 4-digit SIC level out of the total of 440 in manufacturing sector (SIC 20-39).

Table 1 reports descriptive statistics for the 334 SIC industries. PPI changes between 1987 and 1992 average to approximately 13.57 percent, with minimum and maximum PPI changes at -31.69 percent and 45.41 percent, respectively. The distribution of the RoO index, as defined in (23), is also reported at the SIC level. Regarding industry concentration, the HHI spans from 4 to 2,830, with a mean of 671. It is worth noting that a market with an HHI below 1,500 is generally considered competitive, while an HHI above 1,500 indicates moderate to high concentration.[33] We list the top and bottom ten US sectors based on the rankings of the HHI and RoO indices in Appendix C.

On average, the number of firms shows a small increase (approximately 0.57 percent), but there is variation across industries, with the minimum indicating a firm exit by 146.63 percent and the maximum suggesting a firm entry by 53.41 percent. Sales, on average, grow by 17.25 percent over the period considered, but growth rates vary across industries, ranging from -72.15 percent to 113.17 percent. In the final two rows of Table 1, we present the average tariff gaps at the SIC industry level between the US MFN rates and the CUSFTA rates. These gaps are reported for all intermediate goods defined in CUSFTA's content requirements (input tariff gaps) and for all associated outputs (output tariff gaps). The average tariff gaps for both categories are approximately 2%, with a range from zero to around 10%. All tariff data are sourced from the World Integrated Trade Solution (WITS).

The second dataset incorporates export prices data to complement our industry-level analysis, using Canadian product-level monthly trade statistics from Statistics Canada for the post-CUSFTA period (1988-2000). Information on monthly exports data includes

[32] For the 2-digit SIC sector ranking and additional summary statistics of the RoO index, see Section 4.2.

[33] See U.S. Department of Justice & FTC, "Horizontal Merger Guidelines" (2010), available at https://www.justice.gov/atr/herfindahl-hirschman-index.

Table 1: Summary Statistics: US manufacturing industries (SIC)

	Mean	Median	Std. dev.	Min	Max
Observations	334	–	–	–	–
PPI change (%), 1987-1992	13.57	14.07	0.09	−31.69	45.41
RoO index (at the 4-digit SIC level)	0.32	0.29	0.12	0	1
Herfindahl-Hirschman Index (HHI)	671	461	610.06	4	2,830
Firm number change (%), 1987-1992	0.57	2	0.19	−146.63	53.41
Sales change (%), 1987-1992	17.25	18.28	0.21	−72.15	113.17
Avg. tariff gaps (RoO input)	0.02	0.02	0.02	0	0.1
Avg. tariff gaps (RoO associated output)	0.02	0.01	0.01	0	0.09

Notes: For each variable, the table reports its mean, median, standard deviation, and the minimum and maximum values.

the 6-digit HS classification of product codes, the province of origin, the value, the mass, the unit of measurement, the time of exports (year and month), and the destination country. Given that export prices are not observed, we proxy export prices with unit values computed as the ratios between the value and the corresponding mass at monthly frequency.[34]

We clean the data in several ways. First, we drop those observations for which the value of exports is recorded as positive but the corresponding mass is zero or undefined. Second, we aggregate the data at an annual frequency by computing the yearly average of unit values for each observation at the province$\times$product$\times$country level. Finally, to minimize the influence of potential outliers, we exclude the 0.5 percent of observations with the largest and smallest log change in unit value gaps from the initial gaps in 1988 between FTA and non-FTA regions (our dependent variable, akin to a triple difference approach)—one percent of all observations in total.

The cleaned sample contains only intermediate inputs (for industrial use) that are defined in CUSFTA's rules of origin and had been traded since 1988 with both FTA and non-FTA regions.[35] Therefore, in the sample, the same goods are exported to both the US (the FTA region), which accounts for roughly 85 percent of total exports, and the rest of the world, with a broad coverage of destination countries. The largest market in the non-FTA region is Japan (31.5 percent), followed by the UK (7.4 percent), China (6.17 percent), South Korea (5.64 percent), Germany (5.01 percent), Netherlands (3.63 percent), Italy (3.33 percent), and Belgium (2.93 percent).

[34]The data contain 20 very detailed units of measurements. These include, for example, KGM (kilogram), NMB (number), TNE (Metric tonne), MTK (square metre), TMQ (1,000 cubic metres), TSD (metric tonne air dry), LTR (litre), and PAR (pair). With this additional information we are able to measure unit values more precisely.

[35]Good classification is based on the Broad Economic Categories (BEC) classification, which categorizes goods into three types: intermediate goods for industrial use, capital goods, and consumption goods. Results for capital and consumption goods can be found in the robustness section.

Table 2: Summary Statistics: Canadian exports

	Mean	Median	Std. dev.	Min.	Max.
Observations	54,536	–	–	–	–
Products	1,071	–	–	–	–
Destination countries	158	–	–	–	–
RoO Index (at the 6-digit HS level)	0.27	0.24	0.14	0	1
Log change in univ value gaps (%)	0.13	0.031	1.4	−7.76	8.94
Log unit values (Canadian dollars): US	3.49	3.52	2.84	−3.25	13.89
Log unit values (Canadian dollars): non-US	3.23	2.73	2.94	−4	14.63
Log transaction values: US	16.47	16.67	2.76	4.8	23.07
Log transaction values: non-US	11.99	11.76	2.63	0.69	21.65
Preferential ad valorem tariffs (%)	1.7	0	4.77	0	78.04
MFN ad valorem tariffs (%)	3.87	1.95	6.63	0	86.74

Notes: For each variable, the table reports its mean, median, standard deviation, and the minimum and maximum values.

As shown in Table 2, our sample includes 1,071 intermediate products and 158 destination countries (including the US) with a total of 54,536 observations. The distribution of the RoO index, as defined in (22), is reported at the product level (HS 6-digit). It is worth noting that the distribution of the RoO index appears to be evenly distributed across different destinations (regions).[36] Our primary variable of interest, the unit value gap between FTA and non-FTA regions, increases by 13 percentage points from 1988.

We can also see that unit values and transaction values are both slightly higher for US-bound exports than for exports to the rest of the world. Table 2 also shows the distributions of CUSFTA's preferential tariffs and MFN tariffs, as reported by the US. Overall, CUSFTA's preferential tariffs are significantly lower on average, and although many products face a zero rate, trade barriers within CUSFTA are not eliminated completely.

4.3 Empirical analysis: RoOs and regional prices

We begin with testing our Prediction I, namely that stricter content requirements are associated with higher regional prices, that a given content requirement is more likely to be binding the smaller are input tariffs and the larger are output tariffs, and that the effect on prices in a given intermediate goods industry is more likely to large the more concentrated the industry is. Section 4.3.1 presents evidence on US manufacturing prices at the industry level, while Section 4.3.2 looks at Canadian export prices at the product level.

[36] These results are not presented here but can be made available upon request.

4.3.1 US manufacturing prices

For evidence of the effects of content requirements on US manufacturing prices, we run the following regression with US PPI and Census data (the first dataset discussed in Section 4.2):

$$\begin{aligned} PPI\_Change_j = \quad & \gamma_0 + \gamma_1\, ROI_j + \gamma_2\, D_j^{TB} + \gamma_3\, ROI_j \times D_j^{TB} + \gamma_4\, \Delta ti_j + \gamma_5\, \Delta tf_j \\ & + \vec{\gamma}_\chi \chi_j + \delta_{SIC\_2} + \epsilon_j, \end{aligned} \tag{24}$$

where $PPI\_Change_j \equiv \ln(PPI_{j,92}) - \ln(PPI_{j,87})$ is the log change of PPI from 1987 (pre-CUSFTA) to 1992 (post-CUSFTA) for industry j.[37] The RoO index is denoted by ROI_j, and measures the restrictiveness of CUSFTA's content requirements for industry j as defined in (23).

The role of import and export tariffs in generating binding constraints on US producers for given content requirements is captured by a dummy variable, D_j^{TB}, which takes the value of one (and zero otherwise) if the following two conditions are both met: the input tariff gap of industry j between the US's external MFN and preferential tariffs is below the sample median, and the output tariff gap of final goods associated with industry j between Canada's MFN and preferential tariffs is above the sample median.[38]

Given that our theoretical predictions are applicable to US intermediate good producers that sell to exporters of final goods to the FTA region (cases (i) and (ii) discussed in the beginning of Section 4), we account for the intermediate good share and export share by weighting observations in specification (24) with the product of: (a) industry j's share of output that is used as an input by other industries, calculated with US input-output tables in 1987 published by the US Bureau of Economic Analysis (BEA), and (b) the trade share of exports to Canada in total US exports of final goods associated with industry j's products used as intermediate inputs, which reflects the relative importance of CUSFTA's rules of origin in industry j's pricing decisions.

Fixed effects are included at the SIC 2-digit level (δ_{SIC_2}) to account for sector-specific factors that could affect marginal costs. We also control for the absolute tariff gaps between the preferential and MFN tariffs for all input products in an industry j and for

[37] Changes in PPIs reflect changes in prices that affect all users and are therefore fully independent of quality variation in sales across different buyers.

[38] In variant specifications, we relax or tighten these thresholds to the 25th or the 75th percentile for both tariffs. Note that as we focus on US intermediate good sectors, the relevant MFN input tariffs are those that apply to competing intermediate imports into the US from non-FTA regions and the relevant MFN output tariffs are those that apply to competing imports of final goods into Canada from non-FTA regions. In robustness checks, we carry out a placebo test that shows that MFN input tariffs facing Canada and output tariffs facing the US have no effects on price differentials. We also conduct robustness tests using the input tariff condition and the output tariff condition separately. The results show either non-significance (with the input tariff condition) or marginal significance (with the output tariff condition). These findings align with the predictions of our theoretical analysis, which says that both conditions must be met for RoOs to be binding. These results are not presented here but are available upon request.

all associated output products (Δti_j and Δtf_j, respectively), as these may have a direct impact on pricing. Log changes in firm numbers and sales between the years of 1987 to 1992 are also used as extra controls (χ_j). We also consider a variant specification where we further interact all variables with a dummy for industries with a high HHI, indicating a market structure that is closer to oligopoly, and we test Prediction I that the coefficient on the interaction $ROI_j \times D_j^{TB}$ should be positive for oligopolistic industries.[39]

Estimation results

Table 3 Panel A presents estimation results for (24). Column (1) reports results for the full sample of 334 SIC 4-digit industries; even without accounting for market structure, the coefficient on $ROI_j \times D_j^{TB}$, our coefficient of interest, has the expected positive sign (0.171) and is significant at the 5% level.

In column (2) we interact all variables with a dummy that takes the value of one if the industry's HHI was above $1,500$ in 1987 ($Olig_j = 1$) and is zero otherwise. This gives 45 oligopolistic industries (out of 334). Stricter and binding RoOs are associated with higher prices for oligopoly industries only, offering evidence in support of Prediction I, according to which effects should be stronger in oligopolistic markets: the coefficient on the interaction $ROI_j \times D_j^{TB} \times Olig_j$ is significantly greater than zero at the 1% level, whereas the coefficient for non-oligopolistic industries is significant at the 10% level.

Notice that a higher RoO index itself is not necessarily associated with a higher PPI change, as the coefficient for the RoO index, ROI_j, is mostly insignificant. This suggests that it is not the content requirement alone but rather its interaction with the stringency of tariffs that is associated with higher PPI increase. The negative coefficient on the binding tariffs dummy, D_j^{TB}, isolates the effect of tariff gaps, and can be interpreted as reflecting the fact that, when goods fall into the binding tariffs group ($D_j^{TB} = 1$), they face lower input MFN tariffs, which translates into more competition in export markets and lower prices—in line with the predicted positive relationship between the input tariff and the markup in (13) absent a content requirement.

In column (3), we drop the extra controls (changes in sales and firm numbers) and our results remain very similar to those in column (2). In column (4) we use a higher HHI threshold for defining oligopolistic industries, giving us 28 oligopolistic industries, and see a slightly larger magnitude for the coefficient on the triple interaction $ROI_j \times D_j^{TB} \times Olig_j$. In column (5) we consider a lower HHI threshold (giving us now 53 oligopolistic industries); overall, our results are robust to using different HHI thresholds.

Panel B of the table presents the differences in predicted effects on PPI_change_j across various levels of the RoO index. Results are shown for the full sample in column (1) and for oligopoly industries ($Oligj = 1$) in columns (2)-(5), conditional on tariffs being binding ($D_j^{TB} = 1$) in all columns. These include estimates of the magnitude of the predicted combined effect $\hat{\gamma}_1 + \hat{\gamma}_3$ in (24) at different points of the distribution of ROI_j.

[39] The RoO index and sectoral HHI measures do not exhibit any significant correlation in the data.

Table 3: Rules of origin and US PPIs

Dep. variable: PPI_change_j	(1)	HHI $\geq 1,500$ as oligopoly (2)	(3)	HHI $\geq 1,800$ as oligopoly (4)	HHI $\geq 1,200$ as oligopoly (5)
Panel A: Estimates					
ROI_j	-0.035 (0.032)	–	–	–	–
$ROI_j \times (Olig_j = 0)$	–	-0.026 (0.033)	-0.027 (0.035)	-0.025 (0.032)	-0.019 (0.034)
$ROI_j \times (Olig_j = 1)$	–	-0.062 (0.137)	-0.044 (0.141)	-0.116 (0.153)	-0.122 (0.123)
D_j^{TB}	-0.064^c (0.032)	–	–	–	–
$D_j^{TB} \times (Olig_j = 0)$	–	-0.027 (0.024)	-0.034 (0.025)	-0.024 (0.024)	-0.027 (0.024)
$D_j^{TB} \times (Olig_j = 1)$	–	-0.789^a (0.193)	-0.838^a (0.184)	-0.965^a (0.22)	-0.709^a (0.216)
$ROI_j \times D_j^{TB}$	0.171^b (0.08)	–	–	–	–
$ROI_j \times D_j^{TB} \times (Olig_j = 0)$	–	0.1^c (0.059)	0.115^c (0.061)	0.093 (0.06)	0.097 (0.06)
$ROI_j \times D_j^{TB} \times (Olig_j = 1)$	–	1.927^a (0.595)	2.04^a (0.566)	2.386^a (0.798)	1.768^a (0.653)
Panel B: Predicted effects of ROI_j on PPI_change_j for $D_j^{TB} = 1$ and $Olig_j = 1$ (for columns (2)-(5))					
ROI_j : P50 - P25	0.002^b (0.001)	0.034^a (0.011)	0.037^a (0.01)	0.042^a (0.014)	0.031^a (0.012)
ROI_j : P75 - P25	0.013^b (0.007)	0.185^a (0.057)	0.198^a (0.054)	0.225^a (0.077)	0.163^a (0.063)
ROI_j : P95 - P25	0.035^b (0.017)	0.481^a (0.148)	0.516^a (0.141)	0.586^a (0.202)	0.426^a (0.164)
FE: Sector	Yes	Yes	Yes	Yes	Yes
Extra controls	Yes	Yes	No	Yes	Yes
Observations	334	334	334	334	334
R^2	0.23	0.293	0.253	0.303	0.285

Notes: The dummy variable, D_j^{TB}, equals one (and zero otherwise) if both binding conditions are satisfied: the input tariff gap of industry j between the US's external MFN and preferential tariffs is below the sample median, and the output tariff gap of final goods associated with industry j between Canada's MFN and preferential tariffs is above the sample median. The *Olig* dummy, tariff gaps, ROI_j and extra controls (changes in sales and firm numbers) are included but not reported. All columns are weighted with the product of two ratios: industry $j's$ share of production used as intermediate inputs, and Canada's share in US exports of final goods associated with industry j's products used as intermediate inputs. ^{a} indicates significance at the one percent level, ^{b} indicates significance at the five percent level and ^{c} indicates significance at the ten percent level. Standard errors are clustered at the SIC 2-digit level and reported in parentheses.

Overall, a monotonic relationship is observed across all columns between the RoO index and PPI changes when the conditions for RoOs to be binding are met. In column (1), we note that for the full sample, industries at the 75th percentile RoO index exhibit, on average, roughly 1.3 percentage points higher PPI changes than industries at the 25th percentile RoO index, and this estimate is statistically significant at the 5% level.[40]

In column (2), estimates for oligopoly industries show a significantly higher magnitude. Specifically, industries at the 75^{th} percentile RoO index, on average, exhibit roughly 18.5 percentage points higher PPI changes than industries at the 25th percentile RoO index. Estimates are of comparable magnitudes when employing different binding thresholds in columns (4) and (5). In summary, these findings strongly support Prediction I, indicating that more stringent and binding content requirements are associated with higher prices, with a more pronounced effect observed in oligopoly industries.

Robustness

Appendix D reports results of robustness checks, which are supportive of our main findings. In summary, we show in Table D1 that our estimates for PPI changes remain similar when running an unweighted regression, when using different trade shares as regression weights, and when using trade weights as additional controls. Our findings are qualitatively robust to adopting stricter or looser binding criteria for tariffs, with a slight loss of significance for looser binding criteria.

4.3.2 Canadian export prices

Evidence on the relationship between content requirement and regional prices can also be found by comparing prices for Canadian manufacturing exports to the US with the corresponding prices for exports to other destinations. This corresponds to case (iv) outlined in the beginning of this section, which concerns Canadian intermediate good exporters whose products are used by US producers of final goods that export to Canada. Specifically, focusing on Canadian exports over the period 1989-2000 that follows the formation of CUSFTA (dataset 2 discussed in Section 4.2), we compare export prices of intermediate inputs to the US (where exporters of final goods face CUSFTA's regional content requirements) with export prices to non-CUSFTA destinations.

To test Prediction I—that a given content requirement is more likely to be binding the larger is the required level of domestic content, the smaller are input tariffs, and the larger are output tariffs—we run the following triple-difference regression:

$$\Delta p_{inct} = \alpha_0 + \alpha_1 \, ROI_{it} + \alpha_2 \, D_i^{TB} + \alpha_3 \, ROI_{it} \times D_i^{TB} + \delta_{j(i)nc} + \delta_{ct} + \varepsilon_{inct} \, , \tag{25}$$

where $\Delta p_{inct} \equiv (\ln p_{int}^{US} - \ln p_{inct}) - (\ln p_{in,88}^{US} - \ln p_{inc,88})$ is the differential log change between year 1988 and year t in the unit value gap for exports to the US relative to exports

[40]This is calculated as $(\hat{\gamma}_1 + \hat{\gamma}_3 \mid ROI_j = \text{P75 and } D_j^{TB} = 1) - (\hat{\gamma}_1 + \hat{\gamma}_3 \mid ROI_j = \text{P25 and } D_j^{TB} = 1)$.

to country c (other than the US) for good i originating in province n; and where ROI_{it} is the RoO index which measures the restrictiveness of CUSFTA's content requirements for good i as defined in (22).[41] This approach allows us to account for product-level and province-level trends in Canadian exports. As in (24), the role of import and export tariffs in generating binding constraints for given content requirements is captured by a dummy variable, D_i^{TB}, which takes the value of one if the following two conditions are both met: the input tariff gap of good i between the US's external MFN and preferential tariffs is below an arbitrary threshold starting with the sample median (P50), and the output tariff gap of final goods associated with good i between Canada's MFN and preferential tariffs is above an arbitrary threshold starting with the sample median (P50)—taking a value of zero otherwise.[42]

Our definition of the price differentials, Δp_{inct}, accommodates time-varying cost factors for specific product-province pairs. It also takes into account initial quality differentials (as of 1988). We also include industry (HS 2-digit)$\times$province$\times$destination fixed effects, $\delta_{j(i)nc}$ (with $j(i)$ denoting the industry category to which good i belongs), which control for how systematic variation in good characteristics across different industries and provinces of origin may contribute to price differentials—e.g., quality selection effects in response to variation in the relative incidence of transportation costs by distance (Alchian and Allen, 1967), or income-related variation in quality demand for a given province-industry pair across destinations. Finally, we include destination$\times$time fixed effects, δ_{ct}, that control for time-varying and destination-specific factors such as income and exchange rate fluctuations. All regressions are weighted by relative trade values, so that observations with higher trade shares relative to the US would be assigned higher weights.[43]

Specification (25) exploits the variation in rules of origin over time and across products within an industry, using unit value gaps to proxy for price differentials for goods exported to the US versus goods exported to non-FTA destinations, controlling for costs and quality gaps across markets. According to Prediction I, the unit value gap Δp_{inct} should be larger where ROI_{it} is comparatively higher and, simultaneously, the binding criteria for tariffs are met. We also explore variant specifications by introducing interactions with a dummy variable as an indicator of market structure, such as the product concentration ratio, the classification of good characteristics according to Rauch (1999),

[41]The time-varying dimension comes from the trade shares used as weights in the calculation of the RoO index.

[42]As our focus is on the prices charged by Canadian exporters to US importers of intermediate inputs, the relevant MFN input tariffs are those that apply to competing intermediate imports into the US from non-FTA regions. And as US final goods producers are the ones facing origin requirements, the relevant MFN output tariffs are those that apply to competing imports of final goods into Canada from non-FTA regions. In robustness checks, we carry out a placebo test that shows that MFN input tariffs facing Canada and output tariffs facing the US have no effects on price differentials.

[43]Results are robust to using industry-level tariff binding thresholds. These results are available upon request.

and end use of products according to the Broad Economic Categories (BEC) classification.[44]

Estimation results

Results for specification (25) with our full sample are reported in Panel A of Table 4. Columns (1)-(4) use median values (P50) for all tariffs as binding criteria with different combinations of fixed effects. Focusing on column (4), our preferred specification, the main coefficient of interest (the coefficient on the interaction $ROI_{it} \times D_i^{TB}$) is 1.363, positive and statistically significant, indicating that stricter and more likely to be binding content requirements are associated with a higher unit value gap between FTA and non-FTA regions. Notice again that a higher RoO index itself is not necessarily associated with a higher unit value gap, as the coefficient for the RoO index alone is mostly insignificant, consistent with the US PPI results. Similarly, the negative coefficient on the binding tariffs dummy (-0.29) reflects the fact that, when goods fall into the binding tariffs group ($D_i^{TB} = 1$), they face lower input MFN tariffs, which translates into more competition in export markets and lower prices—consistent with the predicted positive relationship between the input tariff and the markup in (13) absent a content requirement.

In column (5), we consider stricter criteria for binding tariffs, using the 25th percentile (P25) for input tariff gaps and the 75th percentile (P75) for output tariff gaps. The estimated effect on unit value gaps is wider (2.475), pointing to stronger market power of Canadian exporters of goods facing more stringent content requirements. In column (6), where we consider looser tariff binding thresholds with P75 for input tariff gaps and P25 for output tariff gaps, our results remain significant.

With regard to the magnitude of the combined effect $\hat{\alpha}_1 + \hat{\alpha}_3$ in (25), Panel B of the table displays predicted effects on $\Delta\hat{p}_{inct}$ at different levels of the RoO index, contingent on tariffs being binding ($D_i^{TB} = 1$). Focusing again on column (4), goods at the 75th percentile RoO index have on average 28.4 percentage points higher unit value gaps between FTA and non-FTA export markets than goods at 25th percentile RoO index.[45] In line with results in Panel A, the estimated gap of unit values becomes wider with stricter tariff binding criteria (column (5) of Panel B), at 50.5 percentage points, again suggesting stronger market power of Canadian exporters under more strictly binding content requirements. In column (6), with less stringent tariff binding thresholds, the estimate is lower, at 17.1 percentage points.

Table 5 investigates the importance of market structure through a modified specification of (25), incorporating an additional dummy variable D_i^{GC}. This variable categorizes

[44]Due to the inadequate alignment between SIC and HS codes and the exclusion of numerous observations, we opt not to use US HHI as a proxy.

[45]Formally, this is calculated as $\left(\hat{\alpha}_1 + \hat{\alpha}_3 \mid ROI_{it} = \text{P75} \text{ and } D_i^{TB} = 1\right) - \left(\hat{\alpha}_1 + \hat{\alpha}_3 \mid ROI_{it} = \text{P25} \text{ and } D_i^{TB} = 1\right)$.

Table 4: Rules of origin and unit export values

Dep. variable: Δp_{inct}	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Estimates						
ROI_{it}	0.123 (0.107)	0.152 (0.156)	0.165 (0.116)	0.23 (0.156)	0.359^{c} (0.189)	-0.078 (0.161)
D_i^{TB}	-0.452^{a} (0.071)	-0.321^{a} (0.071)	-0.396^{a} (0.076)	-0.29^{a} (0.078)	-0.688^{a} (0.086)	-0.281^{a} (0.071)
$ROI_{it} \times D_i^{TB}$	1.918^{a} (0.311)	1.609^{a} (0.291)	1.699^{a} (0.334)	1.363^{a} (0.319)	2.475^{a} (0.28)	1.036^{a} (0.245)
Panel B: Predicted effects of ROI_{it} on $\Delta\widehat{p}_{inct}$ for $D_i^{TB}=1$						
ROI_{it} : P50 − P25	0.145^{a} (0.025)	0.125^{a} (0.027)	0.133^{a} (0.027)	0.113^{a} (0.029)	0.202^{a} (0.028)	0.068^{a} (0.019)
P75 − P25	0.364^{a} (0.062)	0.314^{a} (0.067)	0.332^{a} (0.067)	0.284^{a} (0.072)	0.505^{a} (0.07)	0.171^{a} (0.048)
P95 − P25	0.814^{a} (0.138)	0.703^{a} (0.151)	0.744^{a} (0.15)	0.636^{a} (0.161)	1.131^{a} (0.156)	0.382^{a} (0.108)
Binding criteria	P50, P50	P50, P50	P50, P50	P50, P50	P25, P75	P750, P25
FE: prov.× ind.×country	No	Yes	No	Yes	Yes	Yes
FE: country×time	No	No	Yes	Yes	Yes	Yes
Observations	54,536	54,536	54,536	54,536	54,536	54,536
R^2	0.01	0.205	0.044	0.215	0.215	0.213

Notes: Binding criteria define the thresholds used for D_i^{TB}, so (P50,P50) refers to the median for input tariffs and the median for output tariffs. All columns are weighted with relative trade values of good i in year t between the US and non-FTA partner c. ^{a} indicates significance at the one percent level, ^{b} indicates significance at the five percent level, and ^{c} indicates significance at the ten percent level. Standard errors are clustered at the product×country level.

goods based on (i) the export concentration ratio, defined as the sum of the squared shares of each commodity in total exports within a 4-digit HS industry in 1988 (similar to the HHI, ranging from nearly zero to one), (ii) the degree of product differentiation according to the Rauch classification, and (iii) the end-use of products based on the BEC classification.[46] The binding criteria for tariffs are as in column (4) of Table 4.

In columns (1)-(2) of Table 5, we see that our main findings hold only for markets with higher export concentration ratios ($D_i^{GC} = 1$, row 6), using the median and the 25th percentile of concentration ratios as thresholds, respectively.[47] These findings strongly support the notion that the mechanism by which content requirements influence prices is more pronounced in less competitive markets. In column (3), we compare Rauch

[46]Canada's export concentration ratio is defined following the approach of Statistics Canada, as outlined in https://www150.statcan.gc.ca/n1/pub/13-605-x/2017001/article/54890-eng.htm. The results remain robust to specifying export concentration ratios at either the 4-digit HS-province or the 2-digit HS level (not reported). The Rauch classification categorizes goods into three types: differentiated products, reference priced goods, and homogeneous goods. The BEC classification further categorizes goods into three types: intermediate goods for industrial use, capital goods, and consumption goods.

[47]The median concentration ratio is 0.69 while the 25th percentile is 0.44.

Table 5: Rules of origin and unit export values: industry and good characteristics

Dep. variable: Δp_{inct} D_i^{GC}:	Concentration ratio >P50	Concentration ratio >P25	Differentiated goods	non-reference	non-capital/ consumption
	(1)	(2)	(3)	(4)	(5)
$ROI_{it}\times(D_i^{GC}=0)$	-0.324^c (0.176)	0.084 (0.244)	0.062 (0.155)	0.06 (0.162)	-0.205 (0.183)
$ROI_{it}\times(D_i^{GC}=1)$	1.044^a (0.235)	0.373^c (0.195)	0.182 (0.22)	0.264 (0.202)	0.239^c (0.144)
$D_i^{TB}\times(D_i^{GC}=0)$	0.048 (0.073)	0.264^c (0.146)	0.131^a (0.048)	0.229^a (0.085)	-0.071 (0.075)
$D_i^{TB}\times(D_i^{GC}=1)$	-0.395^a (0.077)	-0.347^a (0.075)	-0.784^a (0.124)	-0.41^a (0.076)	-0.366^a (0.075)
$ROI_{it}\times D_i^{TB}\times(D_i^{GC}=0)$	-0.141 (0.213)	-0.767^b (0.385)	-0.424^a (0.16)	-0.594^a (0.228)	-0.039 (0.236)
$ROI_{it}\times D_i^{TB}\times(D_i^{GC}=1)$	2.135^a (0.346)	1.727^a (0.329)	2.951^a (0.397)	2.08^a (0.346)	1.513^a (0.308)
FE: prov.×ind.×country	Yes	Yes	Yes	Yes	Yes
FE: country×time	Yes	Yes	Yes	Yes	Yes
Observations	54,025	54,025	53,959	53,959	96,627
R^2	0.222	0.217	0.22	0.218	0.155

Notes: In column (1), the threshold for high concentration ratio is P50 (= 0.69) whereas in column (2), the threshold is P25 (= 0.44). The binding criteria for tariffs are as in column (4) of Table 4. All columns are weighted with relative trade values of good i in year t between the US and the non-FTA partner c. ^{a} indicates significance at the one percent level, ^{b} indicates significance at the five percent level, and ^{c} indicates significance at the ten percent level. Standard errors are clustered at the product×country level.

differentiated goods ($D_i^{GC} = 1$) with non-differentiated goods ($D_i^{GC} = 0$). We would expect market power to be more relevant, and the effects of content protection more sizable, for differentiated goods compared to non-differentiated ones. We find that this is indeed the case: we obtain $\hat{\alpha}_3 > 0$ only for differentiated goods (see row 6). In column (4) we consider Rauch reference priced goods ($D_i^{GC} = 0$) versus non-reference priced goods ($D_i^{GC} = 1$); and, again, the main coefficient of interest is significant and of the expected sign only for non-reference priced products.

Guided by our theoretical predictions, our main analysis has focused only on the intermediate goods used to produce final goods qualifying for FTA preferential tariffs, excluding those goods that are classified as consumption and capital goods in the BEC classification. In column (5), we expand the sample to include consumption and capital goods. In this case, the dummy variable D_i^{GC} takes a value of one for intermediate goods (corresponding to our main sample) and zero for consumption and capital goods. We find that the interaction term between the RoO index and binding dummy is insignificant for consumption and capital goods ($D_i^{GC} = 0$), consistent with the theory's prediction that binding RoOs should enhance market power only for goods used as manufacturing inputs.[48]

[48]The coefficients do not coincide with those in column (4) of Table 4 because here we do not allow fixed

In summary, our findings support Prediction I: binding content requirements are associated with higher market power for producers of intermediate goods. Impacts of these content requirements on market power vary based on the levels of MFN input and output tariffs. Additionally, these effects are evident only in concentrated markets (as indicated by the export product concentration ratio), for differentiated goods (based on Rauch good classification), and for goods used as intermediate inputs for industrial use (according to BEC classification). These results align with the idea that product differentiation contributes to market power.

Further specification variants and robustness checks

Our empirical strategy of using changes in unit value gaps for exports net of any initial (1988) differences across destinations can account for unobservable, time-invariant quality differentials. However, it does not address variation in the strength of the relationship across different goods, such as quality gaps or differing degrees of competition at the product level. To address this, we run a Finite Mixture Model (FMM) specification based on (25) that can detect unobservable heterogeneity across goods in how RoOs and prices are linked.[49] These results are reported in Table D2 of Appendix D.

Appendix D also presents results from a battery of robustness checks, including variant specifications, alternative samples, and fixed effects (see Tables D3-D4). We also explore an alternative specification using a single-difference dependent variable, $\Delta p_{inct} \equiv \ln p_{inct} - \ln p_{inc,88}$, to separately examine two sub-samples of US-bound goods and non-US-bound goods (see Table D5). In general, the observed patterns support our main findings.

4.4 Empirical analysis: RoOs and firm entry

In this section, we examine Prediction II, asserting that, other things equal, the equilibrium number of suppliers of intermediate inputs should be higher under a binding domestic content requirement than in its absence—i.e., that rules of origin encourage entry.

To relate RoOs to changes in firm numbers pre- versus post-CUSFTA, we run the following specification with US Census data (dataset 1 discussed in Section 4.2):

$$D_j^{FN} = \theta_0 + \theta_1 \, ROI_j + \theta_2 \, D_j^{TB} + \theta_3 \, ROI_j \times D_j^{TB} + \theta_4 \Lambda_j + \delta_{SIC\_2} + \varepsilon_j, \tag{26}$$

where D_j^{FN} is a dummy variable that takes the value of one if there is an increase in US firm numbers from 1987 (pre-CUSFTA) to 1992 (post-CUSFTA) for sub-industry j (at SIC 4-digit level) and zero otherwise. All other variables, including the RoO index (ROI_j)

effects to vary by D_i^{GC}.

[49]See McLachlan and Peel (2000), for a comprehensive treatment of finite mixture modeling techniques.

and the binding dummy variable (D_j^{TB}), as well as the trade weights assigned to each industry, are as defined in specification (24).

Fixed effects are included at the SIC 2-digit level (δ_{SIC_2}), and we use the log changes in sales between the years 1987 to 1992 as an additional control (Λ_j). As in (24), we also consider a specification where we further interact variables with a dummy for industries with a high HHI and test the theoretical prediction that the coefficient on $ROI_j \times D_j^{TB}$ should be positive for oligopolistic industries.

Estimation results

Table 6 Panel A reports estimation results for specification (26). Column (1) reports results for the full sample of of 333 SIC 4-digit industries.[50] Without accounting for market structure, none of the coefficients is significant. In columns (2)-(3) we interact all variables with a dummy which takes the value of one if the industry's HHI in 1987 was above 1,500 ($Olig_j = 1$). Results from our main specification are reported in column (2) and indicate that stricter and binding RoOs are associated with relatively higher firm entry in oligopolistic industries only (the last row, where the coefficient is positive). In column (3), we drop the extra control (changes in sales) and results remain similar to those in column (2). The results are also robust to adopting a higher HHI threshold for defining oligopoly industries in column (4) and a lower level of HHI for defining oligopoly industries in column (5). Overall, these findings provide strong support for Prediction II on firm entry in oligopoly.

Panel B of the table illustrates the variations in predicted effects on the firm entry dummy across different levels of the RoO index. Results are displayed for the entire sample in column (1) and for oligopoly industries ($Olig_j = 1$) in columns (2)-(5), contingent on tariffs being binding ($D_j^{TB} = 1$) in all columns. In column (1), covering the full sample, no significant difference in the probability of firm entry is observed across various RoO index levels. On average, there is a 44-45% chance that an industry will experience an increase in firm numbers. The effect of RoOs becomes apparent when focusing on oligopoly industries in columns (2)-(5). Across all columns, a monotonic relationship is observed between the RoO index and the probability of firm entry when binding conditions are met. For instance, in column (2), industries at the 25th percentile RoO index have only a 19.4% probability of an increase in firm numbers, while this rises to 84.4% for industries at the 75th percentile RoO index.

Robustness

Appendix D presents the results of robustness checks that support our main findings. In summary, Table D6 demonstrates that our estimates for firm entry remain consistent across different specifications, including unweighted regression, using different trade

[50] Compared to the PPI exercise, one industry is dropped due to missing data on firm numbers.

Table 6: Rules of origin and firm entry

Dep. variable: D_j^{FN}		HHI $\geq 1,500$ as oligopoly		HHI $\geq 1,800$ as oligopoly	HHI $\geq 1,200$ as oligopoly
	(1)	(2)	(3)	(4)	(5)
Panel A: Estimates					
ROI_j	-0.077 (0.307)	–	–	–	–
$ROI_j \times (Olig_j = 0)$	–	-0.162 (0.409)	-0.083 (0.366)	-0.171 (0.334)	-0.144 (0.421)
$ROI_j \times (Olig_j = 1)$	–	0.395 (0.859)	0.344 (0.924)	0.81 (0.976)	0.112 (0.99)
D_j^{TB}	-0.074 (0.14)	–	–	–	–
$D_j^{TB} \times (Olig_j = 0)$	–	0.052 (0.171)	0.047 (0.17)	0.035 (0.158)	0.063 (0.179)
$D_j^{TB} \times (Olig_j = 1)$	–	-2.032^a (0.577)	-2.132^a (0.554)	-1.892^a (0.506)	-2.25^a (0.673)
$ROI_j \times D_j^{TB}$	-0.107 (0.378)	–	–	–	–
$ROI_j \times D_j^{TB} \times (Olig_j = 0)$	–	-0.345 (0.523)	-0.368 (0.552)	-0.33 (0.445)	-0.33 (0.513)
$ROI_j \times D_j^{TB} \times (Olig_j = 1)$	–	6.245^a (2.03)	6.506^a (2.029)	5.91^a (1.744)	6.707^a (2.262)
Panel B: Predicted effects of ROI_j on D_j^{FN} for $D_j^{TB} = 1$ and $Olig_j = 1$ (for columns (2)-(5))					
$ROI_j =$ P25	0.457^a (0.073)	0.194^b (0.075)	0.173^b (0.073)	0.258^a (0.053)	0.195^b (0.082)
$ROI_j =$ P50	0.454^a (0.072)	0.316^a (0.07)	0.301^a (0.072)	0.382^a (0.057)	0.318^a (0.075)
$ROI_j =$ P75	0.439^a (0.07)	0.844^a (0.159)	0.856^a (0.175)	0.919^a (0.135)	0.854^a (0.166)
FE: Sector	Yes	Yes	Yes	Yes	Yes
Extra controls	Yes	Yes	No	Yes	Yes
Observations	333	333	333	333	333
R^2	0.204	0.237	0.181	0.239	0.244

Notes: The $Olig_j$ dummy, changes in sales as an extra control and the variable ROI_j are included but not reported. All columns are weighted with the product of two ratios: (a) industry $j's$ share of production used as intermediate inputs for all industries, and (b) Canada's share in US imports of intermediate goods in industry j's products used as intermediate inputs. ^{a} indicates significance at the one percent level, ^{b} indicates significance at the five percent level and ^{c} indicates significance at the ten percent level. Robust standard errors are reported in parentheses.

shares as regression weights, and including of trade weights as additional controls. We also confirm in Table D7 that our findings are robust to using an alternative dependent variable, FN_change_j, defined as the log changes in the number of firms relative to the 2-digit SIC industry mean. Overall, the results are generally consistent with those presented in Table 6, although they lose significance when using stricter binding criteria.

5 Conclusion

The implications for oligopolistic competition and market structure of the specific institutional arrangements in trade agreements have received comparatively little attention, both in the academic literature and in the policy debate. With some notable exceptions (Neary, 2003), much of the trade literature has gravitated around the monopolistic competition paradigm, despite many real-world markets clearly being oligopolistic; and the policy debate has tended to stress the broad pro-competitive advantages of trade liberalization shying from away from more detailed distinctions between different market scenarios.

In oligopolistic markets, the RoOs that accompany the formation of FTAs can fundamentally undermine the pro-competitive effects of trade liberalization. Regional content requirements generate a degree of market segmentation that boosts the market power of oligopolistic producers of intermediate goods, translating into higher markups and higher prices even in the absence of decreasing returns to scale in production. We should then expect to observe higher markups under a binding domestic content requirement than they in its absence. In turn, domestic content requirements should be more likely to be binding the tighter is the requirement, the smaller are MFN input tariffs, and the larger are MFN output tariffs. These predictions are borne out by evidence in US PPI data and Canadian export data.

In light of the increasingly widespread adoption of FTAs, much of the "free" trade that is now taking place is actually constrained by content requirements. Under these conditions, although formal trade barriers may be low, the full pro-competitive gains of international market integration may fail to materialize.

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A Proofs of theoretical results

Derivation of equilibrium markups

Absent content requirements, the levels of demand faced by a representative supplier of intermediate goods, i, originating from producers of final goods in the FTA to which they belong and from the other FTA are then respectively equal to

$$
\begin{aligned}
q_{Dih} &= \left(\frac{Y/2}{P_h} + \frac{Y/2}{\tau_F P_h}\right)\left(\frac{P_h}{p_{Dh}}\right)^{\sigma}\left(\frac{p_{Dh}}{p_{ih}}\right)^{\sigma} = KY\, e(p_{Dh}, p_{Mh})^{\sigma-1}\ \left(p_{ih}\right)^{-\sigma}, \\
q_{Xih} &= \left(\frac{Y/2}{P_{h'}} + \frac{Y/2}{\tau_F P_{h'}}\right)\left(\frac{P_{h'}}{p_{Mh'}}\right)^{\sigma}\left(\frac{p_{Mh'}}{\tau_I p_{ih}}\right)^{\sigma} = KY\, e(p_{Dh'}, p_{Mh'})^{\sigma-1}\left(\tau_I p_{ih}\right)^{-\sigma},
\end{aligned}
\tag{27}
$$

with $\tau_F = 1 + t_F$ and $K \equiv (1/2)(1 + 1/\tau_F)$; and so its net profits are

$$
\Pi_{ih} = (p_{ih} - 1)\left(q_{Dih} + q_{Xih}\right) - F = \mu_{ih}\left(q_{Dih} + q_{Xih}\right) - F, \tag{28}
$$

where $\mu_{ih} \geq 1$ represents a markup factor on marginal cost.

Given the pricing choices of all other suppliers, the profit maximizing pricing choice of a representative supplier of intermediates satisfies

$$
\frac{\partial \Pi_{ih}}{\partial p_{ih}} = 0. \tag{29}
$$

In a symmetric equilibrium, we have $\mu_{ih} = \mu_{ih'} = \mu,\ \forall i$, and so the profit maximization condition for a representative supplier from either region is

$$
\left.\frac{\partial \Pi_{ih}}{\partial p_{ih}}\right|_{\mu_{ih}=\mu_{ih'}=\mu,\ \forall i} \equiv \Omega(\mu, N) = 0. \tag{30}
$$

Solving for the optimal markup μ, we obtain (13).

Under a content requirement, we have

$$
\begin{aligned}
\hat{q}_{Dih} &= \left(\frac{Y/2}{\hat{P}_h} + \frac{Y/2}{\tau_F \hat{P}_h}\right)\ r\ \left(\frac{\hat{P}_h}{p_{Dh}}\right)\left(\frac{p_{DH}}{p_{ih}}\right)^{\sigma} \\
&= KY\ r\ \left(p_{Dh}\right)^{\sigma-1}\ \left(p_{ih}\right)^{-\sigma}, \\
\hat{q}_{Xih} &= \left(\frac{Y/2}{\hat{P}_{h'}} + \frac{Y/2}{\tau_F \hat{P}_{h'}}\right)(1-r)\left(\frac{\hat{P}_{h'}}{p_{Dh'}}\right)\left(\frac{p_{Dh'}}{\tau\, p_{ih}}\right)^{\sigma} \\
&= KY\,(1-r)\ \left(p_{Dh'}\right)^{\sigma-1}\left(\tau\, p_{ih}\right)^{-\sigma},
\end{aligned}
\tag{31}
$$

$$
\hat{\Pi}_{ih} = \hat{\mu}_{ih}\left(\hat{q}_{Dih} + \hat{q}_{Xih}\right) - F, \tag{32}
$$

where $\hat{P}_h = \hat{e}(p_{Dh}, p_{Mh}, r)$. We can then use these to derive a symmetric profit-maximization condition, $\hat{\Omega}(\hat{\mu}, \hat{N}) = 0$. Solving this condition for μ gives (15).

Proof of Proposition 1: Since $\Phi(\tau_I) < 1$, the ratio $N/(N-1)$ is greater than the ratio $N/(N - \Phi(\tau_I))$, i.e., a binding content requirement results in a higher level of markup in comparison with the unconstrained case. □

PROOF OF PROPOSITION 2: Let $\Pi(p) = (KY/N)\,(1 - c/p)\,\big((1+\tau_I{}^{\sigma})/(\tau_I + \tau_I{}^{\sigma})\big) - F$ denote individual profits, in an unconstrained scenario where all suppliers charge a price p, with c denoting marginal cost; and let $\hat{\Pi}(p,r) = (KY/N)\,(1 - c/p)\,\big(1 + r\,(\tau_I - 1)\big)/\tau_I - F$ denote individual profits in a constrained scenario at level r where all producers charge a price p. Also, for given input tariffs, let $\tilde{r} = \tau_I{}^{\sigma}/(\tau_I + \tau_I{}^{\sigma})$ denote the regional value content under a common input price, p: this is independent of p. Finally let $\hat{p}(r)$ denote the equilibrium price under an RVC constraint at level r.

It is easy to verify that $\hat{\Pi}(p,\tilde{r}) = \Pi(p)$. Thus, in the absence of constraint, if all producers were to charge a price coinciding with $\hat{p}(\tilde{r})$, profits would be the same with and without a constraint. Next, suppose that, absent a constraint, all producers charge a price $\hat{p}(\tilde{r})$, and consider a unilateral price deviation by a single domestic producer, i'. As $\hat{p}(\tilde{r})$ exceeds the unconstrained equilibrium price, and since $\hat{\Pi}(p,\tilde{r}) = \Pi(p)$, a downwards deviation in $p_{i'}$ from $\hat{p}(\tilde{r})$ must be profitable, and so the optimal price deviation, $p^*_{i'}(\hat{p}(r)) = p^*(r)$ must lie below $\hat{p}(\tilde{r})$. Denoting the regional value content under such a deviation with $\check{r}\big(\hat{p}(r), p^*(r)\big)$, homotheticity implies $\check{r}\big(\hat{p}(r), p^*(r)\big) = \check{r}\big(1, p^*(r)/\hat{p}(r)\big) = \bar{r}(\gamma^*(r))$, where $\gamma^*(r) = p^*(r)/\hat{p}(r)$. The assumption $\sigma > 1$ implies $\bar{r}\big(\gamma^*(\tilde{r})\big) > \tilde{r}$, making a constraint at level $r = \tilde{r}$ slack under an optimal unilateral deviation, which implies that an outcome where all producers price at $\hat{p}(r)$ cannot be an equilibrium under a binding constraint $r = \tilde{r}$. If the RVC requirement equals or exceeds the level $\underline{\underline{r}} > \tilde{r}$ for which $\bar{r}\big(\gamma^*(\underline{\underline{r}})\big) = \underline{\underline{r}}$, on the other hand, unilateral deviations to $p^*(r) = \gamma^*(r)\,\hat{p}(r)$ cannot produce a switch to an unconstrained regime where $\tilde{r} > r$. (A value $\underline{\underline{r}}$ such this must exist by continuity given that $\bar{r}\big(\gamma^*(\tilde{r})\big) > \tilde{r}$ and $\bar{r}\big(\gamma^*(1)\big) < 1$.) In this case an outcome where all producers price at $\hat{p}$ corresponds to an RVC constrained oligopolistic equilibrium outcome. □

PROOF OF PROPOSITION 3: The first part of the result follows directly from (16) and (17). The last part follows from $\dfrac{d(\mu^* - \hat{\mu}^*)}{dN} = -\dfrac{1-\Phi(\tau_I)}{(NN-1)^2(\sigma-1)\big(\sigma - \Phi(\tau_I)\big)} < 0$ (since $\Phi(\tau_I) < 1$ and $\sigma > 1$). □

PROOF OF PROPOSITION 4: For a given level of $\tau_I > 1$, the equilibrium level of domestic value content in the absence of an RVC constraint is $\underline{r}(p, \tau_I p_D)$. Setting $\tau_I = 1$ (i.e., zero tariffs in intermediate imports) and imposing an RVC constraint at the level $r = \underline{r}(p, \tau_I\, p_D)$ will thus produce the same effect on the relative value of imported intermediates in total intermediates use as imposing the tariff ($\tau_I > 1$) does. As long at the RVC constraint is binding, however, the expression for the markup under a binding RVC constraint, given by (15), is independent of r and always greater than the corresponding expression (13) for any level of τ_I. □

PROOF OF PROPOSITION 5: Equilibrium levels for markups and the number of firms can be expressed as

$$N^* = \frac{KY}{F}\,\frac{\mu^*-1}{\mu^*}\,\frac{1+\tau_I{}^{\sigma}}{\tau_I + \tau_I{}^{\sigma}}; \tag{33}$$

$$\mu^* = \frac{\sigma}{\sigma-1}\left(1 - \frac{F}{KY}\,\frac{\tau_I + \tau_I{}^{2\sigma}}{(1+\tau_I{}^{\sigma})^2}\right)^{-1}. \tag{34}$$

$$\hat{N}^* = \frac{KY}{F}\,\frac{\hat{\mu}^*-1}{\hat{\mu}^*}\,\frac{1+(\tau_I-1)\,r}{\tau_I}; \tag{35}$$

$$\hat{\mu}^* = \frac{\sigma}{\sigma-1}\left(1-\frac{F}{KY}\,\frac{\tau_I}{1+(\tau_I-1)\,r}\right)^{-1}. \tag{36}$$

Expressions (20) and (21) in the text are obtained by respectively combining (33)-(34) and (35)-(36).

Examining the expressions (34) and (36), and letting $Z = \left(\tau_I + {\tau_I}^{2\sigma}\right)/(1+{\tau_I}^{\sigma})^2$, $\hat{Z} = \left(1 + (\tau_I-1)\,r\right)/\tau_I$, we can see that $\hat{Z} > Z$ implies $\hat{\mu}^* > \mu^*$. The denominator of the expansion of $\hat{Z} - Z$ is positive. The numerator equals

$$\tau_I\left(1+{\tau_I}^{\sigma}\right)^2 - \left(\tau_I + {\tau_I}^{2\sigma}\right)\left(1+(\tau_I-1)\,r\right) \equiv A_1.$$

Since $\sigma > 1$ and $\tau_I \geq 1$, this is monotonically decreasing in r, reaching a minimum at $r = 1$; and so

$$A_1 \geq \tau_I\left(1+{\tau_I}^{\sigma}\right)^2 - \left(\tau_I + {\tau_I}^{2\sigma}\right)\left(1+(\tau_I-1)\,r\right) \equiv A_2.$$

Dividing this by τ_I, expanding and simplifying, we obtain:

$$\frac{A_2}{\tau_I} = 1 + 2{\tau_I}^{\sigma} - \tau_I,$$

which is positive for $\sigma > 1$ and $\tau_I \geq 1$. The inequalities $A_1 > A_2$ and $A_2 > 0$ imply $A_1 > 0$. This implies $\hat{K} > K$ and hence $\hat{\mu}^* > \mu^*$. Comparing next (33) and (35), we can conclude that, since $\hat{\mu}^* > \mu^*$, a sufficient condition for $\hat{N}^* > N^*$ is $\left(1+(\tau_I-1)\,r\right)/\tau_I \geq \left(1-{\tau_I}^{\sigma}\right)/\left(\tau_I - {\tau_I}^{\sigma}\right)$. A sufficient condition for this to be met is $\tau_I \leq \left(r/(1-r)\right)^{1/(\sigma-1)}$; this coincides with condition (10), a necessary condition for the domestic content requirement to be binding.

In the absence of any preferential agreement, imports of intermediates to any of the four countries from any of the other three countries would face a tariff τ_I and so (3) for the home country becomes

$$e(p_{Dh}, p_{Mh}) = \left((1/2)\,{p_D}^{1-\sigma} + (3/2)\,{p_M}^{1-\sigma}\right)^{1/(1-\sigma)}. \tag{37}$$

Proceeding as we do above to obtain equilibrium levels of N and μ, and combining the resulting expressions, we obtain

$$N_0^* = \frac{(K^0 Y/F)\,\left(3+{\tau_I}^{\sigma}\right)^2 + (\sigma-1)\,\left(9\tau_I + {\tau_I}^{2\sigma}\right)}{\sigma\left(3+{\tau_I}^{\sigma}\right)\left(3\tau_I + {\tau_I}^{\sigma}\right)}, \tag{38}$$

where $K^0 \equiv (1/4)(1+3/\tau_F)$. The difference between (38) and (20) is positive under fairly general conditions, implying that preferential trade liberalization reduces the overall number of intermediate goods producers, but this effect is smaller under a binding regional content requirement (since $\hat{N}^* > N^*$).[51] □

[51] The difference involves two terms, the first of which is unambiguously positive. The second term is an income effect stemming from a simplifying assumption we have made in our analysis, namely that tariff revenues are not spent on the goods produced by the industry the analysis focuses on. This mechanically implies that a fall in tariff revenues following from a move to a preferential agreement raises the value

B Derivation of RoO index

Value-based RoO Index

Consider a general value-based content requirement rule where a specific regional value content applies to each input-output pair. A RoO stringency index for each intermediate good $i \in I$ can be constructed as follows:

$$R_i = \sum_k \varsigma_k^X \lambda_{ik},$$

where ς_k^X is the share of exports of final good k to the FTA region in total exports and λ_{ik} measures the degree of RoOs stringency when using input i in the production of final good $k \in K$. The latter, in turn, can be defined as

$$\lambda_{ik} = \theta_{ik} r_{ik} + \bar{\beta}_i \sum_{h \neq i} \theta_{hk} r_{hk}, \tag{39}$$

where $r_{ik} \in [0, 1]$ denotes the input i-specific RVC requirement for satisfying the rules of origin when producing final good k, and θ_{ik} is the relative importance of input i in the production of final good k (e.g., the input share). Because of technological complementarity between inputs, RVC requirements for *all other inputs*, indexed by h, also matter for stringency, with $\bar{\beta}_i > 0$ reflecting the extent of this complementarity for input i.[52] In the simplest case where there is only one single RVC rule, we have $r_{hk} = \bar{r}$, and fully assuming $\bar{\beta}_i = 1$ for all i, the RoO index collapses to the RVC rate: $R_i = \bar{r}$.

Alternative RoO Index for list-based rules

In the case of CUSFTA's content requirements, all listed inputs are to be fully sourced within the FTA region, and so $r_{ik} = 1$ for any listed input. This is more restrictive than the input value share requirement in the value-based rule. In this case, each individual input share for good i is equally important, i.e., $\theta_{ik} = 1$, which gives

$$\lambda_{ik} = 1 + \bar{\beta}_i N_k^I,$$

where N_k^I is the total number of inputs (including i itself) that are listed in the rule of origin for

---

of demand for the final goods produced in the industry and thus for intermediate goods (because $KY > K^0 Y$), working against the standard pro-competitive effect that encourages exit. This effect would vanish if we assumed, for example, that all tariff revenues associated with an industry are spent on the goods produced by that industry. However, even if this effect were present, the difference $N_0^* - N^*$ would remain positive under realistic parameterizations. For example, for an escalating tariff structure with $\tau_I = 1.05$ and $\tau_I = 1.1$ (which is in line with external tariffs under the EU-UK TCA, for $\sigma = 6$ (close to the median value of literature substitution elasticity estimates reported by Feenstra and Romalis, 2014), and setting $F/Y = 0.017$ (chosen so that $N_0^* = 10$, which in turn translates into an HHI value of 1,000), a move to a FTA causes the number of intermediate goods producers to fall from 10 to ≈ 9.6, with N_0^* remaining above N^* as long as $\tau_F < 1.29$. The corresponding number of entrants under an FTA with an RVC requirement $r = 0.1$ is $\hat{N}^* \approx 9.8$.

[52] The degree of complementarity between i and other inputs may vary for different inputs. A more general measure reflecting this variation would incorporate pair-specific parameters $\bar{\beta}_{ih}$.

final good k. The RoO index then becomes

$$R_i = 1 + \sum_{k \in K_i} \bar{\beta}_i \varsigma_k^x N_k^I \ \propto \ \bar{\beta}_i \sum_{k \in K_i} \varsigma_k^x N_k^I. \tag{40}$$

We cannot directly observe $\bar{\beta}_i$; but if we assume $\bar{\beta}_i = \bar{\beta}_{j(i)} \forall i$, where $j(i)$ represents the industry to which i belongs, variation in $\bar{\beta}_i$ becomes inconsequential after normalizing the index at the industry level.

We also consider the following alternative normalized index: $R_i = \sum_{k \in K_i} \varsigma_k^x N_k^I$. The correlation coefficient between this alternative index and the index we use in our empirical analysis is 0.98; and when using this alternative index, all our main findings remain qualitatively robust.[53]

What if not all inputs are named inputs in RoOs? If θ_k is the share of all named inputs in a RVC based rule and $\bar{\beta}_i = 1 \ \forall i$, we obtain $R_i = \theta_k \bar{r}$. In the case of CUSFTA, $\theta_{ik} = \bar{\theta}$ for all named inputs, as they bear the same relative importance for meeting the requirement (but not unity, as there exists other non-named inputs). Thus,

$$\lambda_{ik} = \bar{\theta} + \bar{\theta} \bar{\beta}_i N_k^I,$$

and the RoO index becomes

$$R_i = \bar{\theta} \Big(1 + \sum_{k \in K_i} \bar{\beta}_i \varsigma_k^x N_k^I \Big) \ \propto \ \bar{\theta} \bar{\beta}_i \sum_{k \in K_i} \varsigma_k^x N_k^I, \tag{41}$$

which is identical to (40) after normalization.

[53]These results are not presented here but are available upon request.

C Ranking of US sectors by HHI and RoO indices

Table C1: Top and bottom 10 US sectors by HHI

Top 10	
SIC Code	Sector
277	Greeting Cards
386	Photographic Equipment and Supplies
333	Primary Smelting and Refining of Nonferrous Metals
321	Flat Glass
366	Communications Equipment
301	Tires and Inner Tubes
206	Sugar and Confectionery Products
322	Glass and Glassware, Pressed or Blown
351	Engines and Turbines
372	Aircraft and Parts
Bottom 10	
SIC Code	Sector
275	Commercial Printing
279	Service Industries for the Printing Trade
233	Women's, Misses', and Juniors' Outerwear
249	Miscellaneous Wood Products
306	Fabricated Rubber Products, Not Elsewhere
254	Partitions, Shelving, Lockers, and Office and Store Fixtures
345	Screw Machine Products, and Bolts, Nuts, Screws, Rivets, and Washers
344	Fabricated Structural Metal Products
242	Cutlery, Handtools, and General Hardware
237	Fur Goods

Table C2: Top and bottom 10 US sectors by RoO Index

SIC Code	Sector
Top 10	
281	Industrial Inorganic Chemicals
285	Paints, Varnishes, Lacquers, Enamels, and Allied Products
289	Miscellaneous Chemical Products
283	Drugs
287	Agricultural Chemicals
284	Soap, Detergents, and Cleaning Preparations; Perfumes, Cosmetics, and Other Toilet Preparations
286	Industrial Organic Chemicals
291	Petroleum Refining
386	Photographic Equipment and Supplies
221	Broadwoven Fabric Mills, Cotton
Bottom 10	
SIC Code	Sector
244	Wood Containers
373	Ship and Boat Building and Repairing
241	Logging
366	Communications Equipment
249	Miscellaneous Wood Products
279	Service Industries for the Printing Trade
334	Secondary Smelting and Refining of Nonferrous Metals
242	Sawmills and Planing Mills, General
372	Aircraft and Parts
365	Household Audio and Video Equipment, and Audio Recordings

D Robustness checks

US manufacturing prices

Results of robustness checks for US PPI with specification (24) are reported in Table D1. In column (1), we show that our findings are robust to using unweighted regressions. In column (2), we use unweighted regressions but add regression weights as an extra control variable. In column (3), we replace the trade share in weights with the share of imports from Canada in total US imports of intermediate goods. In columns (4) and (5), we consider alternative tariff binding criteria. Overall, our results are robust across all these variants.

Canadian export prices

To account for unobservable heterogeneity across goods in relation to how binding RoOs are linked to export prices, we employ a Finite Mixture Models (FMM) specification capable of identifying latent product groupings in our sample, which may be related to quality or other unobservable factors orthogonal to RoOs. We opt for two latent product groups.[54] The distribution of FMM-predicted unit value gaps (i.e., our dependent variable, Δp_{inct}) is depicted in Figure D1b, contrasting with the distribution of the full sample presented in Figure D1a. Figure D1b distinctly displays two distributions for the identified groups, labeled as the high-gap group and low-gap group.

The FMM estimation procedure calculates, for each good, the probabilities of the good belonging to each of the two groups. We subsequently assign a good to a specific sub-sample if the corresponding probability exceeds 0.5. The estimation results are presented in Table D2. In column (1), we report the estimated marginal means of the unit value gap by group. Column (2) presents the ex-ante probability for a randomly selected good to be assigned to any given latent group. Column (3) reports, for each group, the main coefficient of interest, i.e., the coefficient on the interaction $ROI_{it} \times D_i^{TB}$ in specification (25). These results confirm our main finding, with the relationship being positive and statistically significant for both groups, although much stronger for one group than for the other.[55]

In Table D3 we report results of robustness checks for alternative samples and placebo tests, using specification (25). In column (1), our findings remain robust when excluding Mexico (Canada's second NAFTA trading partner) from the sample. In column (2), we verify that our results are robust to excluding products with high initial MFN tariffs—above the median tariffs in our sample. This addresses a potential concern about selection: industries that were initially protected by high tariffs might have lobbied more vigorously for protection through RoOs in CUSFTA negotiations.[56] Column (3) confirms that our results hold for the shorter sample period of 1989-1994, implying that our results are not purely driven by the effects of NAFTA after 1994. In columns (4)-(5), we conduct placebo tests using alternative tariffs to arrive at binding criteria.

[54] Although the Akaike information criterion (AIC) suggests three as the optimal number of groups, the most substantial improvement is observed when moving from one group to two, compared to the improvement from two to three. We present results with two groups for easier interpretations. We also check results for a three-group model, and our findings hold qualitatively for all groups.

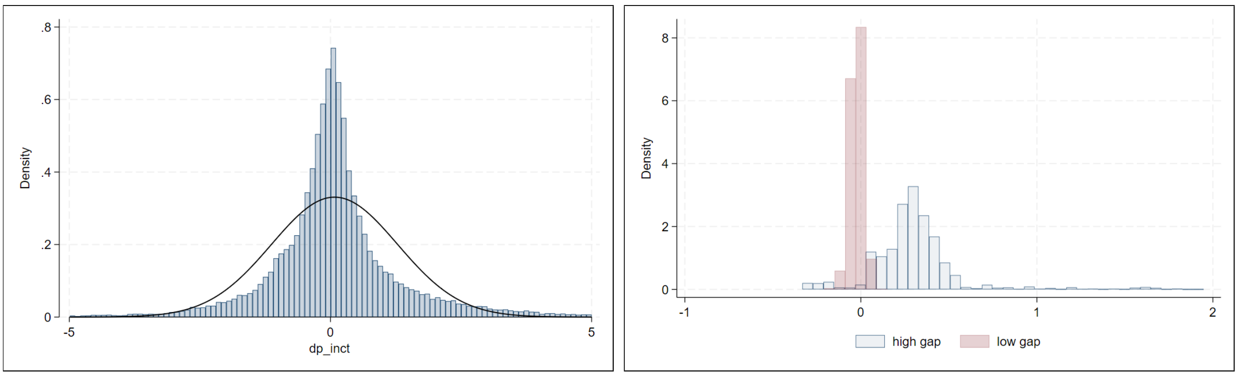
[55] We also verify that for both groups, the results are more pronounced in less competitive markets. Further details on these results are available upon request.

[56] Excluding tariffs higher than the 90th or 95th percentiles does not qualitatively change the results.

Table D1: RoOs and US PPIs: Robustness

Dep. variable: PPI_change_j	Unweighted	Weight as control	Alternative weight	Strict binding criterion	Loose binding criterion
	(1)	(2)	(3)	(4)	(5)
$ROI_j \times (Olig_j = 0)$	-0.006 (0.035)	-0.004 (0.036)	-0.021 (0.051)	-0.012 (0.031)	-0.02 (0.055)
$ROI_j \times (Olig_j = 1)$	-0.072 (0.155)	-0.073 (0.156)	-0.287 (0.238)	-0.1 (0.156)	-0.181 (0.162)
$D_j^{TB} \times (Olig_j = 0)$	-0.033 (0.029)	-0.032 (0.03)	0.003 (0.028)	-0.017 (0.03)	0.022 (0.025)
$D_j^{TB} \times (Olig_j = 1)$	-0.794^a (0.167)	-0.797^a (0.169)	-0.823^a (0.148)	-1.064^a (0.188)	-0.523^b (0.265)
$ROI_j \times D_j^{TB} \times (Olig_j = 0)$	0.101 (0.064)	0.098 (0.067)	0.069 (0.069)	0.09 (0.08)	0.008 (0.066)
$ROI_j \times D_j^{TB} \times (Olig_j = 1)$	1.661^a (0.569)	1.67^a (0.576)	1.46^a (0.454)	3.443^a (0.518)	1.34^c (0.738)
Binding criteria	P50, P50	P50, P50	P50, P50	P25, P75	P75, P25
FE: Sector	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	334	334	334	334	334
R^2	0.25	0.25	0.534	0.265	0.275

Notes: The dummy variable, D_j^{TB}, equals one (and zero otherwise) if both binding conditions are satisfied: the input tariff gap of industry j between the US's external MFN and preferential tariffs is below the sample median, and the output tariff gap of final goods associated with industry j between Canada's MFN and preferential tariffs is above the sample median. The $Olig_j$ dummy (with the threshold of 1,800), tariff gaps, ROI_j and extra controls (changes in sales and firm numbers) are included but not reported. Regression weights are the same as Table 3 except for columns (1)-(3) where column (1) is unweighted, column (2) uses weights as an extra control variable, and column (3) uses the share of imports from Canada in total US imports of intermediate goods rather than the share of exports to Canada in total US exports of final goods. ^{a} indicates significance at the one percent level, ^{b} indicates significance at the five percent level and ^{c} indicates significance at the ten percent level. Standard errors are clustered at the SIC 2-digit level and reported in parentheses.



(a) Full sample

(b) FMM: Predicted

Figure D1: Distributions of Canadian unit export value gaps

Table D2: Finite Mixture Model (FMM) Results

FMM latent classes	(1) Latent class marginal means for Δp_{inct}	(2) Latent class marginal probabilities	(3) Coefficients on $ROI_{it} \times D_i^{TB}$
Low gap	-0.022^a	0.622	0.377^a
	(0.000)	-	(0.007)
High gap	0.302^a	0.378	3.167^a
	(0.002)	-	(0.029)

Notes: Standard errors are in parentheses.

Specifically, for input tariffs, we consider tariff gaps between MFN tariffs and CUSFTA's preferential rates facing Canada, and for output tariffs, we consider tariff gaps between MFN tariffs and CUSFTA's preferential rates facing the US.[57] Our results suggest that the mechanism through which stricter and binding RoOs increase market power only operates through the relevant tariffs identified in our theoretical predictions. The placebo tariffs used in this exercise, following the same logic, would impact market power only for American exporters of intermediate goods selling to Canada.

In Table D4, we implement our main specification (25) with a series of alternative subsamples and fixed effects. In column (1), we consider a sub-sample that includes only exports to advanced economies, for which we would expect quality to be comparatively more homogeneous. Our results still hold.[58] In columns (2) and (3), we present results using non-advanced countries and show that our main coefficients are significant only under the stricter binding criteria (see row 3 in column (3)). Finally, we consider alternative fixed effects, including (a) product×province×country to account for country-specific tastes for a product (column (4)), and (b) province×country×time to account for province-destination-specific and time-varying cost shocks (column (5)). These results align with those reported in Table 4.

In Table D5, we explore an alternative specification that includes a single-difference dependent variable, $\Delta p_{inct} \equiv \ln p_{inct} - \ln p_{inc,88}$, and we separately consider two sub-samples of US-bound goods and non-US-bound goods. As expected, our results hold for the US sub-sample but not for the non-US sub-sample (see columns (1) and (2)).[59] Effects are particularly in evidence in concentrated (less competitive) markets (columns (3)-(4)) and for non-homogeneous goods (columns (5)-(6)).

[57]We use Canada's reported MFN input tariffs from Japan, Canada's main partner outside CUSFTA, and trade-weighted MFN output tariffs from all non-FTA countries reported by the US.

[58]As defined by the IMF, the 39 advanced economies include Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Macao, Malta, Netherlands, New Zealand, Norway, Portugal, Puerto Rico, San Marino, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Taiwan, the UK, and the US. Results are almost identical when using Canada's top ten trading partners (by export shares) instead.

[59]We present the most robust results using the liberal binding criteria, specifically, P25 for input tariffs and P75 for output tariffs. Results with the medians as thresholds are qualitatively robust.

Table D3: RoOs and unit export values: Alternative samples and placebo tests

Dep. variable: Δp_{inct}	Excluding Mexico	Excl. high initial tariffs > median	1989-1994 short sample	Placebo WTO tariffs	
	(1)	(2)	(3)	(4)	(5)
ROI_{it}	0.246	1.232^{a}	0.451^{a}	0.508^{b}	0.604^{a}
	(0.158)	(0.213)	(0.17)	(0.205)	(0.22)
D_i^{TB}	-0.292^{a}	-0.332^{a}	-0.219^{a}	-0.115^{c}	0.011
	(0.079)	(0.079)	(0.081)	(0.059)	(0.083)
$ROI_{it} \times D_i^{TB}$	1.384^{a}	1.591^{a}	1.069^{a}	0.27	-0.339
	(0.323)	(0.296)	(0.34)	(0.167)	(0.244)
Binding criteria	P50, P50	P50, P50	P50, P50	P50, P50	P25, P75 (strict)
FE: prov.×ind.×country	Yes	Yes	Yes	Yes	Yes
FE: country×time	Yes	Yes	Yes	Yes	Yes
Observations	52,942	26,858	31,642	54,025	54,025
R^2	0.215	0.332	0.212	0.212	0.212

Notes: All columns are weighted with relative trade values of good i in year t between the US and the non-FTA partner c. ^{a}, ^{b}, and ^{c} indicate significance at the one, five, and ten percent levels, respectively. Standard errors are clustered at the product×country level.

Table D4: RoOs and unit export values: Further robustness checks

Dep. variable: Δp_{inct}	Advanced countries	Non-adv. countries	Non-adv. countries	Alternative fixed effects	
	(1)	(2)	(3)	(4)	(5)
ROI_{it}	0.329^{c}	-0.294	-0.337^{c}	-8.354^{a}	0.183
	(0.186)	(0.197)	(0.199)	(1.593)	(0.128)
D_i^{TB}	-0.394^{a}	0.014	-0.293^{b}	-0.133^{a}	-0.423^{a}
	(0.094)	(0.064)	(0.133)	(0.035)	(0.089)
$ROI_{it} \times D_i^{TB}$	1.868^{a}	-0.032	0.923^{b}	0.78^{a}	1.864^{a}
	(0.382)	(0.223)	(0.373)	(0.131)	(0.378)
Binding tariffs criteria	P50, P50	P50, P50	P25, P75	P50, P50	P50, P50
FE: prov.×ind.×country	Yes	Yes	Yes	No	No
FE: country×time	Yes	Yes	Yes	No	No
Alternative FE	No	No	No	prod.×prov.×coun.	prov.×coun.×time
Observations	35,323	18,702	18,702	52,045	52,045
R^2	0.179	0.325	0.326	0.68	0.081

Notes: All columns are weighted with relative trade values of good i in year t between the US and the non-FTA partner c. ^{a}, ^{b}, and ^{c} indicate significance at the one, five, and ten percent levels, respectively. Standard errors are clustered at the product×country level.

Table D5: RoOs and unit export values: Alternative specification

			D_i^{GC} : Concentrated		D_i^{GC} : Non-homog.	
Dep. variable:	US	Non-US	US	Non-US	US	Non-US
$\Delta p_{inct} \equiv (\ln p_{inct} - \ln p_{inc,88})$	(1)	(2)	(3)	(4)	(5)	(6)
ROI_{it}	-0.115 (2.305)	-5.167^a (1.386)	–	–	–	–
$ROI_{it} \times \left(D_i^{GC}=0\right)$	–	–	-13.785^b (5.459)	-6.49 (5.866)	17.749^b (8.162)	4.411 (2.457)
$ROI_{it} \times \left(D_i^{GC}=1\right)$	–	–	-0.284 (2.424)	-5.121^a (1.415)	-2.029 (2.506)	-7.748^a (1.536)
D_i^{TB}	-1.593^b (0.73)	-0.052 (0.258)	–	–	–	–
$D_i^{TB} \times \left(D_i^{GC}=0\right)$	–	–	3.557 (3.417)	3.542^b (1.432)	2.905^b (1.329)	1.757^a (0.378)
$D_i^{TB} \times \left(D_i^{GC}=1\right)$	–	–	-2.188^a (0.701)	-0.366 (0.303)	-2.862^a (0.838)	-0.946^c (0.535)
$ROI_{it} \times D_i^{TB}$	4.512^b (2.033)	-0.254 (0.929)	–	–	–	–
$ROI_{it} \times D_i^{TB} \times \left(D_i^{GC}=0\right)$	–	–	-10.615 (12.019)	-10.32^c (5.39)	-13.295^a (4.605)	-6.113^a (1.785)
$ROI_{it} \times D_i^{TB} \times \left(D_i^{GC}=1\right)$	–	–	6.008^a (2.028)	0.518 (1.065)	8.153^a (2.346)	2.54 (1.618)
FE: prov.×ind. (×country)	Yes	Yes	Yes	Yes	Yes	Yes
FE: (country×) time	Yes	Yes	Yes	Yes	Yes	Yes
Observations	45,992	54,041	45,963	54,037	45,751	53,976
R^2	0.267	0.593	0.293	0.601	0.299	0.601

Notes: The country dimension in all fixed effects drops for the US sub-sample. The D_i^{GC} : dummy itself and product trends as controls are included but not reported. All columns are weighted with relative trade values of good i in year t between the US and the non-FTA partner c. ^{a}, ^{b}, and ^{c} indicate significance at the one, five, and ten percent levels, respectively. Standard errors are clustered at the product×country level.

Firm entry

Results of robustness checks for firm entry with specification (26) are reported in Table D6. In column (1), we demonstrate the robustness of our findings by employing unweighted regressions. Moving to column (2), we continue to use unweighted regressions but introduce regression weights as an additional control variable. In column (3), we substitute the trade share in weights with the share of imports from Canada in total US imports of intermediate goods. Columns (4) and (5) explore alternative tariff binding criteria. Our results remain robust across all these variants.

In Table D7, we present results for a variant of (26) where the entry dummy is replaced by the log change in the number of firms relative to the 2-digit SIC industry mean. Results are generally consistent with those from our main specification, although they lose significance when using stricter binding criteria.

Table D6: RoOs and firm entry: Robustness

Dep. variable: D_j^{FN}	Unweighted	Weight as control	Alternative weight	Strict binding criterion	Loose binding criterion
	(1)	(2)	(3)	(4)	(5)
$ROI_j \times (Olig_j = 0)$	0.006	-0.005	-0.148	-0.296	-0.519
	(0.218)	(0.238)	(0.31)	(0.362)	(0.498)
$ROI_j \times (Olig_j = 1)$	0.363	0.43	0.74	0.753	0.859
	(0.728)	(0.697)	(1.046)	(0.977)	(1.001)
$D_j^{TB} \times (Olig_j = 0)$	-0.074	-0.042	0.034	0.062	-0.126
	(0.191)	(0.189)	(0.15)	(0.193)	(0.218)
$D_j^{TB} \times (Olig_j = 1)$	-2.241^b	-2.423^b	-1.89^a	-1.983^a	-1.62^a
	(0.845)	(0.903)	(0.515)	(0.509)	(0.452)
$ROI_j \times D_j^{TB} \times (Olig_j = 0)$	-0.045	-0.129	-0.326	-0.043	0.388
	(0.682)	(0.645)	(0.415)	(0.569)	(0.622)
$ROI_j \times D_j^{TB} \times (Olig_j = 1)$	6.524^c	7.095^b	5.911^a	6.246^a	5.234^a
	(3.244)	(3.253)	(1.801)	(1.771)	(1.608)
Binding criteria	P50, P50	P50, P50	P50, P50	P25, P75	P75, P25
FE: Sector	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	333	333	333	333	333
R^2	0.144	0.19	0.235	0.236	0.233

Notes: The $Olig_j$ dummy, changes in sales as an extra control and the variable ROI_j are included but not reported. Regression weights are the same as Table 6 except for columns (1)-(3) where column (1) is unweighted, column (2) uses weights as an extra control variable, and column (3) uses the share of imports from Canada in total US imports of intermediate goods rather than the share of exports to Canada in total US exports of final goods. ^{a} indicates significance at the one percent level, ^{b} indicates significance at the five percent level and ^{c} indicates significance at the ten percent level. Robust standard errors are reported in parentheses.

Table D7: RoOs and firm entry: Alternative dependent variable

Dep. variable: FN_change_j		HHI $\geq 1,500$ as oligopoly		HHI $\geq 1,800$ as oligopoly	HHI $\geq 1,200$ as oligopoly
	(1)	(2)	(3)	(4)	(5)
ROI_j	-0.078 (0.114)	–	–	–	–
$ROI_j \times (Olig_j = 0)$	–	-0.057 (0.145)	-0.124 (0.152)	-0.141 (0.139)	-0.13 (0.151)
$ROI_j \times (Olig_j = 1)$	–	-0.181 (0.202)	0.378 (0.569)	0.653 (0.739)	0.265 (0.487)
D_j^{TB}	-0.029 (0.065)	–	–	–	–
$D_j^{TB} \times (Olig_j = 0)$	–	-0.019 (0.051)	-0.044 (0.054)	-0.053 (0.053)	-0.044 (0.053)
$D_j^{TB} \times (Olig_j = 1)$	–	-0.567^a (0.126)	-0.354 (0.384)	-0.192 (0.54)	-0.409 (0.344)
$ROI_j \times D_j^{TB}$	0.08 (0.163)	–	–	–	–
$ROI_j \times D_j^{TB} \times (Olig_j = 0)$	–	0.005 (0.171)	0.084 (0.174)	0.095 (0.162)	0.082 (0.171)
$ROI_j \times D_j^{TB} \times (Olig_j = 1)$	–	2.323^a (0.312)	1.614^c (0.884)	1.416 (1.031)	1.729^b (0.774)
FE: Sector	Yes	Yes	Yes	Yes	Yes
Extra controls	Yes	Yes	No	Yes	Yes
Observations	333	333	333	333	333
R^2	0.027	0.053	0.057	0.085	0.058

Notes: The dependent variable FN_change_j is defined as the changes in the number of firms relative to the 2-digit SIC industry mean. The *Olig* dummy, changes in sales as an extra control and the variable ROI_j are included but not reported. All columns are weighted with the product of two ratios: (a) industry $j's$ share of production used as intermediate inputs for all industries, and (b) Canada's share in US imports of intermediate goods in industry j's products used as intermediate inputs. [a] indicates significance at the one percent level, [b] indicates significance at the five percent level and [c] indicates significance at the ten percent level. Robust standard errors are reported in parentheses.