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# The Role of NAFTA and Returns to Scale in Export Duration\*

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## Abstract

While exports within NAFTA face a lower hazard, its onset has increased the hazard of exporting between the members, though intra-NAFTA exports still enjoy a lower hazard. There are differences in the timing of the effect of NAFTA across the three members. Unlike the effect on Canadian exports, the effect on Mexican and U.S. exports is persistent. Exports of IRS manufacturing products faced the highest hazard across all three members. The effect of NAFTA on the hazard of exporting each of the three returns to scale type of products is exporter specific with no uniform patterns.

**Keywords:** hazard; export survival; returns to scale; NAFTA

**JEL Codes:** F10, F14

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# 1 Introduction

The goal of this paper is twofold: (1) to investigate the effect of the North American Free Trade Agreement (NAFTA) on the hazard of exporting of the three member countries and (2) to investigate how production technology, different returns to scale, affect affect the hazard of exporting. I focus on the three members of NAFTA, Canada, Mexico, and the U.S., to take advantage of the virtually barrier free trade between them and evaluate the effect of NAFTA on trade between the members and their trade with non-members. I use annual exports at the 6-digit Harmonized Schedule level between 1990 and 2007.

NAFTA was an expansion of the Canadian U.S. Free Trade Agreement (CUSFTA) to include Mexico in the free trade area. One of the arguments in favor of CUSFTA was the well known source of welfare gains in models incorporating increasing returns to scale or economies of scale – namely that tariff-free access to the U.S. market will allow the Canadian firms to expand production, take advantage of economies of scale, and become more productive resulting in welfare gains for both producers and consumers. Trefler's (2004) influential work has shown that the effect of CUSFTA was precisely as predicted by economy of scale models. CUSFTA initiated a contraction of low productivity plants resulting in a 12 percent decrease in employment, but also ushered a period of rising labor productivity increasing it by 15 percent. This paper contributes to the understanding of the difference between different types of returns to scale.

The effect of CUSFTA/NAFTA on productivity is but one of many aspects of the agreements to have been investigated. Canadian industries that experienced the largest tariff cuts enjoyed the largest productivity gains. Romalis (2007) shows that the two free trade agreements have had a substantial effect on the volume of international trade, but a much smaller effect on prices and welfare. Much work has been devoted to identifying whether CUSFTA and NAFTA were primarily trade creating or trade diverting. Clausing (2001) found that

CUSFTA was primarily trade creating having increased U.S. imports from Canada without reducing imports from other trading partners. Treffler (2004) found evidence of both trade diversion and trade creation, with creation the dominating force. Romalis (2007) raises the possibility of a substantial trade diversion effect of NAFTA/CUSFTA which may be responsible for increased North American output and prices in once highly protected sectors.

Other researchers have focused on the effects of NAFTA/CUSFTA on the extensive margin. Kehoe and Ruhl (2009) found that especially in cases of thin trade relationships, trade liberalization is a key ingredient in sparking the growth of the extensive margin, an important source of new trade. Canada and Mexico are one example of a country-level relationship which did not involve much trade prior to Mexico joining NAFTA. Debaere and Mostashari (2010) find a small effect of trade liberalization on the extensive margin of U.S. imports for the 1989–1999 and 1996–2006 periods.

After providing some descriptive information on the evolution of exports of NAFTA members, I examine the hazard of exporting. I find that while exports between the three NAFTA members face a much lower hazard rate than their exports to non-members, the onset of NAFTA itself has increased the hazard of Mexican and U.S. exports to fellow NAFTA members and had no net effect on the hazard of Canadian exports to other NAFTA members. Canadian, Mexican, and U.S. exports of increasing–returns–to–scale manufacturing products face a higher hazard than do constant–returns–to–scale products. The onset of NAFTA has increased the hazard of exporting increasing–returns–to–scale products for Mexico and the U.S., but has had no effect on Canadian exports of those products. Mexican exports of increasing–returns–to–scale natural resource products face a lower hazard than constant–returns–to–scale products, U.S. exports of the same products face a higher hazard, while there are no differences between the two in Canadian exports. NAFTA has significantly increased the hazard of U.S. exports of increasing–returns–to–scale natural resource products and has had a marginal increasing effect on Canadian exports of the same products. Only

U.S. exports of constant-returns-to-scale have experienced a change due to NAFTA with the hazard increasing.

The role of returns to scale and free trade agreements in duration of exports has not been examined to date. Thus, this paper makes a contribution to the duration of trade literature in addition to making a contribution to the literature on the effects of NAFTA. Duration of trade was first examined by Besedeš and Prusa (2006a, 2006b) who noted that most U.S. import relationships are short lived and that differentiated products are exported to the U.S. in longer lasting relationships than homogeneous goods. Nitsch (2009) has found similar results for German imports. Besedeš and Prusa (2010a) provide a comprehensive summary of the duration of trade literature.

## 2 Motivating Model

To motivate the estimation of the hazard of exporting consider the following simple extension of the Melitz (2003) model. Suppose that firms are subject to exogenous, serially correlated productivity or product appeal shocks,  $\mu$ . Firms that draw a favorable parameter  $\mu$  are more likely to export. Firms which have drawn positively correlated  $\mu$ 's are likely to remain exporters for a long period, while those with negatively correlated  $\mu$ 's are more likely to cease exporting sooner. Firms that draw a particularly large  $\mu$  will tend to export more both in terms of volume and duration, particularly if their  $\mu$ 's are positively correlated. Even in the case of a negative correlation, firms with initially large  $\mu$ 's may export for a longer period, depending on the rate of decrease and initial value of  $\mu$ . Firms which have just started exporting are more likely to exit than those that have exported for a long time because their  $\mu$ 's are closer to the level at which they are indifferent between exporting and not exporting. Exporters who have been active for a long time are more likely to have drawn a sequence of positive  $\mu$ 's and are likely to have wandered farther from the margin of indifference between

exporting and not exporting. Thus one should expect to observe a lower hazard the longer the relationship. This basic model explains why one might observe firms of varying duration of exporting.

NAFTA (or any free trade agreement) affects firms through its effect on  $\mu$ . Free access to a foreign market can either be attributed to a positive productivity shock or product appeal as it reduces costs of supplying a market. NAFTA may have had a differential effect based on the nature of returns to scale used in the production of a product. Classic economies of scale models argue that access to a large foreign market increases firm productivity as Trebler (2004) has found for NAFTA. This would entail an increase in the parameter  $\mu$ , thus making it more likely firms would both start exporting and export longer, even if their  $\mu$  is negatively correlated over time. In addition, one would expect this effect to be the strongest for smaller countries, Canada and Mexico in this particular investigation, given their new access to a significantly larger U.S. market. For U.S. firms the domestic market is sufficiently large to exploit most economies of scale making it less likely that additional economies of scale can be exploited by accessing another market. Given Trebler's (2004) results on the effect of NAFTA on productivity of Canadian firms, one would expect to find that IRS manufacturing products face a lower hazard when destined to NAFTA members.

### **3 Data**

I used data on Canadian, Mexican, and U.S. export flows recorded at the 6-digit Harmonized Schedule (HS) level. Data for Canada and Mexico come from the UN Comtrade database, while data for the U.S. were aggregated from 10-digit HS data available from the U.S. Census *U.S. Exports* CDs/DVDs. I use annual data between 1990 and 2007 for all three countries. In each year I identify new export relationships and track these relationships until they cease to be active. A relationship is defined as the instance of a country exporting a 6-digit

HS product to another country, such as Mexican exports of “Monumental/building stone, cut/sawn” (HS 680221) to Argentina, Australia, Belgium, Brazil, Canada, France, Italy, Japan, and the U.S. among others. Since the purpose of this paper is to investigate the hazard of exporting I convert annual data to spells of service. A spell reflects the number of consecutive years while a relationship is active.

To identify the production technology and the nature of returns to scale for each product, I use the classification developed by Antweiler and Trefler (2002). They identify four types of returns to scale: increasing-returns-to-scale (IRS) manufacturing, increasing-returns-to-scale natural resources, constant-returns-to-scale (CRS), and non-robust increasing-returns-to-scale industries for which they could not establish the exact nature of the returns to scale. The latter group of industries are omitted from the analysis. The share of export volume and export relationships of products with identified returns to scale varies across the three countries. Canada has some 22% of its export volume and a half of its export relationships in products with robustly identified returns to scale. Mexico has 40% of export volume and 44% of export relationships in such products, while the U.S. has 65% of export volume and 59% of export relationships in such products.

		Canada	Mexico	U.S.
Annual observations	All	559,942	311,881	2,250,343
	New	416,970	253,713	1,165,839
	Fraction new	0.75	0.81	0.52
Relationships	All	140,215	71,082	356,969
	New	116,046	61,990	240,942
	Fraction new	0.83	0.87	0.68
Spells	All	231,055	124,300	621,910
	New	206,886	115,208	505,883
	Fraction new	0.90	0.93	0.81

Table 1: Data Summary

Table 1 presents summary information for products with robustly identified returns to scale for each country. Since I focus on exports created after 1990 the table presents infor-

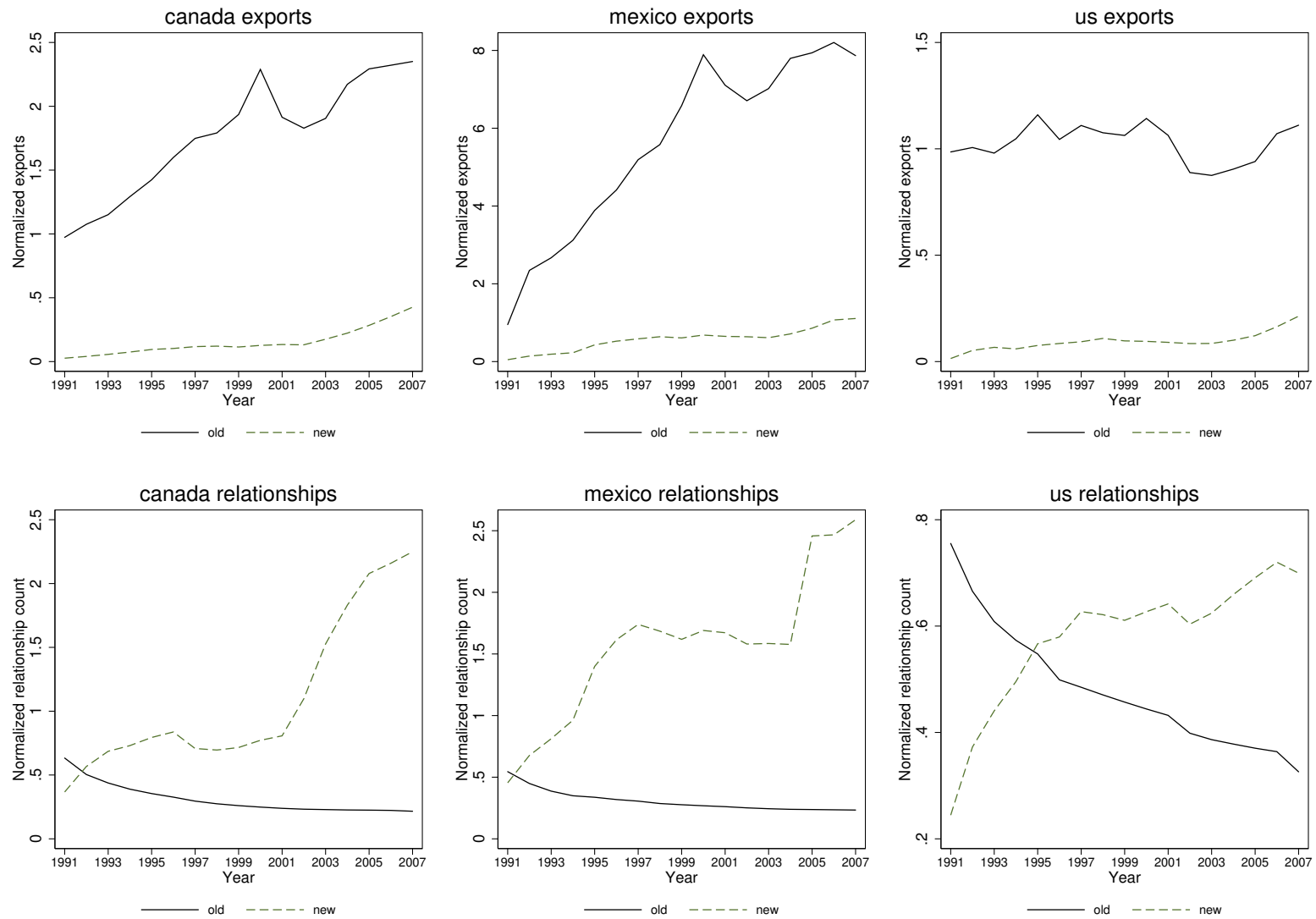


Figure 1: New and Old Exports and Relationships



mation for all exports as well as new exports. The U.S. has significantly more annual observations, export relationships, and spells of service than Canada and Mexico put together. Perhaps the largest difference across the three countries is in the fraction of observations in exports created since 1990. While Canada and Mexico have 75% and 81% of all annual observations created after 1990, the U.S. has almost a half of all of its observations started prior to 1990. These differences decrease as one looks at export relationships, 83% and 87% for Canada and Mexico and 68% for the U.S., and spells of service, 90% and 93% for Canada and Mexico versus 81% for the U.S.

Figure 1 offers a different perspective on the difference between exports started prior to 1990, old exports, and those started afterwards, new exports. Top row panels show the total volume of both old and new exports, while bottom row panels show the total number of both old and new export relationships. A note on the use of the term 'new' – it refers to all export volume or relationships created after 1990. For example, in 2005 new exports and relationships would be all those created since 1990 and not only those created in 2005 alone. In every panel old and new values are normalized by the total 1990 values. Thus, values for new exports are fractions of the 1990 value of old exports.

For every country, new exports embody a significantly lower volume, with the difference the largest for Mexico. While old exports embody more value, they also grow at a much slower rate than new exports. For Canada the 1991–2007 growth rate of the volume of old exports is 141% while it is 1,512% for new exports. For Mexico the corresponding figures are 727% and 2,172%, while for the U.S. they are only 13% for old exports and 1,372% for new exports. By 2007 some 15% of all Canadian, 12% of all Mexican, and 16% of all U.S. exports are embodied in relationships started since 1990.

While the top row of Figure 1 shows that new exports are significantly smaller in volume than old exports, the opposite is true for the number of export relationships which carry that volume. The number of old relationships declines over time for every country since their

ranks cannot increase by definition. The rate of decline from 1991 to 2007 is similar across the three countries: 66% for Canada and 57% for both Mexico and the U.S. Canada and Mexico are similar in that they have slightly more than a half of all relationships in 1991 in old exports, while the U.S. has almost 80% of its relationships in old exports. Canada's new relationships grow the most at 513%, followed by Mexico's at 469%, with the U.S. having the slowest rate of growth at 186%. While new exports account for a relatively small share of total exports in 2007, new relationships account for a significant number of all relationships in 2007: 91% for Canada, 92% for Mexico, and 68% for the U.S. A final note on the growth in the number of relationships. The rate at which new relationships are created exceeds the rate at which new relationships end in almost every year for every country as the number of relationships started after 1990 grows in almost every year.<sup>1</sup> These facts are supportive of the broad conclusion of Besedeš and Prusa (2010), that, for at least some countries, the extensive margin is relatively unimportant in the sense that over time it does not account for much of the volume of exports, even though it accounts for a significant share of relationships. There is a lot of churning at the extensive margin in terms of the number of relationships, but much less in terms of the volume of exports which remain a relatively small share of total exports.

Figure 2 identifies an interesting pattern in the share of export volume and export relationships destined to NAFTA members. Top panels present NAFTA shares of export volume and relationships embodied in old exports, while bottom panels shows NAFTA shares of new exports. In every country much of the effect of NAFTA is by far stronger in relationships already active in 1990. By 2000 almost 90% of Canada's old exports were destined for Mexico and the U.S.. The share of NAFTA destined relationships for Canada has quadrupled from 10% to 40%. Mexico has enjoyed an even stronger dominance of NAFTA destined old

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<sup>1</sup>The exceptions are 1996 for Canada; 1996, 1997, 2000, and 2001 for Mexico; and 1997, 1998, 2002, and 2007 for the U.S.

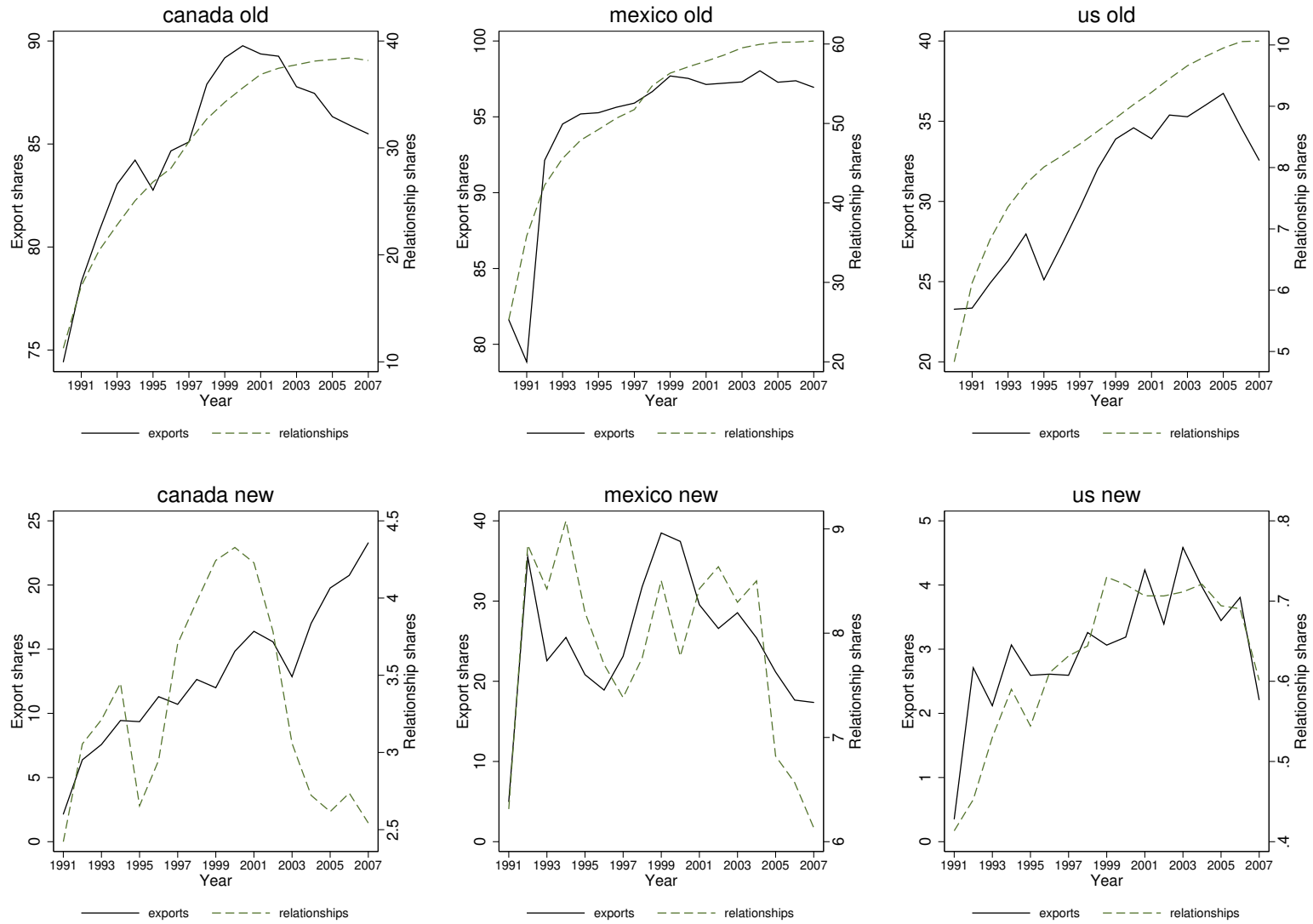


Figure 2: New and Old Exports and Relationships to NAFTA Members

exports, with the share of the volume of old exports increasing to more than 95% and the share of relationships increasing to 60%. The U.S. has the most diversified structure of exports with the share of the volume of exports destined to NAFTA members doubling from 20% to 40% and relationships increasing by some two percentage points to 8%. Top panels indicate that NAFTA seems to have had a very strong positive effect on the growth of both export volumes and relationships in exports created prior to 1990.

Patterns for new exports created after 1990 are more varied. While the share of the volume of Canadian exports destined to NAFTA members has increased by a factor of eight to 24%, the share of relationships displays an inverted U shape, increasing from 2.5% to almost 4.5% before returning to the original share of 2.5%. For Mexico the share of the volume has increased from 5% in 1991 to just under 20% by 2007, but having increased to as much as 40% in the intervening years. The share of relationships was slightly lower in 2007 at roughly 6% than in 1991, but has increased to as much as 9% in the intervening years. The decrease in both Canadian and Mexican exports to NAFTA members in the latter part of this period may have been caused by the displacement of trade due to the rising presence of Chinese exports in the U.S. market, as investigated by Iacovone, Rauch, and Winters (2010). The U.S. has had the smallest shares of exports destined to NAFTA members, a consequence of a more diversified export structure.

In Figure 3 I examine the evolution of shares of export volume and relationships across the three types of products based on returns to scale used in production. While the majority of Canadian exports involve IRS manufacturing products, they have experienced a fair amount of change since 1990. The creation of CUSFTA resulted in a rapid drop in the share of IRS manufacturing products from 80% of exports to 50% by 1994. The addition of Mexico to CUSFTA resulted in an increase in the share of IRS manufacturing products to 60% by but it has trended back towards 50% by 2007. The share of exports in CRS products more than doubled from 20% to 45% by 1994, but has trended downward ever since. The 1996, share

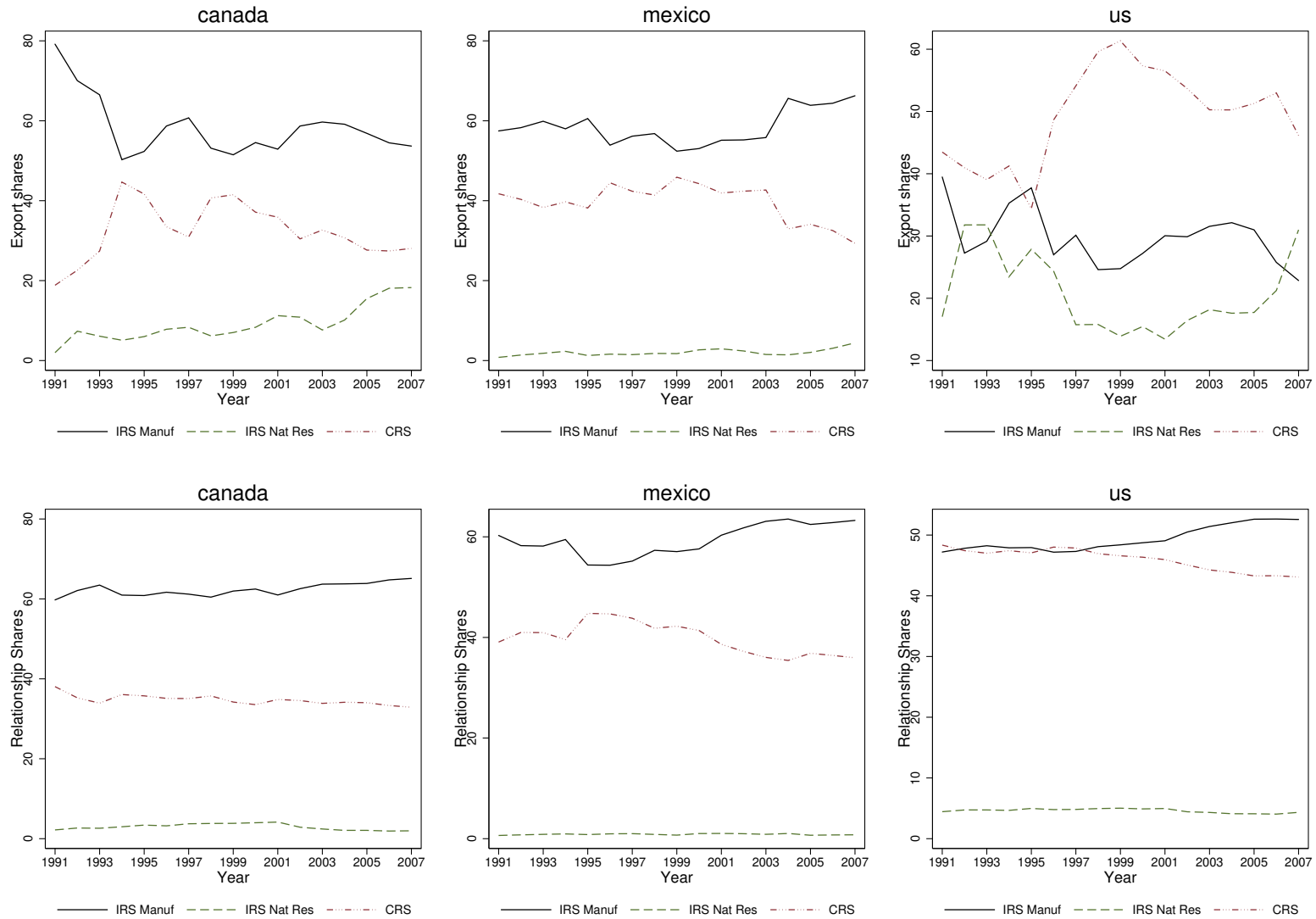


Figure 3: IRS Export and Relationship Shares

of IRS natural resource products has increased rapidly from less than 5% of exports to almost 20% by 2007.

Mexico has had a different experience. While the share of IRS manufacturing products in exports has decreased to 55% immediately after NAFTA took effect, it has since increased to about 65%. The share of CRS products has decreased from slightly more than 40% to about 30% after enjoying an initial boost from NAFTA. The share of IRS natural resource products has increased consistently, though to a much lesser degree than for Canada. The U.S. has a more balanced distribution of exports across the three types of products. Unlike Canada and Mexico the U.S. has the largest share of its exports in CRS products. Following CUSFTA the share of CRS products decreased from 44% to 35% by 1995, followed by a sharp increase to 60% by 1999. It has decreased steadily since to about 47% in 2007. The share of IRS manufacturing products has fluctuated from some 40% in 1991 and 1995 and has decreased to some 25% in 2007. IRS natural resource products decreased from more than 30% in 1994 to less than 15% in 2001 before increasing to roughly 30% by 2007.

NAFTA members are more similar in the distribution of relationships. In every country IRS manufacturing products account for the largest share of and have followed rather similar paths. For all three the share of IRS natural resources has been relatively stable over time, being the largest for the U.S. at some 5%. As a result shares of IRS manufacturing and CRS products largely look as mirror images of each other. IRS manufacturing has increased slightly in Canada, and somewhat more for Mexico and the U.S., though the total increase in the share from 1991 to 2007 is only several percentage points.

There are larger fluctuations in shares of exports destined to NAFTA members, as seen in Figure 4. CRS products dominate the share of exports for each country. For Canada, it has increased from some 40% in 1991 to almost 80% in 1995 before collapsing to some 20% by 2007. In Mexico the share of CRS products has fluctuated between some 40% in both 1991 and 2007 and more than 60% reached on several occasions. In the U.S. the share of

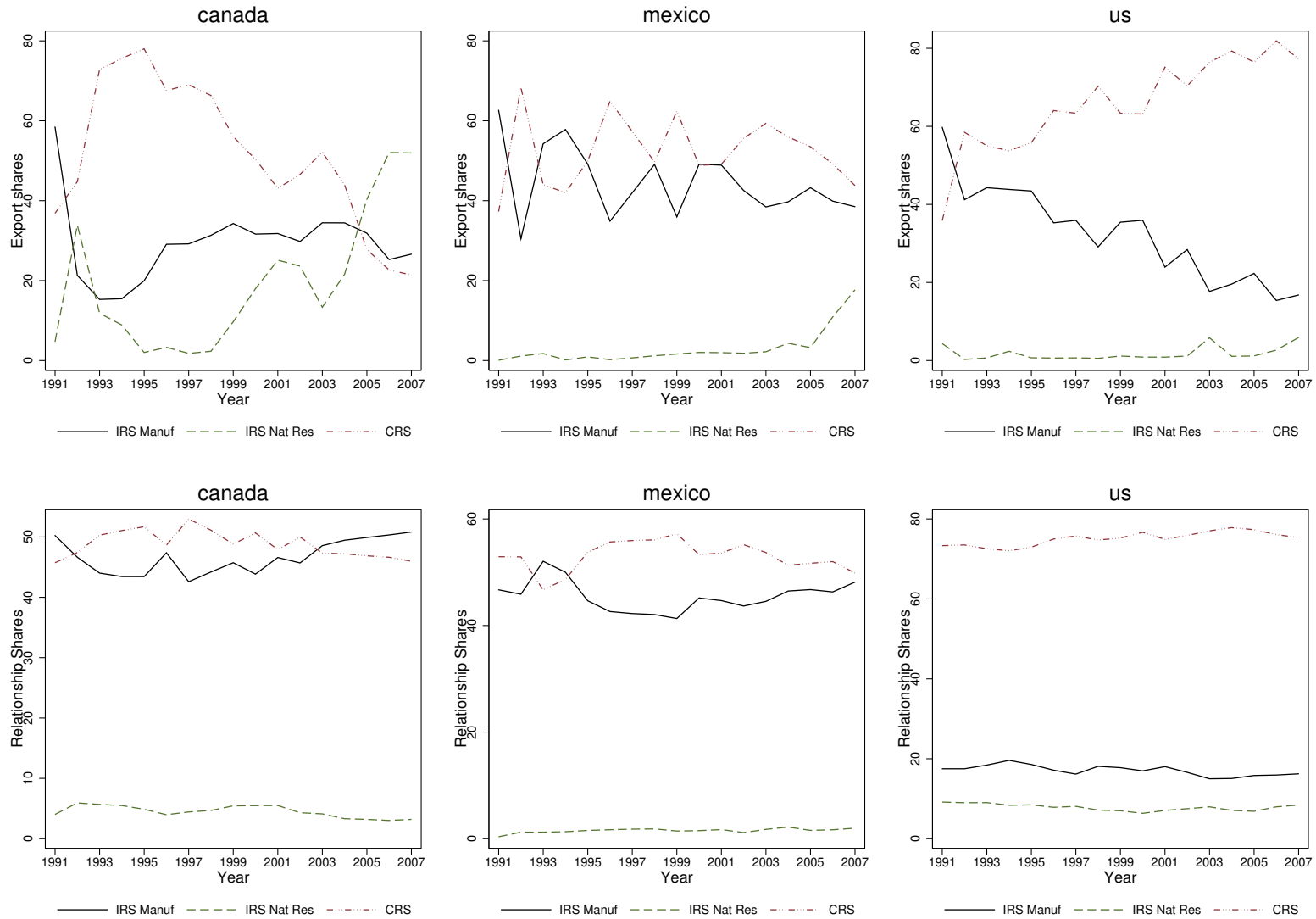


Figure 4: IRS Export and Relationship Shares in Exports to NAFTA Members

CRS products has steadily increased from less than 40% to more than 75% by 2007. Canada's exports of IRS manufacturing goods rapidly decreased with the formation of CUSFTA from almost 60% in 1991 to less than 20% in 1995 before rebounding under NAFTA to more than 30% in the early 2000s and settling at some 25% in 2007. The share of IRS manufacturing products in Mexico's exports to NAFTA members has decreased from 60% to around 40%, while their share in U.S. exports to NAFTA members has decreased from some 60% to around 20%. IRS natural resource products share in Canadian exports increased rapidly between 1991 and 1992, decreased as rapidly by 1995, and finally increased to more than 50%, dominating Canadian exports by 2007. In Mexico's exports the share of IRS natural resource products increased modestly until 2005 when they enjoyed a rapid increase to almost 20%. Their share in U.S. exports has remained largely constant and small.

Fluctuations have been much smaller in the distribution of relationships. The share of IRS natural resource product relationships has remained steady below 10% for both Canada and Mexico, and at roughly 10% for the U.S. The share of CRS product relationships in Canadian exports to NAFTA has increased from 50% to more than 60% in the late 1990s before returning to some 50%. The share of IRS manufacturing products has mirrored that of CRS products, first decreasing from 60% before returning to that level by 2007. The share of CRS product relationships in Mexican exports to NAFTA members has fluctuated around 50% and that of IRS manufacturing has fluctuated around 45%. The U.S. offers a different picture with CRS products relationships accounting for a roughly constant 75% share of relationships and IRS manufacturing products accounting for a roughly constant 18%.

## **4 Hazard of Exporting**

The investigation of the hazard of exporting has a dual purpose: to examine both the effect of NAFTA and returns to scale on the hazard of exporting. I estimate the hazard of exporting



using the most flexible specification by means of estimating a probit model. Unlike the Cox proportional model, it is appropriate for discrete duration data as annual spell data are and does not impose the restrictive proportional hazard assumption.<sup>2</sup> I include a dummy for each year in the spell while the spell is active allowing the hazard to change in every year while the spell is active. This flexibility comes at the cost of a more complicated interpretation of estimated coefficients. Since the hazard can change in every year so will every explanatory variable have a different effect in every year. Interpreting the estimated probit coefficients either by looking at coefficients or the associated marginal effects does not reveal the true effect of each covariate. Instead, I will examine the estimated hazard at means of all variables but the variable of interest to ascertain the full effect of the variable of interest.

I use the following variables to estimate the hazard of exporting. The gross domestic product of the destination country is expected to reduce the hazard, while distance to the destination country is expected to increase the hazard. I use two measures of common language; one capturing whether two countries share an official language and the other whether more than 9% of the population speak the same language. In as much as common language reduces costs, both are expected to reduce the hazard. I use two measures to capture information spillovers; one measures the number of products exported to the same country, while the other measures the number of countries to which the same product is exported. The former measures experience with a country, while the latter measures experience with a product. Both are expected to reduce the hazard of exporting. A lower economic risk of the importer is expected to reduce the hazard. As previous papers in the duration of trade literature have found, the volume of initial exports should reduce the hazard of exporting. The coefficient of variation of unit values measures the extent of the variation of unit values for each product across all export destinations. It reflects the extent of product differentiation

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<sup>2</sup>The proportional hazard assumption implies that the effect of a variable on two different exporters is independent of the length of a spell and is always proportional.

as reflects by unit value differences. I use a dummy to capture any colonial relationship in the past. Finally, I use dummies to capture each multiple instance of a spell which exists since there are more spells than relationships (see Table 1).

Two dummies are used to capture the effect of returns to scale, one for IRS manufacturing products and one for IRS natural resource products with CRS products as the baseline. Since spells of export relationships created after 1990 stretch across the period prior to and after the establishment of NAFTA, it is possible to distinguish between two NAFTA related effects. Therefore, I use two dummies. One simply captures exports to NAFTA members, while the other one captures whether NAFTA itself is in effect. Estimates of these four dummies are of main interest. Results are reported in Table 2.

Most variables have identical qualitative effects across all three exporters. Similar to other papers in the literature, the larger the GDP of importer the lower the hazard for both Canadian and U.S. exports. The effect of importer's GDP on the hazard of Mexican exports is positive whereby larger GDP raises the hazard, an unexpected result. To the extent that Mexican exports to larger and more developed economies are potentially of lower quality may result in them experiencing a higher hazard than exports to smaller economies. The economic risk variable offers a somewhat puzzling result. With higher values indicating a riskier economy, a negative coefficient implies that U.S. exports to riskier economies face a lower hazard, rather than a higher one as one might expect. This result highlights the presence of uncertainty in international trade as modeled by Rauch and Watson (2003) and empirically investigated by Besedeš (2008). It is possible exports to highly uncertain economies are undertaken only once the exporter is relatively certain these exports will be long lived so that they may generate a profit for the exporter. Such a strategy minimizes costs associated with exporting especially in a situation when odds are that exports will not pay off. Economic risk has no significant effect on Canadian exports, while Mexican exports face a lower hazard when destined for less risky markets, as expected.

	Canada	Mexico	U.S.
GDP (ln)	-0.014*** (0.004)	0.036*** (0.003)	-0.037*** (0.002)
Economic risk (ln)	-0.040 (0.025)	0.082*** (0.028)	-0.058*** (0.010)
Initial exports (ln)	-0.046*** (0.002)	-0.069*** (0.002)	-0.092*** (0.001)
Partners by product (ln)	-0.430*** (0.005)	-0.453*** (0.006)	-0.577*** (0.004)
Products by partners (ln)	-0.264*** (0.008)	-0.302*** (0.005)	-0.358*** (0.005)
Cov unit values (ln)	0.026*** (0.002)	-0.009*** (0.002)	0.016*** (0.003)
Distance (ln)	0.045*** (0.010)	-0.062*** (0.011)	0.078*** (0.005)
Common language (official)	-0.027* (0.016)	0.048* (0.026)	-0.050*** (0.005)
Common language (minority)	0.006 (0.015)	-0.063** (0.026)	-0.021*** (0.005)
Colonial relationship	-0.021 (0.017)	-0.011 (0.023)	-0.014 (0.009)
IRS manufacturing	0.104*** (0.007)	0.064*** (0.008)	0.019*** (0.004)
IRS natural resources	-0.003 (0.020)	-0.119*** (0.046)	0.066*** (0.009)
NAFTA members	-0.262*** (0.052)	-0.702*** (0.056)	-0.864*** (0.068)
NAFTA in effect	0.032 (0.055)	0.160*** (0.040)	0.183*** (0.070)
Constant	3.472*** (0.117)	2.849*** (0.122)	6.339*** (0.059)
Observations	187,188	168,642	667,787
Spells	103,851	81,732	292,694
Relationships	70,288	46,272	146,289
Log-Likelihood	-101,030	-91,418	-377,429
Year in spell FE	Y	Y	Y
Spell number FE	Y	Y	Y

Robust standard errors clustered by relationships in parentheses with \*, \*\*, \*\*\* denoting significance at 10%, 5%, and 1%.

Table 2: Hazard Estimates

The volume of exports at the start of a relationship has a significant negative effect for all three countries, consistent with results in the literature, resulting in longer lived spells for relationships starting with a larger volume. Information spillovers have large negative effects – the more products exported to a country or the more countries a product is exported to, the lower the hazard and the longer the duration. Both of these results are consistent with Cadot et al. (2010) and Besedeš (2011). The more variable are the unit values for Canadian and U.S. exports the higher the hazard. The effect for Mexican exports is opposite, with more variable unit values resulting in a lower hazard and longer duration of exports.

To the extent that distance reflects transportation costs, the further away the export markets are the higher the hazard of Canadian and U.S. exports, as expected. For Mexico the effect is the opposite – hazard is lower for exports destined for markets further away from Mexico. Official common language has a significant negative effect for Canadian and U.S. exports resulting in a reduced hazard if exported to a country with English as an official language. Mexican exports to countries with Spanish as the official language face a higher hazard. The minority common language has a statistically significant negative effect for Mexico and the U.S., indicating longer duration and lower hazard, while it has no effect on Canadian exports. Exports to countries with a colonial history are no different from exports to countries without a colonial history for all three exporters.

In terms of the four dummies of main interest, exports of increasing–returns–to–scale manufacturing products face a higher hazard than constant–returns–to–scale products for Canadian, Mexican, and U.S. exports. U.S. exports of increasing–returns–to–scale natural resource products face a higher hazard, while Mexican exports of increasing–returns–to–scale natural resource products face a significantly lower hazard. Canadian exports of such products are indistinguishable from constant–returns–to–scale products. Exports to a NAFTA member face a significantly lower hazard for all three countries, with the effect strongest for the U.S. and weakest for Canada. Surprisingly, the establishment of NAFTA increased the

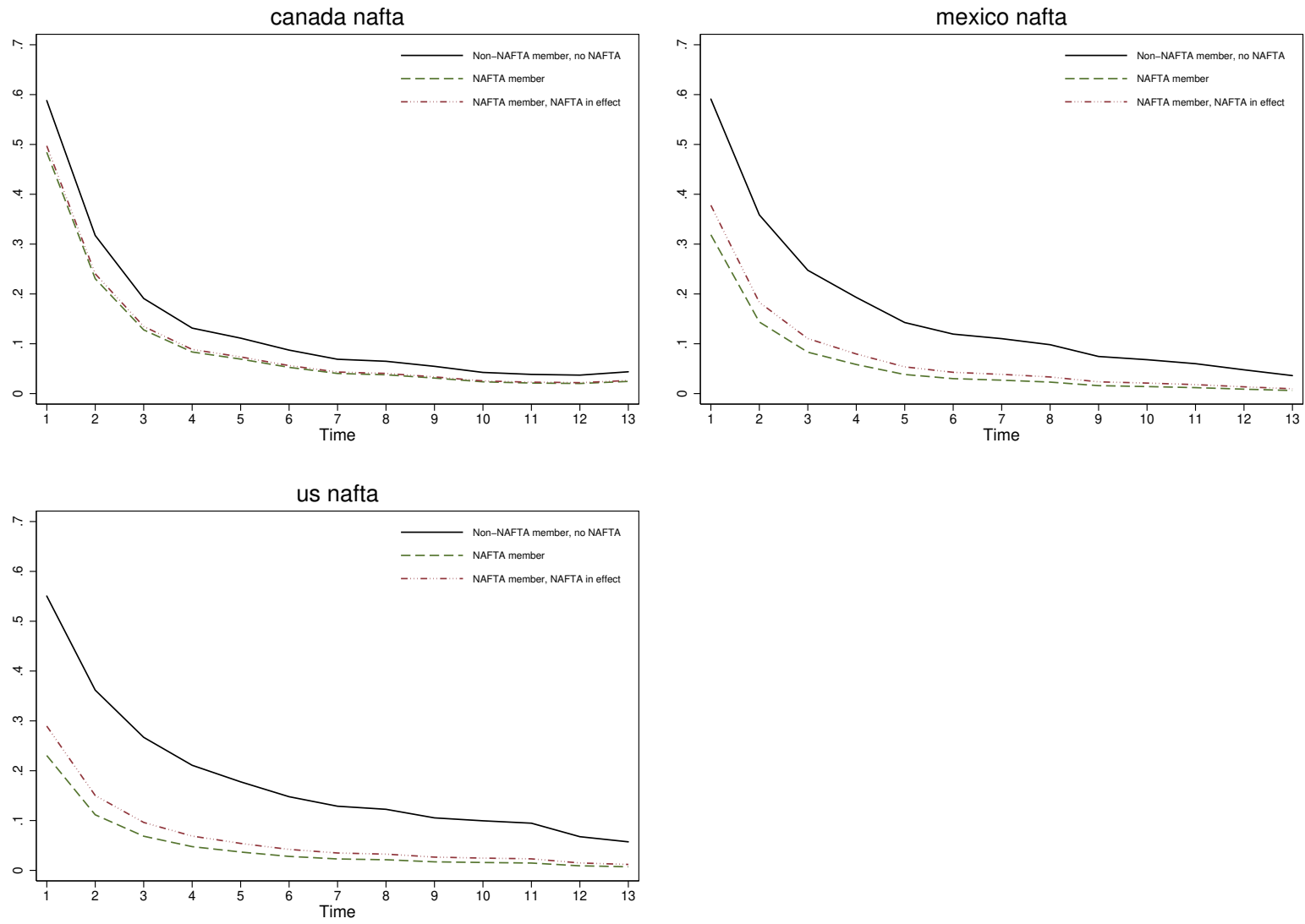


Figure 5: Estimated Hazard and the Effect of NAFTA

hazard of Mexican and U.S. exports, while it has no effect on Canadian exports. The establishment of NAFTA may have induced too many firms to try to take advantage of new opportunities created by NAFTA, thus resulting in more failures. Essentially, NAFTA may have induced some firms who otherwise would not export to do so only to quickly realize they cannot compete in the foreign market.

Figure 5 illustrates the magnitude of the difference in the hazard between exports destined to NAFTA members and non-NAFTA members as well as the magnitude of the effect of NAFTA. The hazard of exporting to NAFTA members is lower than to non-NAFTA countries for all three members, with the difference the largest for Mexico and the U.S. The pure effect of joining NAFTA is almost nonexistent for Canada. The enactment of NAFTA has a much larger effect for Mexico and the U.S., increasing the hazard of exporting to NAFTA members, but not sufficiently to completely offset the lower hazard of exporting to a NAFTA member. The onset of NAFTA has thus increased the hazard of exporting to member countries, with the exception of Canadian exports.

To better understand the nature of the effect of the implementation of NAFTA on the hazard of exporting, Table 3 shows the results with the NAFTA-in-effect variable having a time-dependent effect, for three year intervals starting in 1994. Since the coefficients for other variables are virtually unchanged, I only present the coefficients for the time-dependent NAFTA-in-effect variable.<sup>3</sup> These four dummies indicate in which years did the existence of NAFTA affect the hazard of exporting. While the onset of NAFTA has no net effect on Canadian exports, the time-dependent coefficients indicate that the onset of NAFTA did increase the hazard of Canadian exports to the other two NAFTA members immediately after the onset of NAFTA and had no effect after 1997. The opposite holds for Mexico: there is no effect in the first three years of Mexican participation in NAFTA, while in every subsequent three-year period exports to other NAFTA members face a significantly higher

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<sup>3</sup>Full results are available on request.

	Canada	Mexico	U.S.
NAFTA in effect 1994–1996	0.194*** (0.074)	0.024 (0.048)	0.163** (0.083)
NAFTA in effect 1997–1999	-0.059 (0.068)	0.202*** (0.045)	0.077 (0.082)
NAFTA in effect 2000–2002	-0.061 (0.064)	0.273*** (0.047)	0.337*** (0.078)
NAFTA in effect 2003–2005	0.050 (0.058)	0.145*** (0.046)	0.137* (0.079)

Robust standard errors clustered by relationships in parentheses with \*, \*\*, \*\*\* denoting significance at 10%, 5%, and 1%; year in spell and spell number fixed effects included.

Table 3: Time-Dependent NAFTA Effect

hazard. U.S. exports to NAFTA members face a higher hazard consistently since the onset of NAFTA, with the exception of the three-year period between 1997 and 1999.

#### 4.1 NAFTA and Returns to Scale

I have argued above that one might expect the hazard of exporting increasing-returns-to-scale manufacturing products to have the lowest hazard when destined to NAFTA markets given advantages offered by access to larger markets. The above results that IRS manufacturing products face the highest hazard are potentially indicative of the opposite holding. However, the appropriate examination of such a hypothesis entails comparing the hazard of exporting to NAFTA members, to which I now turn. Rather than introducing a number of interacted variable to examine whether the effect of NAFTA is different for different returns-to-scale products, I estimate the hazard of exporting for each of the three returns-to-scale types of products, focusing on the NAFTA-in-effect coefficients, and compare the fitted hazards for each country. In order to conserve space I only present coefficients relevant to NAFTA.<sup>4</sup> Table 4 collects the results.

Exports of all three countries in all three returns-to-scale types face a lower hazard.

<sup>4</sup>Full results are available on request.

Canada			
	IRS Manufacturing	IRS Natural Resources	CRS
NAFTA members	-0.249*** (0.064)	-0.264*** (0.083)	-0.167*** (0.055)
NAFTA in effect	0.068 (0.067)	0.157* (0.085)	0.031 (0.059)
Mexico			
	IRS Manufacturing	IRS Natural Resources	CRS
NAFTA members	-0.589*** (0.057)	-0.499*** (0.078)	-0.611*** (0.056)
NAFTA in effect	0.187*** (0.043)	0.087 (0.060)	0.061 (0.040)
United States			
	IRS Manufacturing	IRS Natural Resources	CRS
NAFTA members	-0.984*** (0.117)	-0.917*** (0.125)	-0.860*** (0.066)
NAFTA in effect	0.398*** (0.123)	0.416*** (0.126)	0.213*** (0.068)

Robust standard errors clustered by relationships in parentheses with \*, \*\*, \*\*\* denoting significance at 10%, 5%, and 1%; year in spell and spell number fixed effects included.

Table 4: Effect of NAFTA across Returns to Scale

In the case of Canada, the onset of NAFTA has no significant effect on the hazard of exporting increasing-returns-to-scale manufacturing and constant-returns-to-scale products, and only marginally increases the hazard of exporting increasing-returns-to-scale natural resource products. In the case of Mexico, the net effect of NAFTA which was to increase the hazard of exporting to NAFTA members (see Table 2) seems to be driven by its effect on increasing-returns-to-scale products facing a higher hazard. The other two types of products do not seem to be affected by the onset of NAFTA. In the case of the U.S., the onset of NAFTA increases the hazard of exporting all three types of products based on the returns-to-scale used in production.

Figure 6 shows the estimated effects of differences between the different types of returns to scale and their interaction with the implementation of NAFTA for exports to NAFTA



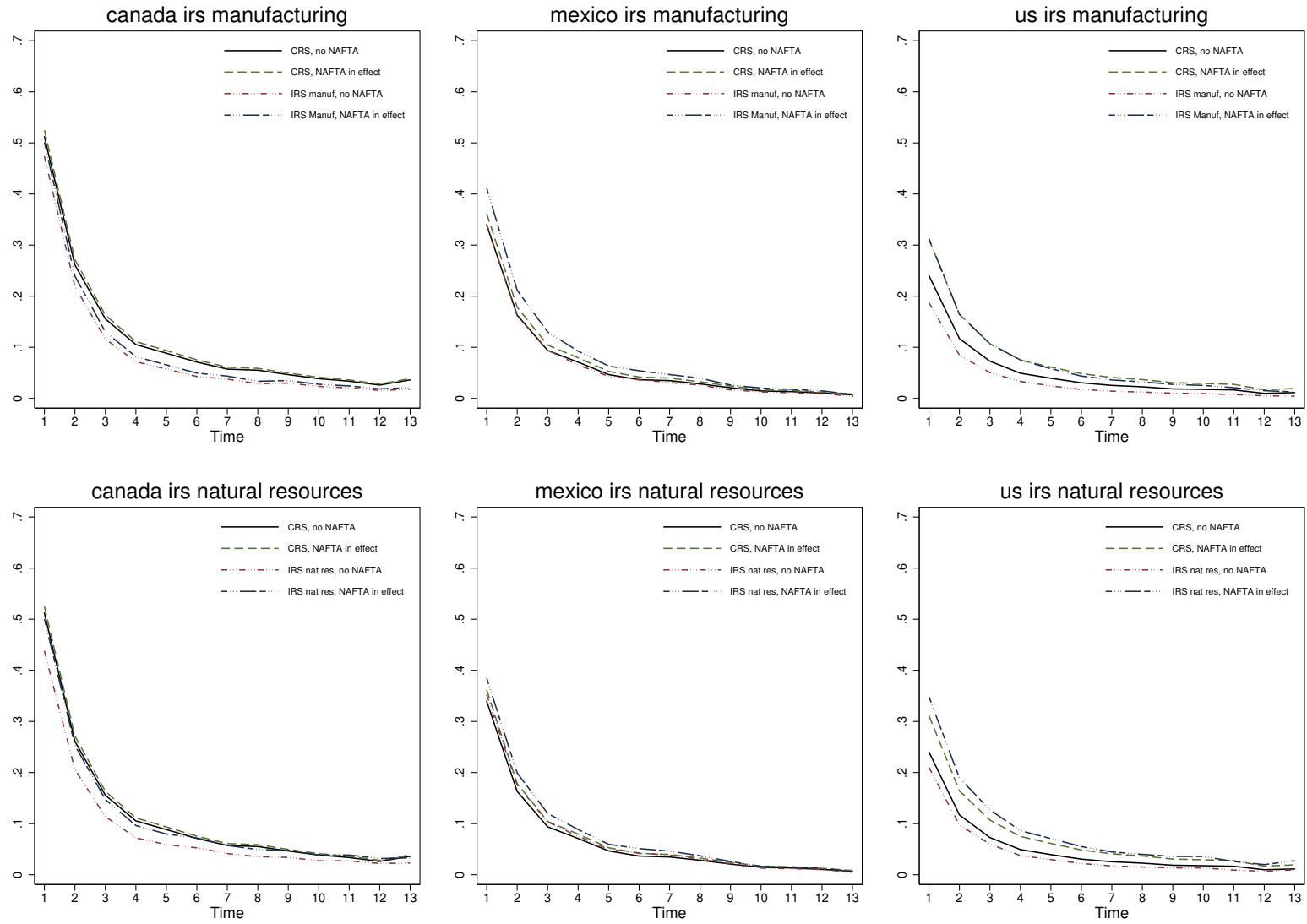


Figure 6: Estimated Hazard and the Effect of NAFTA and Returns to Scale Differences

members. The top panels examine differences between constant-returns-to-scale and increasing-returns-to-scale manufacturing goods, while the bottom panels focus on constant-returns-to-scale and increasing-returns-to-scale natural resource products. Canadian exports of IRS manufacturing products face a lower hazard than exports of CRS products. The hazard of exporting both types of products increases with the onset of NAFTA, though the increase is small, preserving differences between them. Canadian exports of IRS natural resource products face a lower hazard in the absence of NAFTA than do exports of CRS products. The onset of NAFTA makes the two much closer.

There are almost no differences between the hazard of IRS manufacturing and CRS products for Mexican exports to NAFTA members in the absence of NAFTA. NAFTA increases both hazards, with the hazard of IRS manufacturing products increasing more. A similar conclusion can be drawn for IRS natural resource products when compared to CRS products, though differences brought on by NAFTA are smaller. Differences in the hazard of exporting to NAFTA members of the three types of products are largest for the U.S. While IRS manufacturing products face a lower hazard than CRS products in the absence of NAFTA, the enactment of NAFTA increases the hazard of both largely eliminating any difference between the two. IRS natural resource exports of the U.S. face a lower hazard than exports of CRS products. While NAFTA increases both hazards, it increases the hazard of exporting IRS natural resource products by a much larger margin resulting in them having the higher hazard. Thus, only for Canada is there evidence of the expected effect of NAFTA, of IRS manufacturing products having the lowest hazard after the enactment of NAFTA.

Table 5 contains the time-dependent effects of NAFTA for each returns to scale type, shedding more light on the exact nature of the effect of NAFTA on the hazard of exporting. For Canada, NAFTA has increased the hazard of exporting IRS manufacturing and CRS products only during its first three years, while the hazard of exporting IRS natural resource products was higher in the first three years as well as between 2003 and 2005. For Mexico,

Canada			
	IRS Manufacturing	IRS Natural Resources	CRS
NAFTA members	-0.249*** (0.064)	-0.263*** (0.082)	-0.166*** (0.055)
NAFTA 1994–1996	0.270*** (0.089)	0.362*** (0.117)	0.184** (0.081)
NAFTA 1997–1999	-0.003 (0.086)	0.102 (0.108)	0.020 (0.074)
NAFTA 2000–2002	-0.095 (0.077)	-0.065 (0.099)	-0.100 (0.067)
NAFTA 2003–2005	0.106 (0.069)	0.224** (0.089)	0.050 (0.061)
Mexico			
	IRS Manufacturing	IRS Natural Resources	CRS
NAFTA members	-0.589*** (0.057)	-0.499*** (0.078)	-0.612*** (0.055)
NAFTA 1994–1996	0.098* (0.051)	-0.049 (0.071)	-0.127*** (0.048)
NAFTA 1997–1999	0.214*** (0.049)	0.092 (0.071)	0.084* (0.046)
NAFTA 2000–2002	0.326*** (0.051)	0.282*** (0.070)	0.223*** (0.047)
NAFTA 2003–2005	0.111** (0.049)	0.005 (0.069)	0.048 (0.048)
United States			
	IRS Manufacturing	IRS Natural Resources	CRS
NAFTA members	-0.984*** (0.117)	-0.917*** (0.125)	-0.860*** (0.066)
NAFTA 1994–1996	0.484*** (0.145)	0.429*** (0.154)	0.122 (0.081)
NAFTA 1997–1999	0.216 (0.138)	0.446*** (0.145)	0.129 (0.080)
NAFTA 2000–2002	0.609*** (0.136)	0.559*** (0.134)	0.393*** (0.075)
NAFTA 2003–2005	0.251* (0.146)	0.210 (0.151)	0.175** (0.077)

Robust standard errors clustered by relationships in parentheses with \*, \*\*, \*\*\* denoting significance at 10%, 5%, and 1%; year in spell and spell number fixed effects included.

Table 5: Time-Dependent Effect of NAFTA across Returns to Scale

NAFTA has increased the hazard of exporting IRS manufacturing products consistently ever since it was enacted. It has increased the hazard of exporting IRS natural resource products only between 2000 and 2002, while its effect on CRS products is most varied. It has initially reduced it, and then increased it between 1997 and 2002, with no effect since 2003. NAFTA's effect on the hazard of U.S. exports to NAFTA members is the most consistent one, having increased the hazard for every type of product in almost every year. Higher hazard of CRS products started in 2000, while the higher hazard of IRS natural resource products was in effect until 2003.

## **5 Conclusion**

In this paper I investigated how the North American Free Trade Agreement has affected the members' hazard of exporting and how differences in returns to scale in production manifest themselves in exports of three members: Canada, Mexico, and the United States. NAFTA itself has not had a beneficial effect on the hazard of exporting. Rather, the effect has been negative for the U.S. and Mexico, with the hazard of their exports to NAFTA members increasing with the enactment of NAFTA. However, the said increase was not large enough to fully offset the lower hazard exports to NAFTA members enjoy due to the geography of the FTA and proximity of the members to each other. Canada, Mexico, and the U.S. enjoy a significantly lower hazard on exports to each other without the presence of NAFTA. Given the particular geography of NAFTA, the effect of common borders between the members, a well known positive force in international trade, is largely indistinguishable from the effect of NAFTA. The nature of the geography of NAFTA makes it difficult to broadly conclude that every free trade agreement increases the hazard of exports between the members, calling for an investigation of the effect of free trade agreements with less restrictive geographic characteristics.

In terms of differences across the nature or returns to scale, increasing returns to scale in manufacturing increases the hazard relative to constant returns to scale. Exports to NAFTA members in these products are affected differently in the three members countries. Canadian exports of IRS manufacturing products have a lower hazard than CRS products after the enactment of NAFTA. While there are no differences between the two types of products exported by Mexico in the absence of NAFTA, NAFTA itself has increased the hazard of IRS manufacturing products more than that of CRS products. In the U.S. NAFTA has completely eroded the advantage in terms of a lower hazard that IRS manufacturing goods enjoyed prior to its onset.

Canadian exports of IRS natural resource products to NAFTA members have been adversely affected by the onset of NAFTA relative to CRS products facing the same hazard as CRS products after NAFTA's onset. Mexican exports of IRS natural resource products to NAFTA members have experienced an increase in the hazard due to NAFTA which is higher than that of CRS products. U.S. exports of IRS natural resource products used to enjoy a lower hazard than CRS products prior to NAFTA. NAFTA has increased the hazard of both and reversed their ordering with IRS natural resource products facing a higher hazard.

I presented the first evidence of the effect of a free trade agreement on the hazard of exporting. While NAFTA increases the hazard of exporting, further investigation is needed with free trade agreements among countries which are not as geographically clustered as the NAFTA members are. Mercosur and the European Union are two free trade areas which offer a different geography which could shed additional results on the role of a free trade agreement. In addition, I presented the first evidence on the effect of the returns to scale on the hazard of exporting. Unlike differences along the product differentiation dimension, which are largely consistent across a number of countries, the identified effects of returns to scale are exporter specific. Since these results are based on three exporters only, additional investigation of other countries is warranted.

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