Preferential Trade, Sunk Costs, and the Path-Dependent Expansion of Exports

Ingo Borchert *

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Abstract. In the presence of sunk costs to exporting, preferential tariff liberalization may have a prolonged, dynamic effect on the pattern of a beneficiary country's exports. In particular, preferential tariff liberalization might trigger a geographic spread of exports to third markets outside the preferential trading area. I test this hypothesis for the pattern of Mexican exports after the inception of NAFTA to several Latin American trading partners. Identification is achieved by an appropriate normalization of trade flows and a 'triangular' estimation design. The evidence is consistent with the hypothesis that initial exports to the United States further prompted exports to third markets. The results suggest a significant impact on exports to large or geographically proximate countries, which works predominantly through the extensive margin of trade. Growth along the extensive margin owes much to goods with little skill or technology content. The findings also document the simultaneous existence of considerable tariff-induced trade diversion.

Keywords: Preferential tariff liberalization, extensive margin, fixed costs, NAFTA, Mexico

JEL-Codes: F13, F15, K33

*University of St. Gallen, Department of Economics (SIAW-HSG), Bodanstrasse 8, CH–9000 St. Gallen, e-mail: Ingo.Borchert@unisg.ch

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1 Introduction

This paper considers the impact of preferential market access on export product variety. The key idea is that firms might be prompted to extend their exports in a geographical manner when tapping overseas markets initially involves some sort of fixed cost. Hence, any positive shock that helps overcome export barriers—for instance a preferential tariff cut—may trigger a dynamic response. The persistence of export behavior that results from sunk costs is empirically well documented; however, what is less recognized are the implications of sunk costs for the dynamics of trade. One obvious question is whether improved market access to one country, e.g. preferential tariff liberalization, provides for a "bridgehead effect" (Evenett and Venables, 2002) because it is instrumental in overcoming certain fixed costs to trade. This channel could explain why preferential market access translates into a geographic spread of trade that extents well beyond the initial preferential trading partner.

The intuition for the potential path dependency of exports is simple. Suppose there are fixed costs to exporting which are product specific, e.g. arising from quality upgrading. Once a given product is being shipped overseas, it becomes easier to export that same product as well to additional destinations. That is, if average costs of exporting could be lowered by trading with multiple destinations, then preferences could make for a path dependency of exporting, in the sense that initially serving a particular market (the preference-granting country) increases the probability of also tapping additional export markets with the same product. While tariff cuts definitely increase the overall profitability of exporting, a key assumption is that the granting of a preference margin is in fact decisive in recouping the fixed costs of overseas market entry, in which case preferences could directly cause the spectrum of traded varieties to expand. Hence, a testable hypothesis is that for a given developing country, the existence of preferential market access should increase the probability of shipping preferred products to additional export markets. This conjecture is tested, and confirmed, using Mexico's exports after accession to the North-American Free Trade Agreement (NAFTA).

This research addresses a number of both theoretical and policy-related issues. First, with regard to the geographic dimension of diversification, very little is known on "third party effects" of trade liberalization. Preferential trading arrangements in particular have been criticized for their potentially adverse effects on 'outside' countries. Against this background it is an interesting result to find that preferential market access facilitates the geographic spread of trade. Second, evidence to this effect also opens up a new perspective on the evaluation of preferential market access schemes like, for instance, the Generalized System of Preferences (GSP). Those schemes had initially been established to facilitate developing countries' transition towards a more diversified manufacturing export structure. Helping overcome fixed costs to exporting is one possible channel to live up to that goal. Third, fixed costs are widely believed to be important in explaining the many zero trade flows, thus it is desirable—as a matter of theory—to further characterize the nature of these fixed costs based on empirical evidence. Lastly, to the extent that increasing product variety and export diversification gradually replace the many zero trade entries, research on the determinants of export diversification also contributes to the general literature on trade growth.

The mechanism underlying the beachhead effect is actually implied by KRUGMAN's (1979) seminal paper in which he introduced the notion of trade as a way of extending the market and allowing exploitation of scale economies; here I explore the consequences for third countries of changes in trade barriers. The idea is also similar to the literature on 'exporter hysteresis' pioneered by BALDWIN and KRUGMAN (1989). BALDWIN's (1988) "beachhead model" argues that a static shock of the exchange rate can change the number of exporters and prevailing prices by permanently changing the market structure – there is a direct analogy if one replaces temporary exchange rate movements with one-time tariff cuts. In the trade literature, HARRIS (1984) was among the first to specify a fixed cost function that includes both plant and product specific fixed costs components. While HARRIS envisaged production rather than exporting fixed costs and developed the matter in the product dimension, the mechanism works the same when developed along the market size dimension, in which case it leads to falling average unit cost amongst export destinations. Recently, EVANS (2006) and BERGIN and GLICK (2007)—the latter an open-economy macro model—have incorporated mechanisms in which the extensive margin is driven by variable trade cost reductions. Recent empirical work has recognized the role of trade flows to alternative export destinations as part of the extensive margin (BRENTON and NEWFARMER, 2007; BERNARD ET AL., 2007; FELBERMAYR and KOHLER, 2006; BESEDEŠ and PRUSA, 2006).

The existence of fixed cost to exporting is well established, see BERNARD and JENSEN (2004); BERNARD and WAGNER (2001); ROBERTS and TYBOUT (1997). Neither paper, however, uses a combination of geographic and product variation in exports to further characterize fixed costs, as is the focus of this paper. Note that for a newly exporting Mexican firm the product specific fixed costs are part of the (possibly larger) sunk entry costs. DAS ET AL. (2007) quantify those entry costs for Colombian firms in 1986 at around 400,000 USD and thereby confirm their empirical significance. Specifically, fixed costs of the product specific type might include packaging for foreign markets, monitoring customs procedures, ongoing quality control measures, and observing product standards. Regarding the latter, MASKUS ET AL. (2005) consider the costs of standards and regulations inflicted on exporters from developing countries and find that for 27 percent of firms the compliance costs from a 'one-time product redesign' exceed 10 percent of total investment cost. (ROBERTS and TYBOUT, 1997, p.550) report that a substantial part of start-up costs consists of initial investment in product quality. To the extent that trade invoicing is done in US dollars (in contrast to domestic sales), the 14 percent currency barrier mentioned by ANDERSON and VAN WINCOOP (2004) adds to such costs.[1] EATON ET AL. (2004*a*), one of the very few papers with firm-level information on export destinations, are predominately concerned with *destination specific* fixed cost of exporting. However, they also show that the

[1]Insofar as this most recent and by far most comprehensive survey on trade costs does hardly contain any information on product specific fixed costs, the present study also hopes to make progress toward a more nuanced understanding of fixed costs and their implications for export flows.

value added per worker rises consistently with the number of export destinations. To the extent that product specific fixed costs partly take the form of overhead personnel to revamp products for international markets and to administer overseas sales, this positive relationship is unique direct evidence of such product specific fixed costs.

Focusing on the cost side of the profit condition that determines firms' export decisions, Debaere and Mostashari (2005) find that both tariffs and tariff preferences, i.e. particularly the relative position to other countries, significantly influence the extensive margin of countries' exports to the US. Regarding Mexico's post-NAFTA trade pattern, existing empirical evidence on appears consistent with the conjectured mechanism. Hillberry and McDaniel (2002) assess the U.S.–Mexico preferential trade relations and document a rapid increase in Mexico's exports to the US both at the extensive margin (some 24 percent over 8 years) as well as at the quality margin (prices rose about 47 percent over the same period). Hummels (2006) goes a step further and contrasts Mexico's within-NAFTA trade performance with that toward outside countries. His decomposition shows that the time period immediately following NAFTA's inception coincides with a marked increase in the geographic spread of Mexican exports: while the number of products exported to the U.S. increased further, the average number of destinations per HS6 category for Mexican exports *other than the U.S.* increased from 14.9 to 20.7 between 1994–97. Even more strikingly, the number of products shipped exclusively to the U.S. was almost cut in half (down from 457 in 1994 to 295 in 1997) while the number of goods shipped only to non-U.S. destinations stayed roughly constant (592 and 556, respectively). Ostensibly, products that were solely traded with the U.S. were subsequently taken on to new markets outside the U.S. A complementary result is contained in Hummels and Klenow (2005) who uncover important differences in the way how trade growth manifests itself for rich and poor countries, respectively. Poor countries tend to increase their trade by exporting higher quantities per variety at about constant prices, an explanation that would be consistent with a geographic spread of trade in existing products for which fixed costs have once been overcome.

Evenett and Venables (2002) set out to explain the disappearance of zero trade flows and propose a model in which fixed costs of market entry depend on past export performance in (possibly many) markets, thereby coining the term "geographic spread of trade". Their hypothesis centers on the notion of export markets' "similarity". They find that the predominant form of learning occurs through proximity to the supply frontier, i.e. distance to markets previously supplied turns out as the relatively most important channel. As such their mechanism is driven by destination market characteristics rather than product specific sunk costs, and it provides a valuable guide on what might determine the expansion path after favorable shocks from preferential market access. Building on their results I include as candidate countries for third market effects Latin American destinations (due to their proximity) and European destinations (on account of their demand similarity with the U.S. market).

2 Modeling Fixed Costs and the Extensive Margin

The model's demand side is given by the familiar CES framework whereas the supply side is characterized by the explicit formulation of product specific fixed costs. Modeling a firm's export market participation draws on Clerides et al. (1998) and Roberts and Tybout (1997), i.e. trade decisions are made in a dynamic discrete choice model in which exporting is based on a comprehensive profit condition. It is not a model of variety, and its purpose is not—as in Romer (1994)—to endogenously determine the number of goods. Since elaborated fixed cost models have recently been characterized in depth elsewhere (see Evans, 2006), I focus here on tracing out the empirical implications—and deriving testable hypotheses—following from a simple model in which exporters can capitalize on the sunk costs incurred and attain lower unit costs by expanding output at marginal cost. Tapping new market in this manner causes a geographic spread of trade.

This hypothesis is framed from the perspective of a single exporting country; throughout the analysis, let s and d denote the indices for an exporting and destination country, respectively. Assume there is a measure of I industries in the economy, and products within each industry i are differentiated according to country of origin. An importing country thus demands varieties from $s \in 1, \ldots, S$ countries according to the following two-tiered utility function

$$U_d = \left[\int_0^I C(i)\,\mathrm{d}i \right]^\beta C_d^{1-\beta} ; \qquad C(i) = \left(\sum_s^S c_{is}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \tag{1}$$

in which utility is derived from a composite good $C(i)$ that consists of a CES aggregate of S imported product varieties. Note that the elasticity of substitution, σ, pertains to the Armington varieties in industry i. C_d denotes the domestic numeraire good. Based on the demand schedule from maximizing utility, monopolistically competitive producers in the exporting country set prices as a markup over marginal cost. Let mc_i denote the marginal cost in industry i.[2] Hence, the delivered price equals $p_{id} = \frac{\sigma}{\sigma-1}(1 + \tau_{id}^s) \cdot mc_i$, which includes an exporter-specific tariff, τ_{id}^s, that the importing country d might levy on good i from exporter s. With markup pricing, demand from country d for a specific product is then given by

$$c_{id}(p) = \left[(1 + \tau_{id}^s) \frac{\sigma}{\sigma - 1} mc_i \right]^{-\sigma} \underbrace{C(i) \left[\frac{\beta Y}{\int_i C(i)\,\mathrm{d}i} \right]^\sigma}_{\equiv \gamma} \tag{2}$$

It can be shown that, as we should expect, $\frac{\partial p_{id}}{\partial \tau_{id}^s} > 0$ and $\frac{\partial c_{id}}{\partial \tau_{id}^s} < 0$.

At the firm level marginal costs obey the following specification:

$$mc_i = (1 + \eta_i) w ; \qquad \eta \sim \text{lognormal} \tag{3}$$

[2]Since the exporting country here is always Mexico, this subscript is dropped for simplicity and $mc_{is} = mc_i$.

in which w is the wage rate and η is a lognormally distributed random variable. When firms are ordered along the efficiency dimension, the least cost supplier (with $\eta^{(0)} = 0$) faces marginal costs equal to the wage rate while all others incur higher production costs. In the current CES framework, the ordering of firms from low to high cost supplier carries over to good i's delivered prices in country d. Moreover, since fixed costs—to be specified below—are the same for all firms, there also exists a unique ordering of firms' profits, π_{id}, which are inversely related to their efficiency draw, η_i. To illustrate, Figure 1 depicts the relationship between profits and efficiency in a stylized manner. Shifting the profit curve is associated with more firms exporting, i.e. a growth in the extensive margin at the firm level, though that process might be hidden when only country level trade data is available.

Therefore, in the adopted framework cost heterogeneity at the firm level leads to a *monotonic inverse* relationship between firms' profits and efficiency. Hence, predictions that arise from a single firm's zero profit condition, namely whether or not it should start exporting, can be easily aggregated and thus carry over to the country level. This is essential when theoretical implications are framed in terms of probability changes at the firm level but the empirical test is based on country-level data. Clearly, though, we still need to assume that markets—in the sense of exporter–product combinations—clear one by one, which rules out intertemporal cross-subsidization on the part of multi-product firms.[3] Nonetheless, the restrictiveness of this assumption obviously slackens with the length of the time horizon considered.

Next turn to the explicit specification of fixed costs to exporting. Suppose shipping good i from any country to the importer under consideration involves product specific fixed costs, F_i, which are sunk afterwards. We could think of these costs as tailoring the product to foreign tastes, ensure compliance with international standards and regulations, or as overseas marketing outlays for this particular good. These product

[3]As a consequence of substantial sunk entry costs, Das et al. (2007) find that Colombian firms tend to continue exporting even when current net profits are temporarily negative so as to avoid incurring start-up costs again. By the same token, the option value of being able to export appears important for the decision of when to start exporting.

specific fixed costs are a decreasing function of the number of export markets served, that is $F_i(d \in D)$, $\frac{\partial F_i}{\partial d} < 0$. In the simplest case, let these costs be a step function such that they equal a fixed dollar amount A when first encountered and zero afterwards. In this polar case,

$$F_i = \begin{cases} A & \text{if } c_{id} = 0 \qquad \forall\, d \in D; \\ 0 & \text{otherwise.} \end{cases} \tag{4}$$

The profit function for product i to be shipped to destination d, as a function of fixed costs and local tariffs, can then be stated as

$$\begin{aligned} \pi_{id}(\tau, F) &= \left(\frac{p_{id}}{(1+\tau^s_{id})} - mc_i \right) c_{id} \; - F_i(c_{id}) \\ &= \underbrace{\sigma^{-\sigma}(1-\sigma)^{1-\sigma}\gamma \cdot (1+\tau^s_{id})^{-\sigma} \cdot mc_f^{1-\sigma}}_{\equiv R(\tau^s_{id},\gamma)} \; - F_i(D) \end{aligned} \tag{5}$$

in which $R(\tau^s_{id}, \gamma)$ represents 'operating profits' net of tariffs and marginal costs but excluding fixed costs. It can be verified that $\frac{\partial \pi_{id}}{\partial \tau^s_{id}} < 0$, i.e. tariff rate cuts applicable to imports from s on the part of country d unambiguously raise the exporting firm's profits. The key implication though is that the following equation holds as well.

$$\frac{\partial \pi_{ik}}{\partial \tau^s_{id}} < 0 \qquad \forall\, k \neq d \tag{6}$$

That is, profits derived from exporting to any alternative destination $k \neq d$ rise as well in response to a tariff cut on the part of country d towards exporter s, $\Delta\tau^s_{id} < 0$. The reason is that product specific fixed costs, $F_i(D)$, are a function of the set D of all potential export destinations. Since fixed costs are decreasing in export quantities, and the latter are in turn decreasing in tariffs, the result in eq. (6) follows. This is a necessary (though not sufficient) condition for the geographic spread of trade. Whether or not such tariff cuts are sufficiently high to render a product profitable depends on a host of other factors, but the salient point is that it unambiguously increases the probability thereof.

Eq. (6) establishes the impact of (preferential) tariff cuts on the evolution of the beneficiary country's extensive margin with respect to *third* markets. The response in the exporting country's trade portfolio following a tariff cut can be brought about along two different margins: first, it might now turn out to be profitable to ship good i to destination d. Second, after having recouped the product specific fixed costs, that same product could now be shipped to additional destinations other than d, denoted by k. Let two indicator variables y_{idt}, y_{ikt}, respectively, denote whether or not exports at time t take place with respect to those two different channels. Instantaneous profit maximization by firms at time t then obeys

$$\begin{aligned}\max_{y_{idt}, y_{ikt}} \pi(\tau, F) = & \, y_{idt} \cdot \Big[R(\tau^s_{id}) - \Big(1 - y_{idt-1}\Big)\Big(F_i + F_d\Big)\Big] \\ & + \; y_{ikt} \cdot \Big[R(\tau^s_{ik}) - \Big(1 - y_{idt-1}\Big)F_i - \Big(1 - y_{ikt-1}\Big)F_k\Big]\end{aligned} \tag{7}$$

The terms F_d, F_k denote other kinds of fixed costs, e.g. costs that are destination specific or that are incurred anew in each period. Those terms are not of particular interest for the present question but their existence is clearly suggested by EATON ET AL.'s (2004b) finding that most products are shipped to at most one destination. Obviously the decision problem takes on this simple form only when the fixed costs are binary and when optimization is static.[4]

Provided that as of time $t-1$ good i is not yet exported to a third country k, potential dynamic effects manifest themselves exclusively along the extensive margin. Since the primary interest lies in such third party effects, the first-order condition associated with country k is directly read off the maximization problem:

$$y_{ikt}: \qquad R(\tau^s_{id}, \tau^s_{ik}) \;\; \geq \;\; \Big(1 - y_{idt-1}(\tau^s_{id})\Big)F_i + \Big(1 - y_{ikt-1}(\tau^s_{ik})\Big)F_k \tag{8}$$

Notice that the operating profits stemming from a third market k depend on τ^s_{id}. Hence, exploring whether the combination of tariff cuts and fixed costs can provide an

[4]Forward-looking decision making would as well incorporate future net benefits from exporting today, and might thus lead to positive exports even when current profits are negative.

explanation for the extensive margin to expand is tantamount to testing whether τ_{id}^{s}, or some lags thereof, enter significantly in an equation that determines export flows from country s to k. In that regard it is not so much the trivial structure of the FOCs that will be exploited empirically but rather their 'triangular' and possibly dynamic intertemporal relationship given a decline in τ_{id}^{s} is being observed: first, such a tariff reduction has the obvious own-product effect on y_{idt}. This could occur either on the intensive margin when good i has already been shipped, or could cause good i to be exported for the first time. Moreover, in the presence of product specific fixed costs, y_{idt-1} positively affects y_{ikt} according to eq. (8), i.e. a cross-market effect of tariffs that induces the geographic spread of trade. Note that the model prediction hinges on both the initial shock to variable trade costs *and* on the presence of a particular kind of sunk cost. This tight structure should facilitate a causal interpretation of trade patterns observed under a preferential trading regime. Equally important, product specific tariff reductions on the part of country d are arguably exogenous to observed and unobserved factors that determine trade by exporter s with third countries, y_{ikt}. The triangular structure alleviates much of the endogeneity problems that usually afflict trade policy variables.

Thus the vector of the export status variable obeys a discrete dynamic process. Combining with the FOCs from above makes the probability of good i to be geographically spread out to an additional destination k a function of tariff rates

$$\Pr(y_{ikt}=1\,|\,\gamma) \;=\; \Pr\Big(R(\tau_{ik}^{s})-(1-y_{idt-1})F_i-(1-y_{ikt-1})F_k>0\,|\,\gamma\Big) \qquad (9)$$

Notice in particular the key implication

$$\Pr(y_{ikt}=1\,|\,y_{idt-1}=1)>\Pr(y_{ikt}=1\,|\,y_{idt-1}=0) \qquad (10)$$

That is, previously exporting product i to d raises the probability of that good being subsequently exported to k as well, thus capturing the bridgehead effect that is induced by product specific fixed costs. The model prediction in eq. (10) will be the starting point for all of the three alternative empirical specifications that are derived in the next section.

3 Econometric Specifications

3.1 Cross-Sectional Estimation

The first approach derives a static reduced form specification from eq. (10) by taking "long differences" between two points in time around NAFTA's inception. Here I just assume that the spread of exports does take place sometime in between that interval, leaving the exact lag structure unspecified.[5] Consider a normalization of Mexican export flows on its total exports, i.e. world exports except for the US, and then combining those relative import demand functions from two points in time. After rearranging, that approach is effectively tantamount to regressing excess growth rates of exports to a third market on the excess growth rate of exports to the US.

For an estimable equation start from

$$\begin{aligned}\ln\left(\frac{X^C_{i,t1}}{X^W_{i,t1}}\right) - \ln\left(\frac{X^C_{i,t0}}{X^W_{i,t0}}\right) &= \alpha + \beta_1\left[\ln\left(\frac{X^{US}_{i,t1}}{X^W_{i,t1}}\right) - \ln\left(\frac{X^{US}_{i,t0}}{X^W_{i,t0}}\right)\right] \\ &\quad + \beta_3 \ln\left(\frac{(1+\tau^{Mex}_{i,t1})}{(1+\tau^{Mex}_{i,t0})}\right) + \beta_4 \ln\left(\frac{(1+\tau^{MFN}_{i,t1})}{(1+\tau^{MFN}_{i,t0})}\right) \\ &\quad + \beta_5 Z^C + \beta_6 \mu^C + \varepsilon_{i,t}\end{aligned}$$

which is equivalent to

$$\begin{aligned}\Delta \ln X^C_{it} - \Delta \ln X^W_{it} = &\ \alpha + \beta_1 \Delta \ln X^{US}_{it} - \beta_2 \Delta \ln X^W_{it} \\ &+ \beta_3 \Delta \ln \tau^{Mex}_i + \beta_4 \Delta \ln \tau^{MFN}_i + \beta_5 Z^C + \beta_6 \mu^C + \varepsilon_{i,t}\end{aligned} \tag{11}$$

[5] Likewise, a non-structural approach is also taken by Bernard and Jensen (2004); Clerides et al. (1998); Bernard and Wagner (2001) and Roberts and Tybout (1997).

In this form the left-hand side has an immediate interpretation as the excess growth rate of Mexican exports to a third market c over rest-of-world (RoW) exports (ex USA). Dates t_0, t_1 define the long difference; the starting point is always $t_0 = 1993$ whereas t_1 ranges from 1995 to 2000 so as to trace out the evolution of effects over time. The vector Z^C collects country characteristics like GDP per capita, population, distance from Mexico, and R&D expenditures. A full set of country dummy variables, denoted μ^C, controls among others for exchange rate differences and all across-the-board trade policy changes enacted by Mexico's trading partners. Normalization of trade flows by world exports, $X^W_{i,t}$, eliminates all product-specific (demand or supply side) shocks, including proportional measurement error at the tariff line level. After this transformation, identification is achieved by assuming that unobservables of the trade cost function are uncorrelated with US exports. This appears plausible since there is no reason to suspect the remaining error term of *third countries* to be correlated with determinants of exports to the *US*.

The expected signs of coefficients are as follows. The coefficient β_2 will be negative by construction.[6] Next, NAFTA tariff cuts constitute a preferential market access for Mexican goods and, and a positive sign of β_3 means that at the same time third market exports are shrinking, which is thus evidence of some sort of short-run supply capacity constraint on the part of Mexico. Conversely, as the US lowers its MFN rates, other countries gain relatively better market access and might replace Mexican exports to the US, thus β_4 is expected to be negative. Country characteristics that can be expected to have a bearing on the expansion path of exports will carry the usual signs, in particular a negative one on distance. The changes in tariffs (perhaps together with an interaction term) capture the trade diverting effects in Mexican exports to third countries and are thus important control variables. It is only after accounting for these

[6]The high model fit is a direct consequence of the normalization by world exports. As the coefficient on RoW exports approaches -1 the R^2 rises accordingly, thus no particular meaning or significance is attached to the value of that statistic. The prime purpose is not to achieve a high model fit but to control for product-specific shocks and a time trend by constructing excess growth rates of exports.

trade diversion effects plus any product specific shocks and measurement errors and overall export growth, that an *additionally* discernible positive effect of US exports on third country exports is evidence of a geographic spread of Mexican exports following the NAFTA experience.

3.2 Extensive Margin Decomposition

Instead of using the discrete change from non-exports to exports, as would have been natural for an analysis of the extensive margin, the previous section's specification regresses third country trade flows on US trade flows because there is hardly any variation in the discrete count measure in the Mexican–US trade relationship. In order to bolster the inference as to the positive impact of US exports on third market exports, I now employ an index measure of the extensive margin developed by FEENSTRA and KEE (2005) and HUMMELS and KLENOW (2005). The finding that Mexican exports to the US exhibit predictive power for this alternative formulation of the extensive margin lends further support to the hypothesis of a geographic spread of trade.

Since the measure of product variety in both papers mentioned above is framed from an importing country's perspective, an index of the extensive margin that is appropriate for the present analysis must first be adapted so as to be stated from an exporter's point of view. Start from the excess growth rate of Mexican exports which forms the dependent variable in eq. (11).

$$\text{Dep. Variable} = \ln\left(\frac{X^{C}_{i,t1}}{X^{C}_{i,t0}}\right) - \ln\left(\frac{X^{W}_{i,t1}}{X^{W}_{i,t0}}\right) \tag{12}$$

As in FEENSTRA and KEE (2005), define by I^x_t, $x \in \{C, W\}$ the set of good that Mexico exports at time t to any country (C) or to the World (W). The union of both, henceforth called the common set, does not carry a superscript, i.e. $I^c_t \cap I^w_t = I$. Adapting the measures proposed in FEENSTRA and KEE (2005); HUMMELS and KLENOW

(2005) to capture one single country's export variety, define the extensive (EM) and intensive (IM) margin, respectively, as follows:

$$\mathrm{EM}_{c,t} = \frac{\sum_{i \in I^C} X_{i,t}^W}{\sum_{i \in I^W} X_{i,t}^W}\,, \qquad \mathrm{IM}_{c,t} = \frac{\sum_{i \in I^C} X_{i,t}^C}{\sum_{i \in I^C} X_{i,t}^W} \tag{13}$$

Aggregating the HS 6-digit trade flows up to the HS Section level and using the above definitions, the dependent variable in eq. (12) can, at each point in time, be decomposed into an extensive and intensive margin component.

$$\ln\left(\frac{\sum_{i \in I^C} X_{i,t1}^C}{\sum_{i \in I^W} X_{i,t1}^W} \div \frac{\sum_{i \in I^C} X_{i,t0}^C}{\sum_{i \in I^W} X_{i,t0}^W}\right) \;=\; \ln\left(\frac{\mathrm{EM}_{C,t1}}{\mathrm{EM}_{C,t0}}\right) + \ln\left(\frac{\mathrm{IM}_{C,t1}}{\mathrm{IM}_{C,t0}}\right) \tag{14}$$

I have now transformed the excess growth rate of exports between two points in time into changes that are due to movements over time in the extensive and intensive margin, respectively. Each term on the right-hand side of eq. (14) can now be regressed separately on the same set of covariates as in eq. (11), since we are still interested in the effect of exports to the US while controlling for tariff changes. The added benefit of the proposed decomposition is that the coefficients from estimating the EM and IM model, respectively, will exactly add up to the coefficients that obtain from using the excess growth rate as a dependent variable. This feature allows for a straightforward appreciation of the role of the extensive margin in driving Mexican exports to third markets.

3.3 Discrete Choice Panel Estimation

In a binary choice model of a good's export status the testable prediction that emerges from eq. (10) may be captured by the following specification.

$$\Pr(y_{ikt} = 1 \,|\, Z_i, \mu_i, n_i = n) \;=\; G\left(\beta Z_{it-1} + \mu_i\right) \tag{15}$$

This is the fixed effects (FE) conditional logit estimator with unobserved effects. The dependent variable y_{ict} is a binary indicator that takes on the value of 1 if Mexican exports of product i to country c at time t are positive, and 0 otherwise. $G(\cdot)$ represents the conditional logistic distribution function. In the logit case the sum $n_i = \sum_t y_{it}$ is a sufficient statistic for the unobserved effect μ_i so that the joint distribution of y_i conditional on $(Z_i, \mu_i, n_i = n)$ does not dependent any longer on the unobserved effect (hence FE estimator since the conditional logit model accommodates arbitrary correlation between unobserved effects and covariates). This attractive feature affords robustness in the sense that the relationship between unobserved individual effects and independent variables can be left unrestricted. The matrix of covariates, Z_{it-1}, includes the same data as in the previous section, namely the value of exports to the US, X_{it-1}^{US}, as well as US–Mexican and US–MFN tariff rates, $(1+\tau_{it-1}^{Mex})$ and $(1+\tau_{it-1}^{MFN})$, respectively, plus a full set of time dummy variables.

Due to the properties of binary choice panel data models the following remarks apply. First, by conditioning on the sufficient statistic n those observations whose outcome does not change over time (all zero or all ones) will not contribute to the likelihood function and will thus drop out. Second, in a pooled estimation over 16 Latin American destinations the cross-sectional units are given by (product $\times$ country) combinations whose outcome is then tracked over several years. Notice then that any variable that does not vary within those panel units will be collinear and will thus drop out. This feature of the conditional logit functional form—which by the same token delivers the desirable independence from unobserved effects—precludes the estimation of a constant, of country fixed effects, or any of the country-specific variables employed in the pooled 'long difference' approach above. It is always possible, though, to run the pooled specification on subsamples that are stratified across skill, technology, income or other interesting dimensions. The fact that the data pertains to the country level rather than the firm level calls for some flexibility in implementing eq. (15). For instance, what constitutes "one time period" from an exporter's point of view is not likely to coincide with the annual frequency with which trade data is collected. Regarding the empirical analog of eq. (15) it is therefore advisable to experiment with different lag structures (including current values) of the variables involved.

In contrast to the long difference approach, the panel estimation enforces much more structure on the data in that the exporting status to third markets is rigorously tied to the variation of US exports in the time dimension. It therefore gets considerably closer to interpreting the positive impact of US exports on subsequent exports in a causal sense. However, since there is rarely a free lunch, the price to be paid for accommodating arbitrary correlation between unobserved effects and covariates is the inability to calculate (average) partial effects on the response probability. Hence, the discrete panel data approach and the long difference specification are clearly complementary in that the former's inference as to sign and significance underscores the causal interpretation whereas the latter provides some sense of the marginal effect involved.

4 Estimating Mexico's Spread of Exports

While the mechanism of export hysteresis proposed here is quite generic and not confined to NAFTA, its inception in 1994 led to substantial variation in variable trade costs within a short period of time, thus providing an excellent case for studying the dynamic effects of a one-shot improvement in market access conditions. Although Mexico's NAFTA experience has been widely researched there is, to the best of my knowledge, no empirical evidence yet on the positive impact that NAFTA tariff reductions exerted on Mexico's exports toward non-NAFTA partners.

4.1 Data

Data on trade flows and trade costs, especially applicable effective tariff rates, are sufficient to assess the hypotheses derived above. The United States' NAFTA tariff rates towards Mexico are obtained from the data base "U.S. Tariffs Light, 1989–2001", compiled by John Romalis and available on the NBER's International Trade Data website.[7] Tariffs are recorded at the 8 digit level of the Harmonized Tariff Schedule of the United States (HTS), and are subsequently aggregated to the HS-6 digit level to ensure compatibility with trade data. Data include the most favoured nation (MFN) tariff per product as well as an estimated ad valorem equivalent (AVE) for Mexican imports, based on both the ad valorem and the specific portion of Mexico's NAFTA preferences. A major advantage of this data base, which is particularly vital when analyzing the extensive margin, is that it also provides information on applicable tariff rates even when no trade is observed. Without this feature, exactly those tariff line observations would be lost that switch their status at some point from non-traded to traded. However, precisely these tariff lines embody the variation needed for identification.

Country data on per capital GDP, population, and R&D expenditures are taken from the World Bank's *World Development Indicators*. Distance data (relative to Mexico) comes from the Centre d'Études Prospectives et d'Informations Internationales (CEPII). The skill content of trade is proxied by average wage data in 1990 US dollars per hour paid in the respective industry. The three categories 'low skilled', 'medium skilled' and 'high skilled' refer to wage intervals $(5, 10]$, $(10, 15]$ and $(15, 22]$ dollars/hour. The technology classification is based on LALL (2000).[8]

Mexican export data is retrieved from the OECD *International Trade by Commodity Statistics* data base. Trade flows classified by the HS Rev. 2 scheme are available at the HS-6 digit level. Apart from the US, the country coverage in this study spans 16 Central and South American countries.[9]

[7] Or directly from `http://gsbwww.uchicago.edu/fac/john.romalis/research/TariffL.ZIP`.

[8] I thank David Hummels for access to both kinds of data.

[9] Central and South American countries include: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Honduras, Nicaragua, Panama excl. Canal Strip, Peru, El Salvador, Uruguay, and Venezuela.

4.2 Post-NAFTA Export Patterns

If the conjectured mechanism is true, it must be the case that (i) NAFTA tariff cuts attracted higher exports from Mexico in contrast to other comparison countries, and (ii) that subsequently Mexican exports spread out amongst third countries, thereby shrinking the set of goods that are exclusively shipped to the U.S. A first set of statistics confirms both predictions. At a descriptive stage this makes a compelling *prima facie* case for the geographic spread of trade.

First, there is clear evidence that NAFTA itself had a profound impact on the evolution of Mexican exports' extensive margin towards the U.S. in contrast to all other Latin American countries which did not enjoy a similar change in market access conditions. Table (1) documents the surge in new products from Mexico to the U.S. from 1990 onwards, which is not even remotely matched by any other comparable country. Between 1990 and 1997 Mexico added 649 HS 6-digit products to its U.S. export portfolio while the second in line, Ecuador, recorded only 214 new products. This evidence is robust across different levels of aggregation (SITC-5, HS-6, and HS-10 levels). The immediate impact in 1995/97 is clearly visible, while other countries start to catch up towards the end of the 1990s.

Moreover, in order to attribute this extraordinary growth to the inception of NAFTA, it is necessary to disentangle the latter's effect from other macroeconomic events that took place at the same time, most notably the conclusion of the Uruguay Round and the subsequent implementation of tariff reductions on the part of Mexico's trading partners. Table (2) contrasts Mexico's export performance against that of other Latin American countries. Indeed Mexico's growth in the number of exported products to the U.S. as well as in the overall number of destinations stands out against all other comparable countries in Latin America. In particular, the increase of 13 more goods on average *per export destination* and 34 more export destination over the four-year period around NAFTA almost dwarfs the comparison countries' statistics.[10]

[10]The reason that the annual percentage change is not largest for Mexico is the country's high

Second, Mexico's accession to NAFTA coincides with a remarkable acceleration of the extensive margin of Mexican exports to third countries other than the U.S. Table (3) documents the evolution of the extensive margin as a count measure towards a list of Latin American trading partners. It is staggering that the number of 'new' products is at least as large as the number of products already traded, and is often a manifold of the latter.[11] Of the 16 Latin American countries considered, seven turn out to receive more than 1,000 new product lines from Mexico in 1997. New goods often account for one third or more of the export volume in 1997. Consider, for instance, Guatemala which records the highest number of newly traded products from Mexico, even though its figure of continuously traded goods is already large (second only to the US). Trade in those goods grew by 272 percent over the 4 years covered, while 1,307 new HS-6 digit lines were added to the Mexico–Guatemala trade relation, accounting for slightly more than one quarter in 1997 bilateral trade.[12] Another 200 product lines ceased to be traded which had contributed about 10 percent to the initial 1993 bilateral trade volume, leaving a net increase of 1,107 product lines.

From a product point of view, Table (4) shows that the average number of Latin American export destinations for Mexican products more than doubled during the mid-1990s. The average number of destinations stood at 1.95 in 1993 and peaked at 4.8 in 1998. Even more specifically, Table (5) investigates the hypothesis that those exports to third markets are triggered by U.S. exports. In 1993, prior to NAFTA, 12 percent of products were exclusively shipped to the U.S. and 18 percent were exclusively shipped to non-U.S. destinations (the bulk of goods, 70 percent, were exported to both disjunct sets). By 1997 the share of products exported solely to the U.S. was cut by one third while the share of non-U.S. exports remained almost unchanged. This is evidence that

absolute number of goods and destinations to begin with in 1993.

[11] When a 3-year range is considered instead of a point in time alone (i.e. products not traded in 1993 but traded in all three years 1996–98), the numbers come down somewhat but the result remains qualitatively unchanged, meaning that the number of entries is roughly at least as large as the number of already exported goods.

[12] Although trade growth at the intensive margin surged by 272 percent, notice that the *share* of products continuously traded fell from $(100 - 9.5) = 90.5$ percent in 1993 to $(100 - 27.9) = 72.1$ percent in 1997, due to the hefty increase in goods not previously traded.

goods first exported to the U.S. were spread out geographically (or that exports of new goods were from the beginning targeted towards multiple destinations).

4.3 Econometric Results

Empirical estimates of the long difference specification as derived in section (3.1) are presented in Table (6). The model is pooled across countries, controls for country fixed effects, and explores systematic differences across countries in terms of income, size, distance, and R&D expenditures. The main result is that the pooled specification underscores the finding of a geographic spread of trade. It is, to the best of my knowledge, the first empirical evidence on a "geographic spread of trade" triggered by a particular preferential tariff liberalization. At the disaggregated product level, changes in US exports have a highly significant impact on those products' excess growth rates to third markets in Central and Latin America. Tariff-induced trade diversion, from both NAFTA and MFN rates, is highly significant as well. The positive bridgehead effect of US exports increases with a rise in the third country's per capita income and size and decreases with the destination market's distance from Mexico.

Moreover, the range of traded goods has been stratified along its skill and technology content, respectively, and the pooled specification has be rerun on different subsamples of goods, e.g. on low-skilled or high-technology goods, to further characterize the channel through which the bridgehead effect works. In terms of products' skill content the trade-enhancing impact of US exports is strongest in medium-skilled goods and smallest in low-skilled ones (columns 2–4). Furthermore, the positive sign on US–Mexico tariff rates and the negative one on US MFN rates suggest considerable tariff-induced trade diversion (a decrease in NAFTA tariffs faced by Mexico suppresses Mexican exports to third markets). The negative sign on the interaction term of US exports and NAFTA tariffs suggests that the positive impact of the former increases with the depth of tariff cuts, particularly so for low skilled/low technology goods.[13]

[13]Recall that the change in tariff rates is negative, thus a negative coefficient magnifies the positive

When the sample is split according to technology content (columns 5–8) the effect is increasing in technology, i.e. strongest for high-tech goods and smallest for resource-based ones. The destination countries' R&D expenditures exhibit an interesting pattern: its effect is negative for low skilled and low tech goods but strongly positive for medium skilled and medium tech goods. This finding is quite intuitive and suggests that R&D expenditures might usefully proxy the country's similarity with the advanced US market. This is in line with the hypothesis that it is US exports that trigger further shipments to other countries and not common background factors.

Next consider the findings for the extensive margin decomposition. The data that corresponds to eq. (14) in section (3.2) is pooled across sectors and countries, resulting in some 304 observations (19 HS Sections $\times$ 16 countries). The results for the 1997/93 period are presented in Table (8). The first column effectively resembles the pooled estimation as in Table (6) but at the HS Section level instead of being estimated from HS 6-digit lines. In the second column—the extensive margin (EM) model—the coefficient on US exports is positive and significant while in column 3—the intensive margin (IM) part—it is not. Hence, the results boldly support the hypothesis that Mexican exports to the US did promote exports to other Latin American countries via the extensive margin channel. The fact that prior US exports turn out to be fairly uncorrelated with a measure of the intensive margin suggests that broadening the range of traded goods indeed seems to be the primary adjustment margin of Mexican exports after NAFTA.[14]

The decomposition, by which the coefficients from the extensive and intensive margin column exactly add up the one displayed in the first column, turns out particularly useful for interpreting the tariff variables. While neither US–Mexico nor US–MFN tar-

effect of an increase in US exports.

[14]Note that the extensive margin is likely to be underestimated. By construction the extensive margin cannot be calculated in cases in which there are exclusively zero trade flows within a given sector. This is the case for some sectors in the base year 1993 while it is never the case in 1997. These instances, however, are exactly those sectors that by definition feature an increase in the extensive margin. Due to the summation at the sectoral level this problem is of minor significance though.

iffs significantly affect export growth, the decomposition uncovers a highly significant positive impact (i.e. negative sign) of tariff cuts for the extensive margin and a negative impact on the intensive margin. Hence, the decomposition is able to reveal the differential impact of tariff changes on both adjustment margins, which would otherwise by lumped together. To the extent that the range of goods traded with third markets also expands these increased trade volumes will show up in a higher value of the extensive margin, which by definition is measured as world exports in the set of goods exported to a given third country. This channel by which preferential tariff cuts raise the extensive margin is reflected in the negative sign on the change in US–Mexican tariff rates.

The decomposition exercise may equally well be performed on a finer level of aggregation, with product variety then being calculated at the HS 2-digit level from HS 6-digit trade flows. The coefficients thus obtained are somewhat smaller in magnitude but the findings remain qualitatively unchanged. Secondly, one can trace out the extensive margin's impact over time. Here it seems that the EM response was strong in the immediate aftermath of NAFTA but petered out later. Lastly, it is worthwhile pointing out that the pooling over countries hides the fact that despite an overall insignificant coefficient for US exports in later years (for instance in 2000), the impact is still highly significant for individual countries, e.g. Bolivia, Brazil, Ecuador, Honduras, Costa Rica.[15]

Finally consider the results obtained by discrete choice panel data estimation, as presented in Table (9). The set of covariates again includes Mexican exports to the US, US–Mexico and US–MFN tariff rates, as well as time dummies. Recall that the cross-sectional units are product × country combinations so that the unobserved effects already absorb the set of country dummies. Tariff variables include one lag relative to US exports in order to capture both the pure trade diverting effect as well as the lagged indirect effect from the conjectured mechanism that runs via increased US exports.

[15]Countrywise results are not reported to conserve space but are available upon request.

The first column contains the results from the entire sample pooled over 16 third export destinations. It is reassuring to find that the panel estimation supports as well the hypothesis of a geographic spread of trade. On top of the tariff variables, exports to the US exert a positive impact on the status whether or not to export a product to a third destination as well. The coefficient itself is small but the absolute magnitude of point estimates does not have any meaning in conditional fixed effect logit estimation. Moreover, the finding that US–Mexican tariffs switch sign between the contemporaneous and lagged variable exactly conforms to the predictions of the conjectured mechanism. Recall that the lagged variable's negative sign indicates that NAFTA tariff cuts *increase* the probability of a good being shipped to a third country. Therefore the results quite intuitively suggest that the current variable captures Mexico's supply capacity constraint whereas the lagged variable reflects the postulated knock-on effect.

The mechanics of the conditional logit panel estimator preclude estimating the effect of time-invariant variables, so we have to forgo the direct inclusion of country and product specific variables, as was done in the long difference and extensive margin specifications. It is still possible though to cut the data along those dimensions to further inquire into the sources of heterogeneity among destination countries. The remaining columns of Table (9) report the results from different subsamples. US exports appear significant for exports to countries with a lower per capita income, and highly so for countries with above-average expenditures on R&D. The effect of the products' skill content is rather uniformly spread out across low, medium and high skilled goods. In contrast, there is a marked trade effect for low-tech and medium-tech goods only.

In line with the conjectured mechanism, the effect of US exports in the subsample of high R&D countries might reflect the destination's similarity with the advanced US market to which the goods have initially been shipped. Nonetheless it is predominately low-tech goods for which the US acts as a bridgehead to additional markets. Note also that the coefficient on lagged Mexican tariffs is of opposite sign for low and high tech goods, respectively. In contrast to the negative sign for low tech goods (positive impact), the positive sign for sophisticated goods suggests that the supply capacity constraint is much more binding than for low tech goods.

5 Conclusions

Mexico's post-NAFTA export pattern sees a huge increase in the extensive margin, i.e. a host of new products is being shipped to Central and Latin American destinations. The main result of this paper demonstrates that export flows from Mexico to the US have predictive power for the subsequent shipment of those products to additional markets. In order to identify the impact of exports to the US on third destinations—thus verifying the geographic spread of trade—three complementary approaches are implemented. The 'long difference' specification surrounding NAFTA's tariff cuts constructs excess growth rates to alternative destinations relative to world exports and thus effectively controls for all product-specific shocks. A decomposition of excess growth rates into Feenstra-type indices of extensive and intensive margin underscores the predominate role of the former as a response margin, and conditional logit panel estimations exploit the time dimension to pinpoint the conjectured bridgehead effect.

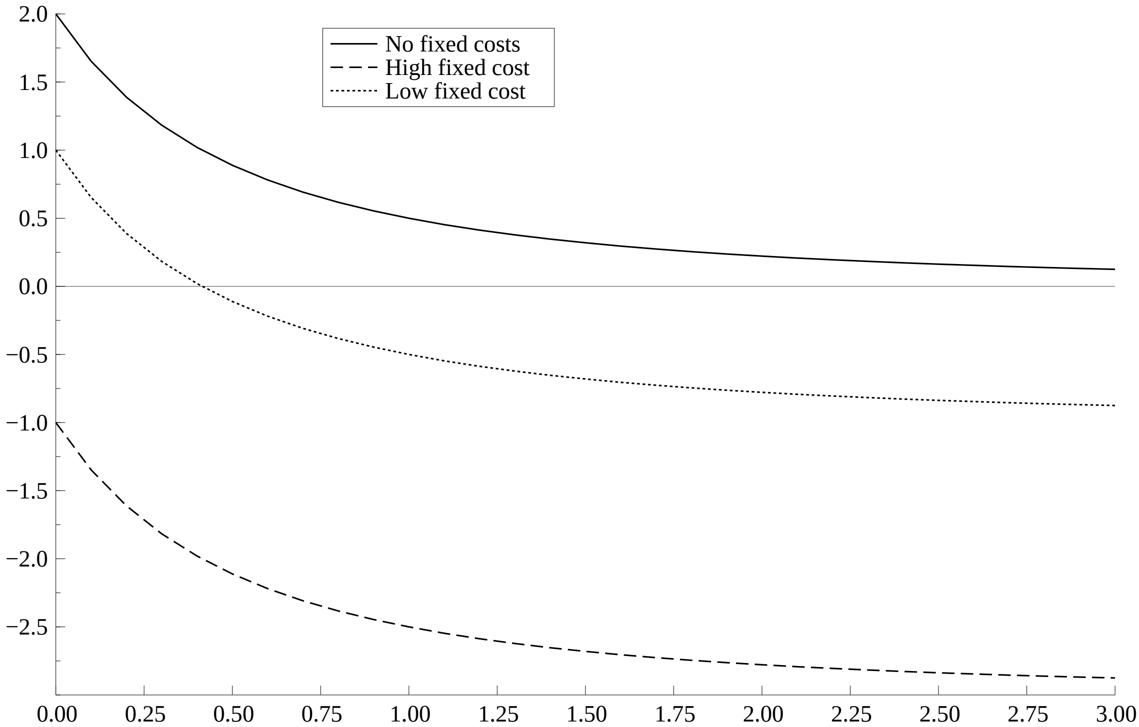
I find that changes in US tariff rates—both preferential rates towards Mexico as well as US MFN rates—exert a profound impact on Mexican patterns. Two developments are simultaneously ongoing. The first stage immediately following NAFTA's inception is characterized by a re-direction of Mexican trade toward the US and a gradually unfolding crowding-out of its exports to neighboring Latin American trade partners. The results appear to be consistent with a capacity constraint on the part of Mexico as a supplier. Simultaneously, exporting a given product to the US has a positive effect on Mexican exports to third markets, even after accounting for product-specific shocks and the overall growth of Mexican exports. This phenomenon is consistent with the existence of product-specific sunk costs of exporting and is, to the best of my knowledge, the first direct empirical evidence of a "geographic spread of trade" triggered by a particular instance of preferential tariff liberalization. The positive impact of US exports takes more time to materialize than the immediate tariff change impact. Hence, in the presence of product specific fixed costs a shock in variable trade costs may yield important dynamic effects as it may lead to a path dependency of those exports that were initially stimulated by, for instance, a preferential tariff cut. The positive and significant effect of exports to the US emerges despite the inclusion of country dummy variables. This finding is important as it suggests that the correlation is not spurious in that it would pick up unilateral liberalization efforts of Mexico's export partners as they implement their Uruguay Round commitments.

The conditional logit fixed effects panel estimation confirms the predictive power of preferential exports for exports to additional markets. In addition, the tight structure of the panel estimation pays off in that it reveals a differential impact of contemporaneous and lagged NAFTA tariff cuts, respectively, whose signs exactly conform to the predictions of a mechanism that works through preferential exports. Regarding the driving forces behind the geographic spread of trade in terms of product groups, the logit panel estimation attributes an important role to low technology goods with a low or intermediate degree of skill content. In the excess growth rate regressions though the trade-enhancing effect is strongest for sophisticated goods at the high end of skill or technology content, while the low end is characterized by considerable tariff-induced trade diversion. It appears therefore that the stunning growth in the extensive margin as a count measure owes much to rather simple goods, while the impact of more sophisticated goods on the value of Mexican exports is not to be underestimated.

I close with a caveat concerning the theoretical underpinnings used in this study. Namely, the decision to export is modeled from a supply side perspective, assuming elastic demand. Thus, whenever demand side factors kick in, either for a given product or at a given point in time, the zero-profit condition that determines export participation becomes slack, yielding possibly inaccurate predictions for trade flows.

Tables and Figures

Figure 1: Profits and Efficiency



Notes: The solid curve shows, as a baseline, the 'no fixed cost' case, whereas incurring fixed costs shifts the profit schedule downwards (dashed line). As it is drawn no trade occurs in this (i, s) combination since not even the least cost supplier finds it profitable to export. The dotted line at last features some limited entry by more productive firms until profits turn negative. Shifting the profit curve even higher is associated with more firms exporting, i.e. a growth in the extensive margin at the firm level.

Table 1: Extensive Margins Towards U.S., HS-6 Level, 1990

	1990	1995		1997		2000	
		Δ	%	Δ	%	Δ	%
Mexico	2742	491	3.3	649	3.1	638	2.1
Argentina	1091	-169	-3.3	-32	-.4	88	.8
Brazil	1912	44	.5	2	0	284	1.4
Bolivia	150	40	4.8	43	3.7	73	4
Colombia	879	53	1.2	85	1.3	228	2.3
Chile	621	70	2.2	99	2.1	154	2.2
Ecuador	301	170	9.4	214	8	320	7.5
Peru	489	68	2.6	177	4.5	329	5.3
Venezuela	1030	-231	-5	-148	-2.2	-208	-2.2
Canada	4060	88	.4	140	.5	86	.2

Notes:
Data source: U.S. International Trade Commission Dataweb. Table entries show the number of products exported to the U.S. at a given level of disaggregation, and the evolution of the extensive margin over time. The column "Δ" lists the total absolute change between 1990 and the respective year whereas the column "%" displays the corresponding average annual percentage change for the that period.

Table 2: COMPARISON OF EXTENSIVE MARGINS, 1997/93

	Extensive Margin 1993–97									Destinations		
	World			USA			Avg No			Avg No		
	1993	Δ	%	1993	Δ	%	1993	Δ	%	1993	Δ	%
Mexico	688	49	1.7	565	55	2.3	52	13	5.6	94	34	8
Argentina	612	70	2.7	238	24	2.4	35	4.2	2.9	112	19	4
Brazil	760	23	.7	482	-13	-.7	69	.9	.3	142	6	1
Bolivia	101	18	4.2	29	9	7	6.7	1.6	5.5	32	5	3.7
Colombia	477	74	3.7	227	8	.9	23	6.7	6.6	95	2	.5
Chile	512	53	2.5	159	31	4.6	27	3.6	3.2	91	17	4.4
Ecuador	260	54	4.8	85	25	6.7	11	2.2	4.8	67	16	5.5
Peru	311	73	5.4	112	43	8.5	13	3.2	5.7	91	16	4.1
Venezuela	431	2	.1	219	-1	-.1	22	2	2.2	80	7	2.1
Canada	800	44	1.3	687	8	.3	67	15	5.2	154	9	1.4

Notes:
Data source: World Trade Flows by FEENSTRA ET AL. (2005). Product classification is SITC 4-digit; there is a minimum threshold of $100,000 per year in the original data set for trade flows to be reported. The first column within each block presents the level of the respective variable in 1993, whereas the column "Δ" shows the total absolute change over the entire period. The column "%" displays the corresponding average annual percentage change for that period. The first block of columns lists the extensive margin of countries towards the World as importer, the second block lists the corresponding figures for the U.S. as an export destination. The third block calculates the average number of products (at the SITC 4-digit level) shipped per export destination and their change over time. The last block shows the number and change in export destinations for each country.

Table 3: Extensive Margin of Mexican Exports, 1993–1997

	C_i		N_i		D_i	
Country	count	growth*	count	share*	count	share*
Argentina	428	124.6	810	21.5	167	10
Bolivia	69	176.4	676	74.9	43	12.8
Brazil	346	335.3	791	39.9	151	25.7
Chile	570	457.5	1266	28.1	103	6.3
Colombia	646	231.4	1049	29.1	173	10.4
Costa Rica	752	292.5	1299	38	163	30.6
Dom.Rep.	189	162.3	826	16.4	75	5.9
Ecuador	295	177.4	774	45.4	118	22.1
Guatemala	1181	271.9	1307	28.5	200	9.5
Honduras	540	340.8	984	28.3	138	15.6
Nicaragua	263	191.2	829	59.2	76	12.8
Panama	465	212.1	1039	36.2	137	8.4
Peru	350	107.9	864	44.5	153	12.2
El Salvador	773	160.3	1035	26.9	157	7.2
Uruguay	149	126.3	472	32.9	112	22.5
Venezuela	622	344	1069	33.2	149	26
USA	3750	95.8	371	.6	392	.6

Notes:
Total number of HS-6 digit products: 4,995;
C_i – product i continuously traded in 1993 and 1997, aggr. growth over entire period;
N_i – product i newly traded in 1997 but not in 1993, value share in 1997;
D_i – product i traded in 1993 but not in 1997, value share in 1993;
* Figures are given as percentage of trade volume in that category.

Table 4: Average Number of Destinations, 1993–2000

	1993	1994	1995	1996	1997	1998	1999	2000
Latin America	1.95	2.79	3.79	4.22	4.55	4.8	4.69	3.71
Europe	.88	1.32	1.58	1.65	1.71	1.77	1.83	1.31

Notes:
Table entries show the average number of export destinations for Mexican products among 16 Latin American and European countries, respectively. For each year, averages are taken is with respect to the 4,995 products at the HS 6-digit level.

Table 5: Direction of Mexican Exports

	Number of Products			Share per Destination		
	All	U.S.	non-U.S.	% U.S.	% non-U.S.	% Both
1993	688	81	123	12	18	70
1994	678	61	110	9	16	75
1997	737	58	117	8	16	76
1998	738	60	114	8	15	76
2000	714	62	80	9	11	80

Notes:
Data source: World Trade Flows by Feenstra et al. (2005). Product classification is SITC 4-digit. In the original data set the minimum threshold for trade flows to be reported is $100,000 per year.

Table 6: Pooled Estimation by Skill/Technology Categories, Latin America, 1997/93

	Full Sample	Skill			Technology			
		low	medium	high	low	medium	high	res-based
Δ US Exports	0.0329***	0.0139**	0.0556***	0.0372***	0.0408***	0.0487***	0.0539***	0.0094***
	(0.003)	(0.006)	(0.006)	(0.006)	(0.008)	(0.007)	(0.014)	(0.003)
Δ US Exports sqrt	–0.0112***	–0.0143***	–0.0159***	–0.0052***	–0.0167***	–0.0092***	–0.0125***	–0.0072***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Δ RoW Exports	–0.9350***	–0.9323***	–0.9368***	–0.9393***	–0.9312***	–0.9528***	–0.9312***	–0.9240***
	(0.003)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.012)	(0.004)
Δ US Mex. Tariff	1.4567***	0.8861	12.0834***	4.0625***	4.5459***	7.5291***	8.6902***	1.3486**
	(0.409)	(0.542)	(1.440)	(1.185)	(0.708)	(0.878)	(3.302)	(0.640)
Δ US MFN Tariff	–2.6901***	–2.2044***	–2.3409***	–1.0669	–2.5326**	–6.5521***	2.7812	–1.0113**
	(0.388)	(0.733)	(0.606)	(0.888)	(1.108)	(1.062)	(3.968)	(0.419)
(Δ Exports)*(Δ Mex. Tariff)	–0.3603***	–0.6507***	–0.7430***	0.0116	–0.5635***	–0.2233	1.4295	0.0476
	(0.069)	(0.089)	(0.253)	(0.179)	(0.134)	(0.165)	(0.978)	(0.091)
GDP p.c.	0.0553	0.0666	0.0631	–0.0488	0.1127	–0.0172	0.1227	0.0539
	(0.042)	(0.070)	(0.078)	(0.091)	(0.088)	(0.086)	(0.175)	(0.054)
Population	0.2176***	0.0289	0.4666***	0.1976***	0.0788	0.3569***	0.4350***	0.1723***
	(0.026)	(0.042)	(0.049)	(0.055)	(0.053)	(0.054)	(0.108)	(0.033)
Distance	–0.8680***	–0.6461***	–1.1373***	–0.9215***	–0.7169***	–1.1467***	–1.0676***	–0.7326***
	(0.058)	(0.093)	(0.106)	(0.129)	(0.113)	(0.119)	(0.240)	(0.081)
R&D Expenditures	0.0079	–0.0178**	0.0368***	0.0059	–0.0134	0.0259**	0.0208	0.0074
	(0.005)	(0.008)	(0.009)	(0.011)	(0.010)	(0.010)	(0.021)	(0.006)
Constant	4.4672***	5.9678***	2.6404***	5.9097***	5.7440***	5.1414***	2.2833	3.5929***
	(0.431)	(0.692)	(0.796)	(0.970)	(0.846)	(0.891)	(1.809)	(0.601)
N	73728	26224	25728	15168	20048	20400	5520	27760
R^2	0.5409	0.5486	0.4613	0.5961	0.4933	0.5205	0.4371	0.6362

Notes: Dependent variable is $\Delta \ln X_i^c - \Delta \ln X_i^W$, with $X_{i,t}^c$ denoting Mexican exports in product i at time t to country c, and $X_{i,t}^W$ worldwide Mexican exports excluding those to the US. Pooled estimation across 16 Latin American export destinations, country dummy variables not reported. "p.c.GDP" denotes per capita GDP in Purchasing Power Parity (PPP) units.

Table 7: Pooled Estimation over Two Subperiods, Latin America, 1997/95 on 1995/93

	Full Sample	Skill			Technology			
		low	medium	high	low	medium	high	res-based
Δ US Exports	–0.0297***	–0.0128	0.0136	–0.0391***	0.0266**	0.0521***	0.0323	–0.0889***
	(0.006)	(0.010)	(0.010)	(0.011)	(0.013)	(0.012)	(0.029)	(0.007)
Δ US Exports sqrt	–0.0061***	–0.0010	–0.0050***	–0.0101***	0.0005	–0.0052***	–0.0012	–0.0090***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)
Δ RoW Exports	0.3398***	0.2503***	0.3380***	0.3240***	0.2219***	0.3026***	0.3898***	0.3591***
	(0.005)	(0.007)	(0.008)	(0.009)	(0.009)	(0.009)	(0.020)	(0.007)
Δ US Mex. Tariff	3.6768***	2.5428***	0.4908	10.4910***	0.3567	14.6432***	14.5151***	0.9944
	(0.637)	(0.785)	(1.861)	(2.388)	(0.949)	(1.695)	(3.579)	(1.193)
Δ US MFN Tariff	–4.0846***	1.2348	–5.1763**	–3.1222	–3.6785	–20.5698***	4.6364	–1.8377
	(1.009)	(1.516)	(2.127)	(2.596)	(3.019)	(3.305)	(4.413)	(1.328)
(Δ Exports)*(Δ Mex. Tariff)	0.1536	–0.0153	–0.4156	2.2507***	1.1239***	–0.1399	–3.4702***	0.2031
	(0.148)	(0.198)	(0.383)	(0.405)	(0.260)	(0.416)	(1.053)	(0.205)
GDP p.c.	0.0001	–0.0223	0.0798	–0.0405	0.0347	–0.0457	0.5216**	–0.0521
	(0.061)	(0.100)	(0.104)	(0.141)	(0.116)	(0.124)	(0.222)	(0.093)
Population	0.0376	–0.0889	0.1580***	0.0826	–0.1601**	0.1496**	0.1547	0.0894*
	(0.036)	(0.059)	(0.061)	(0.082)	(0.067)	(0.073)	(0.131)	(0.054)
Distance	–0.3173***	–0.1782	–0.5446***	–0.3939**	–0.1601	–0.5444***	–0.7942***	–0.2927***
	(0.071)	(0.117)	(0.122)	(0.164)	(0.133)	(0.146)	(0.266)	(0.109)
R&D Expenditures	0.0276***	0.0103	0.0472***	0.0317**	0.0016	0.0500***	0.0411*	0.0287***
	(0.006)	(0.010)	(0.011)	(0.015)	(0.012)	(0.013)	(0.024)	(0.010)
Constant	1.2975**	2.6847***	0.2507	1.3401	3.4958***	1.3891	–1.3709	0.3395
	(0.536)	(0.882)	(0.923)	(1.243)	(1.003)	(1.106)	(2.016)	(0.826)
N	77312	25488	25760	15296	19776	19952	5520	28032
R^2	0.0863	0.0522	0.0847	0.0900	0.0430	0.0769	0.0980	0.1145

Notes: See Table 6. Long difference of dependent variable and regressors refer to different subperiods. Namely, changes in third market exports from 1997/95 are being related to changes in US exports from 1995/93.

Table 8: Extensive Margin Decomposition, Latin America, 1997/93

	Export Growth	Ext. Margin	Int. Margin
Δ US Exports	2.2394***	1.6816**	0.5578
	(0.646)	(0.659)	(0.800)
Δ World Exports	–3.7637***	–2.5533**	–1.2103
	(0.709)	(1.077)	(1.062)
Δ US Mex. Tariff	–5.7162	–18.1270***	12.4108**
	(3.948)	(5.161)	(4.700)
Δ US MFN Tariff	–4.7153	–20.9138***	16.1985*
	(9.057)	(5.854)	(8.719)
GDP p.c.	–0.9320***	–0.7352***	–0.1968***
	(0.010)	(0.030)	(0.024)
Population	0.2469***	–0.1426***	0.3895***
	(0.006)	(0.007)	(0.007)
Distance	0.2515***	0.6713***	–0.4198***
	(0.010)	(0.012)	(0.011)
R&D Expenditures	–0.0033***	–0.0011	–0.0022*
	(0.001)	(0.001)	(0.001)
Constant	4.2823***	4.6399***	–0.3575
	(0.161)	(0.474)	(0.396)
N	289	289	289
R^2	0.1652	0.1634	0.1508

Notes:
Dependent variables: column (1) excess growth rate of exports at sectoral level, column (2) extensive margin, column (3) intensive margin. Due to that decomposition the coefficients in columns 2 and 3 sum up to the one in the first column. Pooled estimation over 16 Latin American countries, country fixed effects not reported.

Table 9: Pooled Conditional Logit Estimation, Latin America, 1997/93

	Full Sample	GDP p.c.		R&D		Skill		Technology	
		< Med	> Med	< Med	> Med	low	high	low	high
US exports	0.0000***	0.0000***	0.0000	0.0000	0.0000***	0.0000**	0.0000**	0.0000***	0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
US tariff MEX	1.1818*	2.1686**	0.0106	2.5948*	0.6183	2.6399***	1.2841	3.2883***	1.4827
	(0.651)	(0.911)	(0.939)	(1.333)	(0.747)	(0.931)	(1.957)	(1.118)	(5.431)
US tariff MFN	0.5325	0.4424	0.5691	0.5299	0.5759	1.1735	–0.4384	–0.0583	11.4228***
	(0.546)	(0.788)	(0.761)	(1.111)	(0.630)	(0.866)	(1.088)	(1.087)	(3.848)
US tariff MEX $_{t-1}$	–1.5708***	–0.8985	–2.0311***	–2.7177***	–1.0950**	–1.2353**	–1.1471	–1.2125*	10.1867***
	(0.461)	(0.661)	(0.646)	(0.905)	(0.539)	(0.611)	(1.709)	(0.728)	(2.984)
US tariff MFN $_{t-1}$	2.0048***	1.4724	2.7037***	4.0535***	1.1514	2.0339	3.8211***	1.7840	–2.5154
	(0.684)	(0.946)	(1.006)	(1.316)	(0.807)	(1.276)	(1.444)	(1.823)	(3.136)
N	93024	44376	48648	27134	65890	34946	16367	31112	8248
pseudoR^2	0.0957	0.0961	0.0961	0.1241	0.0855	0.1266	0.0804	0.1395	0.0594
log $\mathcal{L}$	–31632.0	–15047.6	–16571.1	–8923.2	–22673.9	–11495.6	–5661.5	–10109.0	–2924.3

Notes:
Dependent variable is binary indicator variable on export status. Column 1 estimates refer to entire sample while subsequent models split the sample between country below/above the median per capita GDP and median R&D expenditures, respectively. The last two models split the sample along the products' skill and technology content, respectively. Pooled estimation over 16 Latin American countries, country fixed effects included but not reported.

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