Increasing Marginal Cost and Welfare Implications*

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Abstract

I use a matched firm's product and export destination information for manufacturing firms in Hungary and exploit the exogenous variations in the foreign demand addressed to a firm to study the relationship between a firm's domestic and foreign sales while controlling for the firm's supply determinants. I find that a 10 percent exogenous increase in exports led to approximately 1.6 percent decrease in domestic sales. This pattern persists over time and suggests the presence of an increasing marginal cost of production, contrary to the assumption of constant marginal costs in most trade models. To shed some lights on the implications of this finding for aggregate welfare, I introduce an increasing marginal cost technology into a trade model and show that liberalizing trade results to a new channel of reduction in potential welfare gains not accounted for in previous studies. Our findings provide support for concurrent policies that reduce trade barriers and eases capacity constraints to ensure that the gains from trade are fully realized.

Keywords: exports, domestic sales, imperfect competition, demand shocks
JEL Classification: D24, F10, F14, F12, L20

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1 Introduction

Research have shown that exporting is associated with favourable economic outcomes, but one aspect of it typically understudied in the literature is its effect on domestic sales and implication for aggregate welfare. This is because most trade models (Melitz (2003), Krugman (1980) etc) implicitly assume that a firm's exports have no relationship with its domestic sales (i.e. production with constant marginal cost assumption); if anything, exporting reduces firm-level prices (Garcia-Marin and Voigtländer, 2019) and increases domestic sales (Berman et al., 2015). These trade models form the basis for strong support in favour of large welfare gains from trade liberalization. More recently, there has been a number of growing papers (Almunia et al. (2018), Ahn and McQuoid (2017), Vannoorenberghe (2012) etc), which shows that the relationship between exports and domestic sales is negative (i.e. increasing marginal costs technology), however the long run effect of such relationship, and more importantly the welfare effects of such findings within the context of the "so-called" new trade models remain unclear.

In this paper, we revisit this question on the relationship between exporting and domestic sales. Specifically, we focus on the marginal cost technology and its implication for aggregate welfare using firm-level data from Hungary. By doing this, we make two contributions to the literature. First, we propose a structural model for estimating the marginal cost structure. The resulting structural equation implies that the marginal cost structure can be inferred from the relationship between a firm's domestic and foreign sales conditional on both the firm's supply and demand determinants. We estimate the empirical equation using the novel methodology for the short and long run relationship between exports and domestic sales. As an alternative specification, we employ an instrumental variable approach pioneered by Hummels et al. (2014) and applied to trade by Berman et al. (2015). In all our empirical specifications, we find the relationship between exports and domestic sales to be negative, suggesting the prevalence of increasing marginal cost technology. Second, we study the implication of an increasing marginal cost technology for welfare by building it into Melitz (2003) new trade model and re-derive the resulting welfare equation. The modified model highlights a new channel for reduction in potential welfare gains from trade liberalization which is unaccounted for in previous studies that relies on constant marginal cost assumption.

The knowledge of the short and long run marginal cost structure is important. It tells us about the production capacity of the firm (Ahn and McQuoid, 2017)[1]. Debates and policy discussions on the intersection between production capacity, exports and welfare is not new. For example, United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) devotes a chapter (UNESCAP, 2011) to discuss the importance of addressing capacity constraints in the least developed countries as it is pertinent to their success in global markets. However, identifying capacity constrained industries is not straightforward, but the marginal cost structure sheds some lights on production capacity. Thus, the practical importance of our result is that industrial policies which addresses production capacity be implemented simultaneously with trade liberalizing policies to ensure the full realization of the gains from trade. Unlike some recent studies which finds a net loss in aggregate welfare from trade liberalization[2], ours do not imply a net loss of aggregate welfare, but a new channel that reduces potential welfare gains.

The analysis begins in section 2, where we present our data and a brief descriptive statistics. Our data is a panel of manufacturing firm-level data from Hungary, taken from three different sources and merged together for this analysis. The first dataset consists of firm-level balance sheet information for the period 1993 to 2014 originally from the Hungarian Tax Authority (APEH). Firms are classified according to their NACE-2 industry classification with information on their total sales, exports revenue, labour and cost of material inputs, ownership type etc. The second dataset is an extremely disaggregated trade data

[1]Specifically, Ahn and McQuoid (2017) shows a strong relationship between increasing marginal cost structure and production capacity constraints in their study on Indonesian manufacturing firms.

[2]For example, Hsieh et al. (2018) relaxed the symmetry assumption in their study of the effect of Canada-US Free Trade Agreement (CUSFTA) on aggregate welfare in Canada. They show that import variety gains from CUSFTA are attenuated by domestic variety losses, and domestic productivity gains are attenuated by import productivity losses resulting to a net welfare losses in Canada.

for the period 1992-2003 assembled by Hungarian customs[3]. This data consist of firm's export and import shipments to and fro specific countries at the 9-digit combined nomenclature (CN-9). That is, in each time period, we observe the nominal value of products exported by a firm and its export destination and products imported by a firm and its source country. The third dataset, is a country-level product import data for the period 1995-2003 originally from United Nations Comtrade database (UNCOMTRADE), but cleaned and prepared by Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). This data consists of HS-6 products of the universe of countries imports. We use these information to construct instruments in our empirical exercise as discussed later. Depending on the estimation strategy, we combine some of these datasets as discussed in the relevant sections. The descriptive statistics show that the characteristics of firms are quite heterogeneous and firm's sales are concentrated in the domestic market, whereas export sales are concentrated within a small set of larger firms.

In section 3, we present our empirical model, similar to the framework in Ahn and McQuoid (2017). Our framework builds on existing heterogeneous firms model augmented with flexible marginal cost which embeds all possible structure of the marginal cost. We consider a firm that faces demand in two markets- domestic and foreign- and produce with a cobb-douglas technology using capital and labour as inputs. Capital is predetermined, while labour is a perfectly variable input (i.e. chosen at each time period). On the demand side, we consider a representative consumer in each of the two countries facing the standard CES utility function and chooses varieties to consume subject to a budget constraint. The conventional demand systems emerges which depends negatively on the price and positively on the variety-specific demand shifter. Using the first order condition, we derive an estimable equation of domestic sales on exports and other controls such as the capital, productivity, a time-varying unobserved firm-specific demand conditions and a time-varying industry fixed effect. This equation makes it possible to test for the marginal cost structure. The econometric equation shows that the relationship between

[3]Hungary joined the EU in 2004, so we do not have access to firm-level import and export starting after 2003.

domestic and foreign sales depends on the marginal cost structure - negative for increasing marginal cost, positive for decreasing and no-relationship for constant marginal cost. We propose two empirical strategies. In the first, we employ an instrumental variable approach similar to Hummels et al. (2014) and Berman et al. (2015), where we estimate the model using instruments exogenous to the firm and orthogonal to the domestic demand conditions faced by the firm. Our instrument is constructed by mapping each firm's exposure to exogenous demand shocks in all countries which imports from Hungary. While in the second strategy, we exploit our model by constructing proxies for the unobserved domestic and foreign demand conditions, and time-varying industry effects from observable variables. We substitute these proxies into our econometric equation and estimate by OLS.

In section 4, we present our findings for both empirical strategies. Our results confirm the presence of increasing marginal cost structure. We conduct a number of robustness checks to test the sensitivity of the results to several instruments, data restrictions and specifications. Overall, our results are robust across all specifications suggesting the presence of increasing marginal costs. Our findings corroborate existing work by Vannoorenberghe (2012), Ahn and McQuoid (2017), Blum et al. (2013) etc which employed ordinary least-squares (OLS) regression and data from a different setting. Since exporting is an endogenous event, OLS regression would likely lead to imprecise estimates. Our contribution lies in providing a credible identification for the marginal cost structure.

In section 5, we study the implications of our findings for welfare gains from trade liberalization. To do this, we modify the baseline Melitz model by incorporating the increasing marginal cost structure and study the welfare effect of trade liberalization. We find that reduction in bilateral tariffs has two opposing effects on welfare defined as the inverse of aggregate price index. On one hand, it increases the aggregate price index through its effect on prices of domestic goods and imports. On the other hand, it decreases the aggregate price of domestic goods through (i) its positive effect on average productivity as market shares are reallocated from less to more productive firms, and (ii) through the drop in prices of imported goods since tariffs are declining. The dominating channel is unclear, but one thing we learn from this model is the presence of a new channel that reduces aggregate welfare gains from trade liberalization which is not accounted for if the constant marginal cost assumption is assumed.

We conclude the paper in section 6, and provide additional details on the data and derivation of the theoretical results in the appendix.

1.1 Related Literature

This paper is related to the literature on the "new" trade theory (Melitz, 2003, Krugman, 1980, Bernard et al., 2003 etc), most of which assumes that firms produce with a constant marginal cost technology and studies the welfare implications from trade liberalization. More recent work assumes increasing marginal cost -Vannoorenberghe (2012), Liu (2015) etc- and finds that domestic and export sales growth are substitutes. Relative to these literature, we do not impose any specific marginal cost structure, but instead, we estimate the prevalent marginal cost structure which we find to be increasing. We then introduce the increasing marginal cost structure into the "new" trade theory and study its welfare implications from trade liberalization.

Our paper is also related to the empirical literature that estimates the marginal cost structure prevalent within firms (Blum et al., 2013 - for Chilean firms, Vannoorenberghe, 2012 - for French firms, Soderbery, 2014 - for Thai firms and Ahn and McQuoid, 2017 - for Indonesian firms); all finds the marginal cost structure to be increasing. The empirical strategies in these papers can be best described as OLS. Since exporting is likely an endogenous event, identification requires exogenous variation in exports. We contribute to this literature by improving on the identification by means of two credible estimation strategies. In the first, we provide an instrumental variable approach where we instrument firm-level exports by demand conditions in export destinations faced by the firm. In the second, we offer a structural approach where we construct variables for unobserved demand shifters and control for these variables in the regression.

The closest paper to ours is by Almunia et al. (2018) which exploits the geographical variation in the reduction of domestic demand across Spanish regions during the 2008 economic recession to establish a negative causal effects of demand driven domestic sales on exports. While their paper exploits exogenous variation in domestic demand, in a regression of exports on domestic sales, our paper exploits exogenous variation in exports in a regression of domestic sales on exports. Both papers finds a negative relationship between exports and domestic sales. Our paper goes a step further to study the welfare effects of this non-constant cost structure within the framework developed in Melitz (2003). Our paper is also related to Berman et al. (2015) that studies how sales in exports and domestic markets are related using a panel of french manufacturing firms and finds that exports and domestic sales are positively related. Unlike our paper that focus on the marginal cost structure, theirs look at the relationship between exports and domestic sales.

On the macro trade literature, our paper is related to Dai et al. (2014) which studies the trade diversion of free trade agreements (FTA) from internal trade to new trading partners using aggregate country-level export data. They find that FTAs led to a decrease in internal trade (domestic sales) within member countries. The diversion of internal trade intensifies with the number of FTAs a given country joins. We provide micro-level estimates of trade diversion due to exogenous foreign demand shock and declining tariffs. Very recently, there has been a growing literature on welfare losses from trade liberalization. Hsieh et al. (2018) challenges the conventional knowledge of productivity and variety gains from trade liberalization. They show that import variety gains from trade liberalization are attenuated by domestic variety losses, and domestic productivity gains from trade liberalization is attenuated by import productivity losses. The evaluate these losses and gains and finds "new" net welfare losses in Canada from CUSFTA. In addition, Foellmi et al. (2015) finds that capital constraints can reduce welfare gains from trade liberalization as it inhibits firms from investing in R&D. We complement these literature by showing that there are welfare losses arising from increasing marginal costs (capacity constraint)[4] and that models which assume a constant marginal cost may overstate the welfare gains from trade liberalization. This result lends some support to the empirical findings in Ahn and McQuoid (2012) which constructs the counterfactual aggregate domestic goods price index, compares it with the observed domestic price index, and concludes that the actual domestic price index would be lower had there been no capacity constrained firms in their data, thus a source of welfare losses.

Our paper is also related to Armenter and Koren (2015) that finds that the Melitz model is unable to simultaneously match the size and share of exporters given the observed distribution of total sales of U.S. manufacturing firms. They show that while data suggests that exporters have 4-5 times more total sales, the Melitz model predicts that exporters are expected to be between 90 to 100 times larger than non-exporters. Relative to this paper, our model suggests that exporters are larger than non-exporters by a fraction of the magnitude predicted by the Melitz model.

To the best of our knowledge, this paper is the first to credibly show that the constant marginal assumption in the "new" trade models is not innocuous especially in understanding the effect of trade liberalization on welfare. Similar export policies in different countries may yield differential impacts on welfare and depends amongst other things on the prevalent marginal cost structure.

2 Data and Descriptive Statistics

In this section, we describe our data sources and present some descriptive statistics

2.1 Data

Our data comes from three different datasets. The first is a panel of the universe of Hungarian firms balance sheet data for the period 1993-2014 taken from Hungarian Tax Authority (APEH) and includes balance sheet and income statement information such

[4]Ahn and McQuoid (2017) , Soderbery (2014) etc show that capacity constraint results to increasing marginal cost

as net value of sales and exports, fixed assets, wage bills, annual average employment, costs of goods and material inputs. For the purpose of this paper, we focus on manufacturing firms[5] that reports employment figures only and delete observations for non-manufacturing firms. We drop observations for which total exports is greater than total sales and merge the data with producer price indexes (PPI) at the 2-digit NACE industry identifier. Manufacturing sectors consist of 64,979 firms and 324,351 firm-year observations. Out of these, approximately 39% are exporters and they account for about 96% of total sales revenue. Exports account for approximately 40% of total manufacturing sales. The second dataset is the firm-product-destination panel data for the period 1992-2003 taken from Hungarian statistical Office. It is assembled from customs declarations filled out when exporting or importing. It consists of a complete set of transactions on export and import shipments in Hungary at an extremely disaggregated level (CN-9) to several destinations for exports and source countries for imports. The total number of observation is 12,117,483. Since we are not interested in imports, we keep only the data for exports which amounts to 2,466,408 observations[6] and aggregate at the HS-6 product level[7].

The third dataset is a country-level import data of disaggregated products at the HS-6 level for the periods ranging from 1995 to 2003. This data was originally collected from United Nations Comtrade database but cleaned and prepared by CEPII-BACI. It consist of imports at the HS-6 product level of over 200 countries and 5000 products[8]. We aggregate each specific product imported by a given country over all its trade partners in each year and exploit the variation in total yearly imports of each product in our analysis.

[5]In appendix, I describe the sectors we considered in this work.

[6]We follow the basic cleaning detailed Békés et al. (2011). Detailed stylized facts about both datasets are contained in the paper.

[7]We aggregate because we merged this data with country-level HS-6 product import data. Please note that the CN-6 level is the same as the HS-6 (Békés et al., 2011).

[8]For detailed documentation on the construction of the database, see Gaulier and Zignago (2010).

2.2 Merging Data

From the data description, we remind the reader that each of our data set spans different intersecting periods. We create two different datasets, each suitable for each empirical strategy as described below.

Step 1: The first dataset is a balance sheet data which spans between 1993 to 2014. We estimate the total factor productivity of revenue (TFPR) at the NACE-2 industry level following the proxy method developed by Ackerberg et al. (2015)[9] and save our TFPR estimates. I then restrict this data to only exporters and we are left with 133,089 observations. This dataset will be used in our first estimation strategy.

Step 2: For our second estimation strategy, we merge our updated balance sheet dataset in Step 1 with firm's trade data using the firm's unique identifier and year variable. We also merge this data to the countries-product-import data using product, destination and year identifiers. Since the country's-product-import data (CEPII-BACI dataset) ranges between 1995-2003, we restrict our merged dataset to this period. In each row, we observe a firm in a given year, its characteristics, each HS-6 product it exports to a specific country and the total Worldwide imports of that HS-6 product in that specific country[10]. I construct export demand instrument as discussed later and aggregate over products and year at HS-6 level for each firm, we are left with 41887 observations and 11429 unique firms identifiers. This will be our main data for the descriptive statistics below.

2.3 Descriptive Statistics

We provide some descriptive statistics about the firms in our data using the merged sample described in step 2 of section 2.2. Our sample is an unbalanced panel of 41887

[9]We describe the estimation strategy in the appendix.

[10]This information will be useful in constructing instruments for the IV approach as discussed in later sections

observations and 11429 unique firms exporting at least once during the period 1995-2003. We report information for these firms on the number of employees, domestic sales, exports and total sales revenue in millions of Hungarian Foriths (HUF), export shares and log change of domestic and export sales in Table 1. The characteristics of firms in our data are very heterogeneous. Firms in the 3^{rd} quartile have 9 times more employees, 18 times more domestic sales, 34 times more exports sales, 11 times more total sales than firms in the 1^{st} quartile. In addition, both domestic and foreign sales grew faster by 49% and 76% respectively for firms in the 3^{rd} quartile than those in the 1^{st} quartile. The distribution of export shares show that firms' sales are concentrated in their domestic market. 50% of firms sells at most 27% of their total sales in the export market; however firms at the 75% percentile sells about 74% of its total sales in the export market. This confirms that over all firms sales are concentrated in the domestic market, whereas export sales are concentrated within a small set of larger firms.

Table 2 shows the relationship between export share and the firm's size proxied by

Table 1: Descriptive Statistics: firm size, sales, sales growth and export share

	Mean	1st quartile	Median	3rd quartile	S.D.
Number of employees	117.01	10	29	91	390.20
Domestic sales	1792.55	27.14	120.68	498.03	42300
Export sales	1268.12	8.24	51.31	284.34	16100
Total Sales	3060.67	83.31	263.37	943.68	51400
Export Share	0.40	0.06	0.27	0.74	0.35
Δ ln domestic sales	0.09	-0.18	0.05	0.31	0.89
Δ ln export sales	0.07	-0.31	0.06	0.45	1.14

Notes: The values are in millions of Hungarian Foriths (HUF). Export share is the ratio exports to total sales. Total observations is 41887 with 11429 firm.

number of employees. We report the result of a regression of export shares on dummies representing intervals of sizes in terms of number of employees including sector and year dummies. Clearly, exporting increases with firm size since larger firms have higher export share.

Table 2: Export share by firm-size class

Employment size	Export share	No. of Observations
1-20 employees	0.199	17653
	(0.008)**	
21-50 employees	0.217	8742
	(0.008)**	
50-100 employees	0.271	5856
	(0.008)**	
101-200 employees	0.331	4235
	(0.009)**	
>200 employees	0.354	5403
	(0.008)**	

This table shows the coefficient of regression results of firms export share on dummies corresponding to their employment bins. We control for sector and year dummies. Column 2 is the number of observations in each bin. Standard error are in parentheses $+$, $*$ and $**$ corresponds to 10%, 5% and 1% significant levels respectively.

3 Empirical Framework

In this section, we present the empirical framework for inferring the marginal cost structure from firm-level trade data. We start with a model of demand and supply and derive an estimable econometric equation. We propose two estimation strategies and discussion its identification in subsequent sub-sections.

3.1 Demand

We consider a world consisting of two symmetric countries home H and foreign F and a representative industry with many firms producing differentiated goods. Consumers in both countries have identical constant elasticity of substitution (CES) preferences with same elasticity of substitution denoted by σ. Consumers in country $i = \{H, F\}$ total expenditure is denoted by R_{it}. A representative consumer in each country i maximizes its utility given by

$$U_{it} = \left[\int_{\omega \in \Omega} (\zeta_{it}(\omega))^{\frac{1}{\sigma}} (q_{it}(\omega))^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}} \quad \text{for } i \in \{H, F\} \tag{1}$$

subject to the budget constraint:

$$\int_{\omega \in \Omega} p_{it}(\omega) q_{it}(\omega) d\omega = R_{it}$$

where $\zeta_{it}(\omega)$ is the idiosyncratic shock to the taste of product ω in country i, $q_{it}(\omega)$ is the demand for variety ω in country i and $p_{it}(\omega)$ is the price of variety ω in country i. Demand faced by each firm i at time t is derived as:

$$q_{it}(\omega) = \zeta_{it}(\omega) \chi_{it} p_i(\omega)^{-\sigma} \tag{2}$$

where $\chi_{it} = P_{it}^{\sigma-1} R_{it}$ is the aggregate level of demand in country i at time t, this can be interpreted as the position of the demand curve common to all firms and $P_{it} = [\int_{w \in \Omega} \zeta_{it}(\omega)(p_{it}(\omega))^{1-\sigma} d\omega]^{\frac{1}{1-\sigma}}$ is a summary of the prices of all available varieties in an industry in country i.

3.2 Supply

We assume that all firms j are heterogeneous in their productivity levels A_{jt} and produces a single variety j (to avoid abuse of notations we use j in place of ω such that $q_{it}(\omega) = q_{ijt}$) under monopolistic competition. Firms produce with a Cobb-Douglas technology using labor L_{jt} and physical capital K_{jt}. While labor is a variable input and can be freely adjusted at any point in time, physical capital is assumed to be fixed in the short run. Firm j's production function in time t is:

$$q_{jt} = A_{jt} K_{jt}^{\alpha_k} L_{jt}^{\alpha_l}$$

we normalise the wage rate to one and express the variable cost below as:

$$TVC_{jt} = q_{jt}^{\frac{1}{\alpha_l}} A_{jt}^{-\frac{1}{\alpha_l}} K_{jt}^{-\frac{\alpha_k}{\alpha_l}}$$

Firms can export some of their output to the foreign market by paying a fixed export costs f_F which reflects additional cost incurred by doing business abroad. We assume that the price which exporters receive is different from that paid by foreign consumers. Let $\tau_{it} > 1$ be the import tariff or shipping cost and p^*_{it} be the price received by an exporter, we define price paid by foreign consumers as $p_{Ft}(\omega) = p^*_{Ft}(\omega)\tau_{Ft}$.

The timing is as follows: First, prior to realizing the demand (ζ_{ijt}) and productivity shock (A_{ijt}), firms decides on whether to produce and export and pays the associated fixed costs (f_j and f_{xj}). Secondly, both shocks are realised simultaneously. Finally, each firm observes the demand and decides the quantity of output to sell in each market by choosing an optimal price. Given the market demand for its variety, a firm's problem is to maximize per-period profit by choosing an optimal price to sell in both markets. A firm in the home market that sells to both domestic and foreign markets faces the problem:

$$\max_{q_{jHt}q_{jFt}} \left\{ q_{jHt}^{\frac{\sigma-1}{\sigma}} (\zeta_{jHt}\chi_{Ht})^{\frac{1}{\sigma}} + \frac{q_{jFt}^{\frac{\sigma-1}{\sigma}} (\zeta_{jFt}\chi_{Ft})^{\frac{1}{\sigma}}}{\tau_{Ft}} - \frac{(q_{jHt}+q_{jFt})^{\frac{1}{\alpha_l}}}{A_{jt}^{\frac{1}{\alpha_l}} K_{jt}^{\frac{\alpha_k}{\alpha_j}}} - f_{Ht} - f_{Ft} \right\} \tag{3}$$

The first order condition yields:

$$\underbrace{\left(\frac{\sigma-1}{\sigma}\right) q_{jHt}^{-\frac{1}{\sigma}} (\zeta_{jHt}\chi_{Ht})^{\frac{1}{\sigma}}}_{MR\_home\_sales} = \underbrace{\frac{(q_{jHt}+q_{jFt})^{\frac{1-\alpha_l}{\alpha_l}}}{\alpha_l A_{jt}^{\frac{1}{\alpha_l}} K_{jt}^{\frac{\alpha_k}{\alpha_l}}}}_{Marginal\_cost} \tag{4}$$

$$\underbrace{\frac{\left(\frac{\sigma-1}{\sigma}\right) q_{jFt}^{-\frac{1}{\sigma}} (\zeta_{jFt}\chi_{Ft})^{\frac{1}{\sigma}}}{\tau_{Ft}}}_{MR\_export\_sales} = \underbrace{\frac{(q_{jHt}+q_{jFt})^{\frac{1-\alpha_l}{\alpha_l}}}{\alpha_l A_{jt}^{\frac{1}{\alpha_l}} K_{jt}^{\frac{\alpha_k}{\alpha_l}}}}_{Marginal\_cost} \tag{5}$$

Equating equation (4) and (5), we obtain:

$$q_{jHt} = \frac{\zeta_{jHt}\chi_{Ht}}{\zeta_{jFt}\chi_{Ft}} \tau_{Ft}^{\sigma} q_{jFt} \tag{6}$$

Subsitituting equation (6) into the RHS of (4) , taking logs and simplifying, we obtain the estimable empirical equation as[11]:

$$lnq_{jHt} = \mu + \alpha_{jt} + \delta lnA_{jt} + \alpha_{kt} + \beta lnK_{jt} + \gamma lnq_{jFt} + \eta_{jt} \tag{7}$$

where $\mu = \sigma ln(\frac{\sigma-1}{\sigma}) + \sigma ln\alpha_l - \sigma$ is constant across sectors, and $\eta_{jt} = ln\eta^*_{jt}$ is an exogenous error term (i.e. random optimization error), $\alpha_{jt} = ln\zeta_{jHt} + \frac{(\alpha_l-1)\sigma}{\alpha_l} ln\left[\frac{\zeta_{jHt}\tau^{\sigma}_{Ft}}{\zeta_{jFt}}\right]$ is the firm-time fixed effect, $\sigma_{kt} = ln\chi_{Ht} + \sigma\left(\frac{\alpha_l-1}{\alpha_l}\right) ln(\frac{\chi_{Ht}}{\chi_{Ft}})$ is the sector-time fixed effect[12] which capture industry-specific change in input prices and business cycle conditions; $\delta = \frac{\sigma}{\alpha_l}$, $\beta = \frac{\sigma\alpha_k}{\alpha_l}$ and $\gamma = \frac{\sigma(\alpha_l-1)}{\alpha_l}$ are coefficients of log of productivity, capital and and export sales respectively.

We can infer the marginal cost structure from the relationship between domestic sales and exports (i.e. the coefficient γ) in equation (7). For constant marginal cost, this implies that $\alpha_l = 1$, and so the coefficient on export sales is $\gamma = 0$. Hence, exports and domestic sales are unrelated in firms with constant marginal cost technology. Increasing marginal cost is the case where $0 < \alpha_l < 1$ such that the coefficient of export sales is $\gamma < 0$. This implies that a negative relationship between domestic sales and exports after controlling for every observable and unobservable variables is the case where increasing marginal cost structure is prevalent. Finally, for decreasing marginal cost $\alpha > 1$, we expect to find a positive relationship between foreign and domestic sales.

Estimating equation (7) with firm-year fixed effect α_{jt} is not feasible as each firm is observed once in a given year, as this backs out all the variablility in the RHS variables. Alternatively, one can resort to firm fixed effects and control for industry-year fixed effects. Firm fixed effects control for unobserved time-invariant demand conditions faced

[11]We approximate $ln\left(\frac{\zeta_{jHt}\chi_{Ht}\tau^{\sigma}_{Ft}}{\zeta_{jFt}\chi_{Ft}}+1\right)$ to $ln\left(\frac{\zeta_{jHt}\chi_{Ht}\tau^{\sigma}_{Ft}}{\zeta_{jFt}\chi_{Ft}}\right)$. This assumption is true if domestic demand is very high relative to foreign demand. This condition enables us to separate variables proxying the sector-time fixed effect from that of the firm fixed effect. We relax this assumption in the structural estimation and our results remain unchanged.

[12]This variable is the time fixed effect if we had focus on a single industry. We use data of all manufacturing firms in Hungary in our empirical analysis.

by the firm in both domestic and export markets. However, the estimate of γ will be biased if there are omitted variables from time-variant demand conditions. Since, the foreign demand shock is positively correlated with exports, this will lead to a downwards bias of γ. As such, we may obtain a negative coefficient of gamma, whereas the true coefficient is positive[13]. Given the potential limitations of the fixed-effect regression, we follow two - empirical strategies that corrects for these issues. The first is a reduced form regression where we instrument for the unobserved demand conditions and in the second, we explore a structural estimation approach to uncover the unobservable foreign demand shocks. We describe both in details below:

3.3 Empirical Strategy I

In this subsection, we estimate a reduced form regression using an instrumental variable approach. We proceed by approximating the firm-time fixed effect with a firm fixed effect. This will obviously make it impossible to identify our parameters of interest γ, since the foreign demand conditions is positively correlated with exports and negatively correlated with domestic sales. To control for this problem and identify the variation in exports γ, we use an instrument which: reflects foreign demand conditions and not domestic supply shocks; exogenous to the firm, and orthogonal to domestic demands. We build on Hummels et al. (2014) and Berman et al. (2015) type of instruments which are uncorrelated with the characteristics of the firm, but captures firm-specific demand in the foreign market it sells while controlling for firm-specific home market demand. Our baseline instrument involves computing the sum of foreign imports of a product in the product-destination served by a firm j in a given year weighted by the share of each product-destination in the total exports of firm j over the period. Products denoted by

[13] Assume a case where the true coefficient of $\gamma_{true} > 0$ (i.e. $\alpha_l > 1$). If we estimate equation (7) by firm-fixed effect, the omitted variable bias from this estimation is represented as $\gamma = \gamma_{true} + \gamma_{fd} \frac{cov(\zeta_{jFt}, q_{jFt})}{var(q_{jFt})}$ where γ_{fd} is expressed as $\gamma_{fd} = \frac{\sigma(1-\alpha_l)}{\alpha_l} < 0$. We know that $cov(\zeta_{jFt}, q_{jFt}) > 0$, so $\gamma_{fd} \frac{cov(\zeta_{jFt}, q_{jFt})}{var(q_{jFt})} < 0$. This implies that it is possible to wrongly infer γ to be less than 0 ($\gamma < 0$) when $\gamma_{true} > 0$.

p are defined at the HS-6 level. To be precise, the instrument takes the form:

$$F_{jt} = \sum_{dp} s_{jdp} IM_{dpt} \tag{8}$$

where s_{jdp} is time-invariant and represents the average share of each product p sold in country d in firm j's exports over the period it exports. IM_{dpt} is the total value of imports of product p in country d and year t. The instrument ensures that all the variations in the foreign demand faced by a firm at each period comes from IM_{dpt}. This ensures exogeneity of the foreign demand shock on firm's characteristics. I also control for domestic demand shock faced by a firm to ensure that the results are not driven by correlations between domestic and foreign demand shocks. This variable is defined as the sum of world imports from Hungary for all products exported by firm j, weighted by the share of each product in the firm's exports. That is:

$$D_{jt} = \sum_{p} s_{jp} IM_{HUN,p,t} \tag{9}$$

The construction of D_{jt} follows same structure as F_{jt}. Here s_{jp} denotes the share of total exports of product p in firm j's total exports and $IM_{HUN,p,t}$ is the total Hungarian import of product p in time t. The variation in the domestic demand instrument D_{jt} comes from the variation in $IM_{HUN,p,t}$. This variable controls for possible international business cycle correlation in demand faced by firms in my sample. Our main reduced form econometric model is a two-stage least square (2SLS) estimator represented below as:

$$1^{st} \text{ Stage :} \qquad lnq_{jFt} = \mu + \alpha_j + \alpha_{kt} + \gamma_f lnF_{jt} + \gamma_d lnD_{jt} + \beta_1 lnK_{jt} + \delta_1 lnA_{jt} + \epsilon_{jt} \tag{10}$$

$$2^{nd} \text{ Stage :} \qquad lnq_{jHt} = \mu + \alpha_j + \alpha_{kt} + \beta lnK_{jt} + \gamma ln\hat{q}_{jFt} + \delta lnD_{jt} + \delta lnA_{jt} + \eta_{jt} \tag{11}$$

where $ln\hat{q}_{jFt}$ is firm j's predicted value of log of exports, all other variables are as defined above. lnD_{jt} and lnF_{jt} are the instruments and α_j approximates for firm-level time-invariant variables that are jointly correlated with the covariates and the dependent variable. Productivity A_{jt} is unobserved, so we estimate it using the method proposed in Ackerberg et al. (2015) (See appendix). In the estimation, the standard errors are robust and clustered at the NACE 2-digit sector.

3.3.1 Identification

Identification of γ requires that our instruments for firm exports is uncorrelated with the second stage error term: $cov(F_{jt}, \eta_{jt}) = 0$. This condition will likely be satisfied provided the possible correlations between variations in domestic and foreign demand of a product is controlled. This explains our inclusion of a variable that captures domestic demand (D_{jt}) addressed to a firm. One possible issue with this strategy is that home demand faced by domestic firms is not properly observed because firms may have several product mix in the foreign and domestic market but we assume same structure since we do not observe the product mix sold domestically. However, identification requires that D_{jt} capture variations in domestic demand which are correlated to export demand. This is the case here since the construction of F_{jt} and D_{jt} relies on the firm's export products structure[14]. Another potential concern is that the weights used in the construction of the instrument may be correlated with unobserved firm specific characteristics. That is, if firms self-select into specific markets based on their productivity and any unobserved characteristics, then the instrument is correlated with firm characteristics. While firm fixed effects can control for firm-level presample[15] unobserved characteristics, it fails to control for time-varying ones. To ensure identification, we use weights of HS6-product-destination in the first year the firm began exporting as an alternative specification. Most firms in our sample exports fewer products in their first period of exporting and gradually scales up the number of products. This would lead to dropping several product-destination observations. We construct presamples weight by considering only firms for which we observe their first period of exporting. To ensure the robustness of our results,

[14]Note that the correlation between F_{jt} and D_{jt} is approximately 0.65.

[15]By this we imply the first period which we observe the firm in our data

we explore a number of other alternative instruments detailed in the robustness section.

3.4 Empirical Strategy II

In this step, we take the full structure of our estimation equation to data and test for the presence of increasing marginal costs. This approach offers some advantage over the reduced form estimation. Unlike the reduced form method where we lose a large proportion of our balance sheet observations after merging several datasets[16], this strategy offers the option of using our entire balance sheet data. That is, instead of relying on a shorter panel of firm-level product destination data in constructing instruments that reflect the demand conditions faced by a firm, this strategy makes it possible to construct the unobservable demand parameters from observable variables in the balance sheet data. This ensures a good match between our theory and the data. We proceed by recovering, the foreign and domestic demand shock parameter ζ_{jFt}, ζ_{jHt} and the productivity A_{jt} from observable variables. To this end, we derive the firm's domestic sales R_{jHt} and exports R_{jFt} from the first-order order conditions in equation (4) and (5) as:

$$R_{jHt} = Z^{E(\sigma-1)} A_{jt}^{\frac{E(\sigma-1)}{\alpha_l}} K_{jt}^{\frac{\alpha_k E(\sigma-1)}{\alpha_l}} \zeta_{jHt}\chi_{Ht}(\zeta_{jHt}\chi_{Ht} + \tau_{Ft}^{-\sigma}\zeta_{jFt}\chi_{Ft})^{\frac{E}{\alpha_L}-1} \tag{12}$$

$$R_{jFt} = Z^{E(\sigma-1)} A_{jt}^{\frac{E(\sigma-1)}{\alpha_l}} K_{jt}^{\frac{\alpha_k E(\sigma-1)}{\alpha_l}} \zeta_{jFt}\chi_{Ft}\tau_{jt}^{-\sigma}(\zeta_{jHt}\chi_{Ht} + \tau_{jt}^{-\sigma}\zeta_{jFt}\chi_{Ft})^{\frac{E}{\alpha_L}-1} \tag{13}$$

and the total revenue, $R_{jt}^T = R_{jHt} + R_{jFt}$ is expressed as:

$$R_{jt}^T = \begin{cases} Z^{E(\sigma-1)} A_{jt}^{\frac{E(\sigma-1)}{\alpha_l}} K_{jt}^{\frac{\alpha_k E(\sigma-1)}{\alpha_l}} (\zeta_{jHt}\chi_{Ht})^{\frac{E}{\alpha_L}} & \text{if firm sells at home} \\ Z^{E(\sigma-1)} A_{jt}^{\frac{E(\sigma-1)}{\alpha_l}} K_{jt}^{\frac{\alpha_k E(\sigma-1)}{\alpha_l}} (\zeta_{jHt}\chi_{Ht} + \tau_{jt}^{-\sigma}\zeta_{jFt}\chi_{Ft})^{\frac{E}{\alpha_L}} & \text{if firm sells in both} \end{cases} \tag{14}$$

where $E = \frac{\alpha_l}{\alpha_l - \sigma(\alpha_l - 1)} < 1$ and $Z = (\frac{\sigma-1}{\sigma})\alpha_l$. The relationship between home and domestic sales revenue is driven by the assumption on the parameter α_l. We remind the reader

[16] This is because our balance sheet data spans between 1993-2014, our trade data spans from 1993 - 2003 and the country-level product import data span from 1995 - 2003. Merging both database implies that we use information from 1995-2003.

that our aim is to estimate[17]:

$$\ln q_{jHt} = \mu + z_{jt} + \delta \ln A_{jt} + \beta \ln K_{jt} + \gamma \ln q_{jFt} + \eta_{jHt} \tag{15}$$

where $\mu = \sigma \ln(\frac{\sigma-1}{\sigma}) - \sigma$ and $\eta_{jt} = \ln \eta^{*}_{jt}$ is the constant term and exogenous error term respectively. $z_{jt} = \ln(\zeta_{jHt}) + \ln(\chi_{Ht}) + \sigma \ln \alpha_l + \frac{(\alpha_l-1)\sigma}{\alpha_l} \ln \left[\frac{\zeta_{jHt}\chi_{Ht}\tau^{\sigma}_{Ft}}{\zeta_{jFt}\chi_{Ft}} + 1\right]$ is the combination of firm-time and sector-time fixed effects. δ, β and γ are as already defined above. We deflate R_{jHt} and R_{jFt} using industry domestic and foreign price indexes to obtain the corresponding sales quantities. Both z_{jt} and A_{jt} are not directly observable in the data, so we construct these variables in the following steps.

Step 1: Divide equation (12) by (13) and normalize ζ_{jHt} to 1, we obtain the expression:

$$\frac{\zeta_{jFt}}{\tau^{\sigma}_{jt}} = \frac{R_{jFt}\chi_{Ht}}{R_{jHt}\chi_{Ft}} = \frac{P^{\sigma-1}_{sHt} R_{sHt} R_{jFt}}{P^{\sigma-1}_{sFt} R_{sFt} R_{jHt}} \tag{16}$$

where R_{sHt} and R_{sFt} is the total industry revenue from domestic and export sales respectively. P_{sHt} and P_{sFt} is the domestic and export price index respectively. Other variables are as defined above. ζ_{jFt} is the measure of competitiveness of firm j in the export market relative to the domestic market expressed as the ratio of industry share of firm j in the export market to its industry share in the domestic market. We can substitute equation (16) into z_{jt} to obtain the variable:

$$z_{jt} = ln\chi_{Ht} + \sigma ln\alpha_l + \frac{(\alpha_l - 1)\sigma}{\alpha_l} ln\left[\frac{R_{jHt}}{R_{jFt}} + 1\right]$$

Step 2: Substitute equation (16) into equation (14b) and express A_{jt} as:

$$A_{jt} = (R_{jHt} + R_{jFt})^{1-\alpha_l} Z^{-\alpha_l} K^{-\alpha_k}_{jt} \left(\frac{R_{jHt}}{R_{sHt}}\right)^{\frac{1}{\sigma-1}} P^{-1}_{sHt} \tag{17}$$

[17]We remind the reader that equation (15) is slightly different from equation (7) because we do not approximate $ln\left(\frac{\zeta_{jHt}\chi_{Ht}\tau^{\sigma}_{Ft}}{\zeta_{jFt}\chi_{Ft}} + 1\right)$ to $ln\left(\frac{\zeta_{jHt}\chi_{Ht}\tau^{\sigma}_{Ft}}{\zeta_{jFt}\chi_{Ft}}\right)$. See footnote (13)

Step 3: Construct z_{jt} and A_{jt} using estimated industry elasticity of substitution (σ) from the methodology in Chapter 1 of Maduko (2018) (see Table 15 in the appendix), and industry coefficient of labour (α_l) and capital (α_k) from empirical strategy 1 (see Table 17 in the appendix).

Step 4: We estimate equation (15) by OLS

Since this method does not require information on the export destination, we use our entire balance sheet data from 1993-2014, whilst restricting the data to firms for which we observe both positive exports and domestic sales.

4 Empirical Results

4.1 Instrumental Variable Results

We present the main results from the instrumental variable approach in Table (3) where we instrument foreign sales with foreign demand addressed to the firm (First stage estimates are in table(9) in the appendix). We present the OLS estimate in column 1 and IV estimates in columns (2-9) using the log of the instrument (lnF_{jt}) in columns (2-7) and log change of the instrument (ΔlnF_{jt}) in columns (8-9). Column (1) controls for productivity and domestic demand variations which may be correlated with the foreign demand variations addressed to the firm (D_{jt}), and industry-year dummies. In column (2), we include year and firm dummies, D_{jt} and industry-specific controls such as: the number of firms operating in the same domestic industry and industry domestic sales. In columns (3-9), we include industry-year dummies in place of industry-specific controls.
The OLS result predicts a weak negative impact of exporting on domestic sales which is not suprising because of omitted variable bias since exporting in not an exogenous event. In column (3), we use the foreign demand instrument to predict exporting in the first stage but we do not control for the domestic demand condition. We find a positive relationship between domestic and foreign sales which is possible if demand is positively

correlated across countries. This suggests a positive business cycle correlation between foreign and domestic demand and supports the inclusion of domestic demand conditions as a control variable in the regression. In our most preferred specification (column 7), where we include the variable for the domestic demand addressed to a firm, and control for the characteristics of the firm, we find that predicted variations in exports is negatively related to the variations in domestic sales. The magnitude is strong and significant. This result is stable even when we do not control for capital and productivity (columns 2 & 4).

Findings from the preferred specification implies that a 10% exogenous increase in exports implies a 1.6% decrease in domestic sales. It is imperative to emphazise that our results does not imply a complete substitution of sales between domestic and foreign markets. For example, with an estimated elasticity of -0.156, our finding suggests that if our average firm with 40% export share, increases its exports by 100 HUF, this results to a decrease in domestic sales by 23.4 HUF. A back of the envelope calculation shows that firms in the first quartile of total sales reduces domestic sales by approximately 423,384 HUF in order to increase it exports by 824,000 HUF, whereas the median manufacturing firm reduces its domestic sales by 1,882,608 HUF in order to increase its exports by 5,131,400 HUF. Clearly the net effect is an increase in total sales, consistent with the model's prediction[18]. In column (8) and (9), we report the coefficients for the relationship between domestic and export sales when all variables are expressed in first differences. We use the first difference of the foreign demand as instruments for the first difference of export sales. Industry- year fixed effects is included in both columns, however we include firm fixed effect only in column (9). Our results, in both columns are significant, but the magnitude is weak. These specifications imply that growth in export sales as a result of growth in foreign demand shock reduces the growth in domestic sales. Overall, our results suggests the presence of an increasing marginal costs of production.

We compare these results with similar studies in the literature (Berman et al., 2015,

[18]This can be clearly seen by taking derivatives of equation (12), (13) and (14b) with respect to ζ_{jFt}

Ahn and McQuoid, 2017 and Almunia et al., 2018). Berman et al. (2015) estimates the relationship between domestic and foreign sales using French firm-level data during the periods 1995–2001. We estimate a regression specification similar to columns (2) and (3) in Table (3) of Berman et al. (2015) and reports our coefficients in columns (3) and (4) Table (3). As argued by Berman et al. (2015), this specification provides a causal effect of exporting on domestic sales, and not estimates of the marginal cost structure[19]. They find that exports induced by an exogenous foreign-demand shock led to an increase in domestic sales, contradicting our estimates that finds a decrease in domestic sales. The disparity in the two results could be attributed to differences in production capacity and financial market development across the two countries. It is imperative to note that the period for our analysis spans between 1993 to 2003, prior to Hungary entry to the EU. It is likely that the financial markets in Hungary during this period was less developed than that in France, and Hungarian firms may have been unable to access capital required to scale up capacity when faced with increased demand from abroad.

We also estimate similar regression specifications as in Table (5) of Ahn and McQuoid (2017) in their study on Indonesia, and compare our estimates with theirs. Results from these specifications were reported in Table (18) in the appendix. Clearly our findings are very similar to theirs with slight differences in magnitude, confirming the prevalence of increasing marginal cost structure. Almunia et al. (2018) studies a similar question as ours using firm-level information from Spain. Unlike our regression specification, theirs regresses exports on domestic sales while controling for some covariates. We estimate a similar regression equation as theirs and report the results in Table (19) in the appendix. Comparing our estimates with theirs (in Table 1), we find a similar pattern in almost all cases with some differences in the magnitude. The coefficient on domestic sales in their most preferred specification is -0.28 and statistically significant at 1% levels. In ours (Column 4, of Table 19), it is -0.20 and also significant at 1% levels.

[19]Hummels et al. (2014) argues that this specification allows the supply shocks(such as productivity) to jointly influence the relationship between exports and domestic sales

Table 3: Estimating the Effects of Foreign sales on Domestic Sales

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Estimator	OLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	(2SLS)
Dep. variable	ln of domestic sales							Δ ln of domestic sales	
ln export sales$_{it}$	-0.058	-0.114	0.032	-0.100	-0.128	-0.129	-0.156		
	(0.016)**	(0.024)**	(0.016)*	(0.039)*	(0.033)**	(0.044)**	(0.030)**		
ln domestic demand$_{it}$	0.030	0.070		0.062	0.051	0.051	0.037		
	(0.006)**	(0.009)**		(0.014)**	(0.012)**	(0.011)**	(0.009)**		
ln productivity$_{it}$	0.512				0.550	0.547	0.683		
	(0.036)**				(0.042)**	(0.037)**	(0.051)**		
ln capital$_{it}$							0.356		
							(0.017)**		
ln no. of firms$_{st}$		0.098							
		(0.080)							
ln sector domsales$_{it}$		0.378							
		(0.041)**							
ln export$_{it}$$\times$export share$_{i0}$						0.010			
						(0.088)			
Δln export sales$_{it}$								-0.063	-0.041
								(0.018)**	(0.022)$^{+}$
Δln domestic demand$_{it}$								0.021	0.011
								(0.005)**	(0.005)$^{+}$
Δln productivity$_{it}$								0.487	0.455
								(0.031)**	(0.027)**
Observations	41886	41886	41886	41886	41886	41886	41886	29629	27696
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Year Dummies	No	Yes	No	No	No	No	No	No	No
Sector$\times$yearr FE	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kleib.-Paap stat.		196.73	1170.55	215.70	247.26	573.71	278.40	159.23	98.54

Notes: Robust standard errors, clustered by industry in parentheses. Firm fixed effects is included in all estimation except column (7). In column (1), I report the OLS, column (2)-(8) reports the IV results. Our instrument in (2)-(6) is the foreign demand in HS6 variety exported by the firm. In columns (7)-(8) we use the first difference of the foreign demand. $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$ are 1%, 5% and 10% significant levels respe-. tively

4.2 Structural Method Results

We present the results from the second empirical strategy in Table (4) columns 1-6. In column 1, we omit capital from this specification. This is expected to bias the coefficient of exports γ upwards towards zero if increasing marginal cost is prevalent because capital is correlated with both domestic and export sales. This is confirmed when we compare column 1 (-0.045) to column 2 (-0.067)- a case where we control for capital. This suggests that firms simultaneously increase capital investments with exporting. Note that in both columns (1) and (2), we exclude the variable that captures the demand shocks addressed to a firm z_{jt}. This exclusion is expected to bias our results upwards towards zero. We confirm this in column 3 as coefficient of exports is -0.084 compared to -0.067 in column 2. Our preferred specification is column 3, where we control for the demand conditions, productivity and capital inputs of the firm to reduce the possibility of omitted variables bias. Our estimates imply that a 10% increase in exports (while controlling for foreign demand shock and other relevant variables) implies a 0.84% decrease in domestic sales. Quantifying these results in terms of our data suggests that, all things being equal, a firm in the first quartile will have to reduce its domestic sales by 228,000 HUF in order to increase it exports by 824,000 HUF, whereas the median firm will have to reduce its domestic sales by 1,014,000 HUF so as to increase its exports by 5,131,300 HUF. Clearly, these effects are statistically and economically significant. Columns (4-6) presents the case where we take the first-differences of variables. Clearly we observe that our results are strongly negative compared to when levels were used. An interpretation of this difference in coefficients between levels and first-differences is the idea that missing time-varying covariates are strongly serially correlated and share similar underlying trends with the corresponding firm-level exports, however, their year-to-year variation is weakly correlated with annual changes in exports. In sum, our results suggest the pervasiveness of increasing marginal cost structure for manufacturing firms in Hungary. Findings from both methodology are qualitatively similar and points to the same directions, thus invalidating the constant marginal cost assumption in standard trade models.

Table 4: Estimating the Effects of Foreign sales on Domestic Sales

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)
	ln domestic sales			Δ ln domestic sales		
ln export sales	-0.045	-0.067	-0.084			
	(0.003)**	(0.003)**	(0.010)**			
ln productivity	1.275	1.253	1.267			
	(0.020)**	(0.020)**	(0.025)**			
ln capital		0.174	0.177			
		(0.005)**	(0.005)**			
Δ ln export sales				-0.066	-0.074	-0.133
				(0.002)**	(0.002)**	(0.008)**
Δ ln productivity				1.479	1.506	1.546
				(0.018)**	(0.021)**	(0.023)**
Δ ln capital					0.159	0.167
					(0.004)**	(0.004)**
Observations	127278	127278	127278	93965	93965	93965
Firm FE	yes	yes	yes	yes	yes	yes
Industry-Year Dummies	yes	yes	yes	yes	yes	yes
Demand Shocks	no	no	yes	no	no	yes
Rsquared	0.831	0.851	0.854	0.692	0.705	0.707

Notes: This regression reports the results for the estimation of the increasing marginal cost structure for all manufacturing firms in Hungary. Robust standard errors clustered at the firm-level are in parentheses $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$.

4.3 Robustness

We check the robustness of our results by using alternative instruments and sample restrictions as enumerated below to ensure that our results are not sensitive to any specific method of computation of our instruments or any source of exogenous variation.

1. First, we exclude motor and motor vehicles industry from our data. This is because of the huge presence of multinational firms' subsidiaries involved in the value-chain process in the Hungarian auto industry . Domestic suppliers of auto parts may sell to both the subsidiaries and their parent company (Bisztray, 2016). It might be the case that these firms substitutes between selling to a parent foreign company and its subsidiaries in Hungary if multinational auto firms are switching production

across different locations. Excluding these industries will ensure that our results are not driven by these patterns. We present the findings in the appendix Table 6. The coefficients of exports are very identical to our baseline results.

2. Second, we substract the values of yearly exports from Hungary of each HS6 product from the imports of countries serviced by Hungarian firms in constructing the foreign demand instrument. This ensures our instruments are not driven by supply shocks from Hungary, but demand shocks from those countries. We present the results from this adjustment in Table (8) in the appendix. The coefficients of exports are very identical to our baseline results.

3. Third, more productive firms may produce more of a specific good and may select themselves into specific markets. If such markets grow faster on average, this implies that the weights we use in constructing the instruments is correlated with time-varying firm-level characteristics such as productivity and will introduce some bias in our estimation. Firm fixed-effect backs out time-invariant characteristics but not the time-varying ones. To address this possibility, we reconstruct our baseline instruments using weights for the first period which the firm exports. By doing this, we restrict our data to only firms for which we observe their first period of export entry. Most firms during their first period of exporting, sells fewer number of products to fewer destinations. We further restrict the data to only firm's products that were exported in the first period which the firm began exporting. By doing this, we lose 66% of our initial observations. The estimates using this instrument is reported in Table (7) of the appendix (also see Table (11) for the first stage results). The coefficients of exports are very identical to our baseline results.

4. Fourth, we consider the foreign demand addressed to the core product of the firm while still controlling for domestic demand addressed to the core product. We define firms' core products as the HS-4 product with the highest value of exports in the period we observe. Eckel et al. (2015) finds that firm's tend to produce more

of products in their core competence because of lower costs. A foreign demand shock on a firms core products could be a good instrument for firm's exports. We create instruments that reflects foreign demand shock in the firm's core competence and study the effect of exports driven by this foreign shock on domestic sales. This instruments are constructed in a similar way as our baseline instruments. Specifically, we define the foreign and domestic demand instruments as $F_{jt}^{core} = \sum_d s_{jd}^{core} IM_{d,t}^{core}$ and $D_{jt}^{core} = IM_{HUN,t}^{core}$ respectively, where s_{jd}^{core} is the weight of firm j's core product exported to destination d, constructed as the ratio of total exports of the core product to destination d to the total exports of its core products to all destinations. We report the estimate using this instrument in Table 5 in the appendix. Our estimates here are identical to our baseline results.

5. Finally, it could be that the estimated increasing marginal cost is irrelevant in the mid or long term. That is, firms invest in capacity and produce at a constant marginal cost. To check for this possibility, we estimate up to the fourth-differences using our structural strategy and balance sheet data. Our choice for this strategy and data lies in the longer span of the balance sheet data which make it possible to check for up to the fourth-differences. We present our results in Table (14) of the appendix. In all specifications, we still find a negative and statistically significant relationship between exports and domestic sales. The magnitude of the negative relationship declined marginally over time from -0.133 for first differences and -0.119 for the fourth differences. This implies that capital adjust slowly over time, consistent with Dix-Carneiro (2014) which finds that adjustments to trade liberalization may take several years using Brazilian data.

Does this finding have any implication for welfare? In the next section, we explore the welfare implication of trade liberalization in a standard long-run trade model with increasing marginal cost technology.

5 Welfare Implications of Increasing Marginal Costs

In this section, we propose an extension of Melitz (2003) model of international trade by introducing an increasing marginal cost structure, and highlighting the mechanisms through which it reduces aggregate welfare. Our point here is to emphasize that domestic policies which help firms scale up production capacity have a role in ensuring that the full gains from trade are realized.

5.1 An Economy Without Trade

The demand side is unchanged, with preferences of a representative consumer given by the usual C.E.S. utility function over a continuum of goods and subject to the budget constraint. This yields the usual demand, revenue, aggregate revenue and price equations given by: $q_h(\omega) = p_h(\omega)^{-\sigma} P_h^{\sigma} Q_h$; $r_h(\omega) = p_h(\omega)^{1-\sigma} P_h^{\sigma-1} R_h$; $R_h \equiv P_h Q_h = \int_{\omega\in\Omega} r(\omega)d\omega$; and $P_h = \left[\int_{\omega\in\Omega} p_h(\omega)^{1-\sigma} d\omega\right]^{\frac{1}{1-\sigma}}$ respectively, where $\sigma > 1$ is the elasticity of substitution between any two goods and ω denotes varieties.

On the supply side, we assume a representative industry with a continuum of firms, each producing a different good ω using labor l as the only input which is supplied inelastically at its aggregate level L. The firm produces with a technology that exhibits an increasing marginal cost $q = \psi l^{\alpha_l}$ where ψ is productivity, with $0 < \alpha_l < 1$ and a fixed overhead costs f. The average cost function is denoted as:

$$l = f + \left(\frac{q}{\psi}\right)^{\alpha} \qquad \text{where } \alpha \equiv \frac{1}{\alpha_l} > 1$$

Wage is normalised to one. The profit maximization implies a pricing rule of the form:

$$p_h(\psi(\omega)) = \left(\frac{\sigma}{\sigma-1}\alpha\right)^{\frac{V}{\alpha}} \left(\frac{1}{\psi(\omega)}\right)^{V} (P_h^{\sigma-1} R_h)^{\frac{(\alpha-1)V}{\alpha}} \tag{18}$$

where $V = \frac{\alpha}{1+\sigma(\alpha-1)} < 1$. The corresponding profit of the firm is $\pi(\psi) = \frac{r(\psi)}{V\sigma} - f$, where $r_h(\psi)$ is the revenue of the firm and denoted as:

$$r_h(\psi) = \left(\frac{\rho}{\alpha}\right)^{\frac{(\sigma-1)V}{\alpha}} (P_h\psi)^{V(\sigma-1)} R_h^V \tag{19}$$

So profit can be written as:

$$\pi(\psi) = \frac{R_h^V}{V\sigma}\left(\frac{\rho}{\alpha}\right)^{\frac{(\sigma-1)V}{\alpha}} (P_h\psi)^{V(\sigma-1)} - f \tag{20}$$

where $\rho = \frac{\sigma-1}{\sigma}$. It follows that the ratio of any 2 firms' output and revenue depends on the ratio of their productivity:

$$\frac{q(\psi_1)}{q(\psi_2)} = \left(\frac{p(\psi_2)}{p(\psi_1)}\right)^{\sigma} = \left(\frac{\psi_1}{\psi_2}\right)^{V\sigma}; \qquad \frac{r(\psi_1)}{r(\psi_2)} = \left(\frac{\psi_1}{\psi_2}\right)^{V(\sigma-1)} \tag{21}$$

This implies that more productive firms have bigger output, sales revenue and profits, however the magnitude is lesser compared to that predicted by Melitz (2003) since the elasticity of substitution is scaled by a constant V such that $0 < V < 1$[20] .

5.1.1 Aggregation

Let M be mass of firms and $\mu(\psi)$ be a distribution of productivity over a subset of $(0, \infty)$ for producing firms, then the aggregate price can be rewritten as $P_h = \left[\int_0^\infty p_h(\psi)^{1-\sigma} M\mu(\psi)d\psi\right]^{\frac{1}{1-\sigma}}$. Using equation (18) we can express the aggregate price as:

$$P_h = M^{\frac{1}{V(1-\sigma)}}\left(\frac{\alpha}{\rho}\right)^{\frac{1}{\alpha}}\left(\frac{1}{\tilde{\psi}}\right) R_h^{\frac{\alpha-1}{\alpha}} \tag{22}$$

[20] This consistent with a few and growing literature which showed that the Melitz model overstates the differences in sales between more productive and less productive firms. For example Armenter and Koren (2015) showed that while exporters are more productive than non-exporters, they have 4-5 times more total sales than non-exporters. However, the Melitz model would predict that exporters are expected to have 90 to 100 times larger total sales compared to non-exporters.

where $\tilde{\psi}$ is the weighted average productivity of firms and expressed as:

$$\tilde{\psi} = \left[\int_0^\infty (\psi)^{V(\sigma-1)} \mu(\psi) d\psi \right]^{\frac{1}{V(\sigma-1)}} \tag{23}$$

and the weighted average aggregate revenue and profit respectively.

$$R_h = \int_0^\infty r(\psi) M \mu(\psi) d\psi = M r(\tilde{\psi})$$

$$\Pi = \int_0^\infty \pi(\psi) M \mu(\psi) d\psi = M \pi(\tilde{\psi})$$

5.1.2 Free Entry Condition

We assume a large pool of potential entrants into the industry. Before entry, firms make an initial investment (sunk cost) denoted by f_e in terms of units of labor and then draws its initial productivity ψ from a common distribution $f(\psi)$ with support over $(0, \infty)$ and with a cumulative density function denoted by $F(\psi)$. A firm that realises low productivity draws may decide to exit immediately without producing. Firms that produces faces a constant probability δ of exiting in each period. The resulting value function of each firm becomes:

$$\nu(\psi) = \max\{0, \frac{1}{\delta}\pi(\psi)\}$$

where $\psi^* = \inf\{\psi : \nu(\psi) > 0\}$ identifies the cut-off productivity of producing firms. This implies that $\pi(\psi^*) = 0$ is the zero cutoff profit condition. The distribution of productivity is therefore determined by the initial productivity draws conditional on successful entry.

$$\mu(\psi) = \begin{cases} \frac{f(\psi)}{1-F(\psi^*)} & \text{if } \psi \geq \psi^* \\ 0 & \text{otherwise} \end{cases}$$

Therefore, the ex-ante probability of entry and producing is $p_{in} = 1 - F(\psi^*)$. This defines aggregate productivity in equation (23) as a function of the cut-off productivity

$$\tilde{\psi}(\psi^*) = \left[\frac{1}{1-F(\psi^*)}\int_{\psi^*}^{\infty}\psi^{V(\sigma-1)}f(\psi)d\psi\right]^{\frac{1}{V(\sigma-1)}}$$

Let $\bar{\nu} = \frac{1}{\delta}\bar{\pi}$ be average value of firms, conditional on successful entry. So value of entry becomes:

$$\nu_e = p_{in}\bar{\nu} - f_e = \frac{1-F(\psi^*)}{\delta}\bar{\pi} - f_e$$

Since the mass of prospective entrant is unbounded, free entry condition implies that firms will enter till the value of entry is zero:

$$\bar{\pi} = \frac{\delta f_e}{1-F(\psi^*)} = \frac{\delta f_e}{p_{in}} \tag{24}$$

5.1.3 Zero Cut-off Profit Condition

Weighted average profits and revenue can be defined in terms of the cut-off level as:

$$\bar{r} \equiv r(\tilde{\psi}) = \left[\frac{\tilde{\psi}(\psi^*)}{\psi^*}\right]^{V(\sigma-1)} r(\psi^*)$$

$$\bar{\pi} \equiv \pi(\tilde{\psi}) = \left[\frac{\tilde{\psi}}{\psi^*}\right]^{V(\sigma-1)} \frac{r(\psi^*)}{V\sigma} - f$$

The zero profit condition pins down the revenue of the cut-off firm given by $\pi(\psi^*) = 0 \implies r(\psi^*) = V\sigma f$. Let $k(\psi^*) = (\tilde{\psi}(\psi^*)/\psi^*)^{V(\sigma-1)} - 1$, we express average profit and revenue as:

$$\bar{\pi} = fk(\psi^*), \qquad \bar{r} \equiv r(\tilde{\psi}) = \left[\frac{\tilde{\psi}(\psi^*)}{\psi^*}\right]^{V(\sigma-1)} V\sigma f \tag{25}$$

5.1.4 Equilibrium in Closed Economy

The free entry and zero cut-off profit condition pins down the cut-off productivity ψ^* and average profit $\bar{\pi}$. Let $L = L_p + L_e$ where L_p and L_e represent respectively the aggregate labor used for production and initial investment prior to entry. Then $L_p = R_h - \Pi$ and $L_e = M_e f_e$, where M_e is the mass of potential entrants. In equlibrium, we impose an aggregate stability condition such that new entrants will equate existers

$$p_{in} M_e = \delta M \implies M_e = \frac{\delta M}{p_{in}}$$

$$L_e = M_e f_e = \frac{\delta M}{p_{in}} f_e = \bar{\pi} M = \Pi$$

So the aggregate revenue is show as:

$$L = L_p + L_e = R - \Pi + \Pi \implies L = R_h$$

This implies that

$$M = \frac{R_h}{\bar{r}} = \frac{L}{V\sigma(\bar{\pi} + f)}$$

The aggregate price in equation (22) can be expressed in the form below:

$$P_h = M^{\frac{1}{V(1-\sigma)}} \left(\frac{\alpha}{\rho}\right)^{\frac{1}{\alpha}} \left(\frac{1}{\tilde{\psi}}\right) L^{\frac{\alpha-1}{\alpha}}$$

Welfare per worker defined as $W = P_h^{-1}$ is given by:

$$W = M^{\frac{1}{V(\sigma-1)}} \left(\frac{\rho}{\alpha}\right)^{\frac{1}{\alpha}} L^{\frac{1-\alpha}{\alpha}} \tilde{\psi} = M^{\frac{1}{\sigma-1}} \left(\frac{\rho}{\alpha}\right)^{\frac{1}{\alpha}} \bar{r}^{\frac{1-\alpha}{\alpha}} \tilde{\psi} \tag{26}$$

Welfare is larger in a bigger country because of an increase in product varieties. Note that for $\alpha = 1$ (constant marginal cost), we obtain same welfare as in Melitz (2003). In sum, welfare in the close economy exhibits same qualitative characteristics as the case with constant marginal cost.

5.2 An Economy with Trade

We now consider an open economy where a firm can export to a foreign country. For simplicity, we assume one export market which is symmetric to the domestic economy in every aspect. Consumers in both countries have same CES preferences, and chooses variety to consume subject to a budget constraint. The demand equation in both countries are the same and equal to that derived in the closed economy.

On the supply side, firms are producing with an increasing marginal cost technology. This implies that firms can not maximise profits independently in both foreign and domestic markets. We denote f_x as fixed cost of exporting and express total variable cost function:

$$l = \left(\frac{q_f + q_h}{\psi} \right)^{\alpha}$$

We assume that consumers in foreign market bears the per unit trade cost $\tau > 1$ which implies that the price a firm sells a product in a foreign country is different from the price a consumer pays for it. Let $p_f^*(\omega)$ be price a producer sells its product in the foreign country and $p_f(\omega)$ the price a consumer in the foreign country buys this product such that $p_f(\omega) = \tau p_f^*(\omega)$. Profit maximization yields the following FOC for prices:

$$p_h(\omega) - \frac{\sigma\alpha}{\sigma - 1}\psi^{-\alpha}\left(p_h(\omega)^{-\sigma} R_h P_h^{\sigma-1} + p_f^*(\omega)^{-\sigma}\tau^{-\sigma} P_f^{\sigma-1} R_f \right)^{\alpha-1} = 0$$

$$p_f^*(\omega) - \frac{\sigma\alpha}{\sigma - 1}\psi^{-\alpha}\left(p_h(\omega)^{-\sigma} R_h P_h^{\sigma-1} + p_f^*(\omega)^{-\sigma}\tau^{-\sigma} P_f^{\sigma-1} R_f \right)^{\alpha-1} = 0$$

This implies same factory gate prices for both domestic and export market. Since $p_f = \tau p_f^* = \tau p_h$, it follows that $P_f = \tau P_h$. The domestic price of an exporter with productivity ψ can be expressed as:

$$p_{h,exp}(\psi) = \left(\frac{\alpha}{\rho} \right)^{\frac{V}{\alpha}} \left(\frac{1}{\psi} \right)^{V} \left[P_h^{\sigma-1}(R_h + \tau^{-1} R_f) \right]^{\frac{(\alpha-1)V}{\alpha}} \tag{27}$$

With the assumption of symmetry, price of imported variety becomes:

$$p_{f,imp}(\psi) = \tau p_{h,exp}(\psi) = \tau \left(\frac{\alpha}{\rho}\right)^{\frac{V}{\alpha}} \left(\frac{1}{\psi}\right)^{V} \left[P_h^{\sigma-1}(R_h + \tau^{-1}R_f)\right]^{\frac{(\alpha-1)V}{\alpha}} \tag{28}$$

The aggregate expenditure in both markets are equal, so revenue of an exporting firm with productivity ψ in both markets becomes:

$$r_h(\psi) = \left(\frac{\rho}{\alpha}\right)^{\frac{V(\sigma-1)}{\alpha}} \psi^{V(\sigma-1)} P_h^{(\sigma-1)V} R_h^V (1+\tau^{-1})^{V-1} \tag{29}$$

$$r_f(\psi) = \left(\frac{\rho}{\alpha}\right)^{\frac{V(\sigma-1)}{\alpha}} \psi^{V(\sigma-1)} P_h^{(\sigma-1)V} R_f^V \tau^{-1} (1+\tau^{-1})^{V-1} \tag{30}$$

and total revenue is expressed as:

$$r_T(\psi) = \begin{cases} \left(\frac{\rho}{\alpha}\right)^{\frac{V(\sigma-1)}{\alpha}} \psi^{V(\sigma-1)} (P_h^{\sigma-1} R_h)^V & \text{if firm sells at home} \\ \left(\frac{\rho}{\alpha}\right)^{\frac{V(\sigma-1)}{\alpha}} \psi^{V(\sigma-1)} P_h^{(\sigma-1)V} R_h^V (1+\tau^{-1})^V & \text{if firm sells in both} \end{cases} \tag{31}$$

We see that the relationship between domestic and export sales is driven by the marginal cost technology α. Clearly, a drop in tariffs leads to a decrease in domestic sales and an increase in export sales. This pattern is absent in Melitz (2003) as firms maximize profits independently across markets. Aggregate revenue and profit increases at a slower magnitude with declining tariffs when compared to the model with constant marginal cost[21].

The profit of an exporting firm is given by: $\pi(\psi) = r_h + r_f - \frac{1}{\psi^\alpha}(q_h + q_f)^\alpha - f - f_x$ where $\frac{1}{\psi^\alpha}(q_h + q_f)^\alpha = p_h(\psi)^{1-\sigma} R_h P_h^{\sigma-1}(1+\tau^{-1})\frac{\rho}{\alpha}$ and $r_h + r_f = p_h(\psi)^{1-\sigma} R_h P_h^{\sigma-1}(1+\tau^{-1})$. We now express profit as:

$$\pi(\psi) = \frac{r_h + r_f}{\sigma V} - f - f_x \tag{32}$$

[21]To see this compute the tariff elasticity if revenue in equation (31b) and profit in equation (32)

such that each firms' profit in export and domestic market is given by:

$$\pi_d(\psi) = \frac{r_d(\psi)}{V\sigma} - f, \qquad \pi_f(\psi) = \frac{r_x(\psi)}{V\sigma} - f_x$$

A firm exports if $\pi_f(\psi) \geq 0$, so a firm's combined profit is defined as:

$$\pi(\psi) = \pi_d(\psi) + \max\{0, \pi_f(\psi)\}$$

Similar to the closed economy case, let $\psi_x^* = inf\{\psi : \psi \geq \psi^* \text{ and } \pi_f(\psi) \geq 0\}$ represent the new cut-off productivity level for exporting firms. Thus, if $\psi_x^* > \psi^*$ then some firms with productivity levels between ψ^* and ψ_x^* produce only for the domestic market. Let $k_x = \frac{1-F(\psi_x^*)}{1-F(\psi^*)}$ denote the ex-ante probability that a successful entrant exports (i.e. fraction of exporting firms). We thus represent $M_x = k_x M$ as the mass of exporting firms. The aggregate price of domestically produced varieties sold in the home country is given by:

$$P_h = \left[\int_0^\infty M[(1-k_x)p_h(\psi)^{1-\sigma} + k_x p_{h,exp}(\psi_x)^{1-\sigma}]d\mu(\psi)\right]^{\frac{1}{1-\sigma}}$$

where $p_h(\psi) = \left(\frac{\alpha}{\rho}\right)^{\frac{V}{\alpha}} \left(\frac{1}{\psi}\right)^V (P_h^{\sigma-1}R_h)^{\frac{(\alpha-1)V}{\alpha}}$ is the price in non-exporting firms and $p_{h,exp}(\psi_x) = \left(\frac{\alpha}{\rho}\right)^{\frac{V}{\alpha}} \left(\frac{1}{\psi_x}\right)^V (P_h^{\sigma-1}R_h)^{\frac{(\alpha-1)V}{\alpha}} \left[(1+\tau^{-1})\right]^{\frac{(\alpha-1)V}{\alpha}}$ is the price in exporting firms. Simplifying, we obtain the aggregate price expressed below as:

$$P_h = M^{\frac{1}{(1-\sigma)V}} \left(\frac{\alpha}{\rho}\right)^{\frac{1}{\alpha}} R_h^{\frac{\alpha-1}{\alpha}} \tilde{\psi}^{-V} [(1-k_x) + k_x(1+\tau^{-1})^{V-1}]^{\frac{1}{(1-\sigma)V}} \tag{33}$$

5.2.1 Firm Entry and Exit

We derive the equilibrium conditions in this sub-section. We start with the zero profit condition and later, the free entry condition. In an economy with trade, average domestic revenue is given by: $r_d(\tilde{\psi}) = \int_0^{\infty} r(\psi)\mu(\psi)d\mu$, which can be expressed as:

$$r_d(\tilde{\psi}) = \left(\frac{\rho}{\alpha}\right)^{\frac{V(\sigma-1)}{\alpha}} P_h^{(\sigma-1)V} R_h^V \left[(1-k_x) + k_x(1+\tau^{-1})^{V-1}\right]\tilde{\psi}(\psi^*)^{V(\sigma-1)} \tag{34}$$

For a firm with the cut-off productivity of entry (ψ^*), this firm sells only in the domestic market since $\psi^* < \psi_x^*$, so it's domestic revenue is given by:

$$r_d(\psi^*) = \left(\frac{\rho}{\alpha}\right)^{\frac{V(\sigma-1)}{\alpha}} \psi^{*V(\sigma-1)}(P_h^{\sigma-1}R_h)^V$$

Taking the ratio of average domestic to cut-off revenue, we express average domestic revenue in terms of the cut-off revenue as:

$$r_d(\tilde{\psi}) = \gamma\left(\frac{\tilde{\psi}(\psi^*)}{\psi^*}\right)^{V(\sigma-1)} r_d(\psi^*) \qquad \text{where } \gamma = (1-k_x) + k_x(1+\tau^{-1})^{V-1}$$

From the cut-off profits, we have that $\pi_d(\psi^*) = \frac{r_d(\psi^*)}{V\sigma} - f = 0$, so that the cut-off domestic revenue becomes $r_d(\psi^*) = fV\sigma$ and average profit from domestic sales is expressed as:

$$\pi_d(\tilde{\psi}) = \gamma\left(\frac{\tilde{\psi}(\psi^*)}{\psi^*}\right)^{V(\sigma-1)} \frac{r_d(\psi^*)}{V\sigma} - f = fk(\psi^*)$$

where $k(\psi^*) = \left[\gamma\left(\frac{\tilde{\psi}(\psi^*)}{\psi^*}\right)^{V(\sigma-1)} - 1\right]$. Similarly, a firm with the export productivity cut-off ψ_x^* makes zero profit from exporting such that the cut-off export revenue is:

$$\pi_f(\psi_x^*) = 0 \implies r_f(\psi_x^*) = V\sigma f_x$$

We express the average export sales revenue and profit below as:

$$r_f(\tilde{\psi_x}) = \left(\frac{\tilde{\psi}_x(\psi_x^*)}{\psi_x^*}\right)^{V(\sigma-1)} r_f(\psi_x^*) = \left(\frac{\tilde{\psi}_x(\psi_x^*)}{\psi_x^*}\right)^{V(\sigma-1)} V\sigma f_x$$

$$\pi_f(\tilde{\psi_x}) = f_x k(\psi_x^*)$$

where $k(\psi_x^*) = (\tilde{\psi}_x(\psi_x^*)/\psi_x^*)^{V(\sigma-1)} - 1$. The zero cut-off profit condition implies that:

$$\frac{r_f(\psi_x^*)}{r_d(\psi^*)} = \left(\frac{\psi_x^*}{\psi^*}\right)^{V(\sigma-1)} \tau^{-1}(1+\tau^{-1})^{V-1} = \frac{V\sigma f_x}{V\sigma f}$$

$$\psi_x^* = \psi^*[\tau(1+\tau^{-1})^{1-V}]^{\frac{1}{V(\sigma-1)}} \left(\frac{f_x}{f}\right)^{\frac{1}{V(\sigma-1)}} \tag{35}$$

Equation (35) defines the cut-off export productivity. It is decreasing with trade liberalization (τ) and increasing with fixed export costs (f_x), consistent with the literature. We now derive an expression for average profit as a function of the cut-off productivity levels.

$$\bar{\pi} = \pi_d(\tilde{\psi}) + k_x\pi_x(\tilde{\psi}_x) = fk(\psi^*) + k_x f_x k(\psi_x^*) \qquad \textbf{New ZCP} \tag{36}$$

The free entry condition is same as the closed economy case. That is the value of entry $\nu_e = 0$ if and only :

$$\bar{\pi} = \frac{\delta f_e}{k_{in}} \qquad \textbf{FE}$$

The new ZCP curve and FE curve identifies ψ^* and $\bar{\pi}$ (proof is similar to that in Melitz (2003)) which in turn determines the export productivity cut-off ψ_x^* in equation (35), as well as average productivity $\tilde{\psi}$, $\tilde{\psi}_x$ and the ex-ante successful entry and export probabilities p_{in} and k_x. Using the stability condition $p_{in}M_e = \delta M$, we have the total quantity of labour used in entry to be: $L_e = M_e f_e = \frac{\delta f_e}{p_{in}}M = \bar{\pi}M = \Pi$. Since aggregate labour used in production must satisfy $L_p = R_h - \Pi$, then total labour $L = L_p + L_e$ is the same as the closed economy case and equal to $L = R_h$. From the average revenue equation $\bar{r} = r_d(\tilde{\psi}) + k_x r_x(\tilde{\psi}_x)$ and profit $\bar{\pi} = \pi_d(\tilde{\psi}) + k_x\pi_x(\tilde{\psi}_x)$, we show that both average revenue and profits can be expressed as:

$$\bar{\pi} = \frac{r_d(\tilde{\psi})}{V\sigma} + k_x\frac{r_x(\tilde{\psi}_x)}{V\sigma} - f - k_x f_x \implies \bar{r} = V\sigma(\bar{\pi} + k_x f_x + f)$$

So the total sales and mass of producing firms is expressed below as:

$$R_h = \bar{r}M \implies M = \frac{L}{V\sigma(\bar{\pi} + k_x f_x + f)}$$

Therefore, the aggregate price of domestically produced goods in equation (33) can be written as:

$$P_h = M^{\frac{1}{(1-\sigma)}} \left(\frac{\alpha}{\rho}\right)^{\frac{1}{\alpha}} \tilde{\psi}^{-V} f(\tau)[V\sigma(\bar{\pi} + k_x f_x + f)]^{\frac{\alpha-1}{\alpha}} \tag{37}$$

Where $f(\tau) = [(1-k_x)+k_x(1+\tau^{-1})^{V-1}]^{\frac{1}{(1-\sigma)V}}$ is a decreasing function of τ (i.e. $\frac{df(\tau)}{d\tau} < 0$). Equation (37) implies that trade liberalization (tariff reduction), may result to rising prices of domestic goods in the home country as tariffs has a direct negative effect on the aggregate price index of domestic varieties. This effect is a direct consequence of the increasing marginal cost structure. Intuitively, consider a firm producing at full capacity and selling only in the domestic economy. With decreasing tariffs, this firm is faced with increased demand from abroad. In order to meet demands in both markets, the firm hires additional workers which marginally increases its production. Given that the production plant is fixed and capacity constrained, marginal cost of production will rise which is reflected in the price of domestic varieties. This finding provides theoretical justification for the empirical estimates in Ahn and McQuoid (2012)[22] that employed a structural model and constructs a counterfactual aggregate domestic goods price index that will emerge in the absence of capacity constrained firms in Indonesia. Their paper compared this price index with actual domestic price index and concludes that the actual domestic price index would be lower had there been no capacity constrained firms, thus a source of welfare losses. If it was a constant marginal cost technology ($\alpha = 1$), there will be no direct effect of tariff reduction on aggregate price of domestic goods[23].

[22]This is the working paper version of Ahn and McQuoid (2017).

[23]There will be indirect effects as shown in Melitz (2003). A reduction in tariffs will result in higher average productivity ($\frac{d\tilde{\psi}}{d\tau} < 0$) through reallocation of market shares to more productive firms, which obviously reduces the aggregate price of domestic goods. On the other hand, due to an upward shift in the cut-off productivity (ψ^*) from declining tariffs, average profit increases resulting to a declining mass of firms ($\frac{dM}{d\tau} < 0$), which imply an increase in aggregate price of domestic varieties. Both opposing channels are indirect effects of declining trade tariffs on aggregate price and these effects are present in

We now consider the price of imported variety in deriving an expression for the aggregate price index. Denote $M_t = M + M_x$ as the number of domestic and imported varieties in the economy. The aggregate price will be a combination of domestic price of products manufactured by non-exporters and exporters, and the price of imported varieties multiplied by the tariffs. By symmetry, we also assume that the foreign country produces with an increasing marginal cost technology[24]. The new aggregate price is expressed as:

$$P_h^a = \left[\int_0^\infty \{ M[(1-k_x)p_h(\psi)^{1-\sigma} + k_x p_{h,exp}(\psi_x)^{1-\sigma}] + M_x \tau^{1-\sigma} p_{h,imp}(\psi_x)^{1-\sigma} \} d\mu(\psi) \right]^{\frac{1}{1-\sigma}}$$

where $p_{h,imp}(\psi_x) = p_{h,exp}(\psi_x)$. We define the weighted average productivity $\tilde{\psi}_t$ of all firms selling in a country as :

$$\tilde{\psi}_t = \left[\frac{1}{M_t} \left\{ M[(1-k_x) + k_x(1+\tau^{-1})^{V-1}] \tilde{\psi}^{V(\sigma-1)} + M_x \tau^{1-\sigma} (1+\tau^{-1})^{V-1} \tilde{\psi_x}^{V(\sigma-1)} \right\} \right]^{\frac{1}{V(\sigma-1)}}$$

where $\tilde{\psi}_x$ is the weighted average productivity of exporters in the foreign country. Re-expressing the aggregate price:

$$P_h^a = M_t^{\frac{1}{V(1-\sigma)}} \left(\frac{\alpha}{\rho} \right)^{\frac{1}{\alpha}} L^{\frac{\alpha-1}{\alpha}} \tilde{\psi}_t^{-1} \tag{38}$$

and welfare per worker becomes:

$$W = M_t^{\frac{1}{V(\sigma-1)}} \left(\frac{\rho}{\alpha} \right)^{\frac{1}{\alpha}} L^{\frac{1-\alpha}{\alpha}} \tilde{\psi}_t \tag{39}$$

Unlike Melitz (2003), where trade liberalization increases welfare per worker through its positive effect on average productivity $\tilde{\psi}$ and number of varieties M_t, in our model, the effect of trade liberalization on welfare is not straightforward. While the channel for productivity gains from trade tariffs reduction is still at play here, our model imply that

the standard Melitz framework. The latter channel is true only if there are no imports of varieties from the foreign country. We will study the case of bilateral movement of goods below.

[24]The welfare losses we wish to highlight here is present even if a constant marginal cost structure is assume for the foreign country

trade liberalization may result to welfare losses. We summarize this finding below:

Result 1 : *Under the increasing marginal cost assumption, there is a "new" channel for welfare losses associated with reduction in tariffs. This channel is absent in standard Melitz trade model.*

See proof in the appendix. Our point here is that trade liberalization has two opposing effects on aggregate welfare. The first effect is an increase in aggregate productivity (larger welfare) through reallocation of resources from less to more productive firms. The second effect is the rise in firm-level prices, and aggregate prices (lower welfare). The dominating channel effect is unclear as we do not quantify the net effects due to data limitations.

Understanding the marginal cost structure is important as it sheds some information about whether firms are capacity constraint and helps to understand the welfare implication associated with trade liberalization. Since increasing marginal cost is a consequence of capacity constrained (Ahn and McQuoid, 2017, Suslow, 1986, Bresnahan and Suslow, 1989), our results highlight a significant role capacity plays in the ability of countries to fully benefits from globalization. Such market distortions can result to rising prices and a drop in consumer welfare (Soderbery, 2014). It suggests the importance of understanding and addressing the impact of production capacity on international trade.

6 Conclusion

In this paper, we employed a matched firm-product-destination dataset for exporting firms in Hungary and show that the firm's always substitute domestic sales for exports while controlling for supply determinants. This suggests the prevalence of increasing marginal costs technology, contrary to the conventional assumption of constant marginal costs in models of international trade. With the objective of revalidating the welfare implications from trade liberalization, we build in an increasing marginal costs technology into Melitz (2003) trade model and find that trade liberalization (tariffs cuts) results to two opposing effects on aggregate welfare. On one hand, it increases welfare through its positive effect on aggregate productivity. On the other hand, it results to a new channel of welfare losses through its negative effects on firm-level prices (higher prices), which has not been accounted for in previous studies. Due to data limitations, we do not evaluate the net effect of trade liberalization on welfare, but we hope to do so in future work as the required data becomes available.

A number of existing literature using survey datasets where firms are asked if they are capacity constraint have attributed increasing marginal cost technology to production capacity constraints (Ahn and McQuoid, 2017). Thus, our results suggest that production capacity could hinder the full realization of the gains from trade liberalization, and makes a case for addressing production capacity through implementing domestic policies concurrently with trade policies.

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Appendix

A Robustness Results

A.1 Some Derivations

A.1.1 Estimable Empirical Equations

We can rewrite equation (4) as

$$q_{jHt} = \left(\frac{\sigma-1}{\sigma}\right)^{\sigma} \alpha_l^{\sigma} A_{jt}^{\frac{\sigma}{\alpha_l}} K_{jt}^{\frac{\sigma\alpha_k}{\alpha_l}} (q_{jHt}+q_{jFt})^{(\frac{\alpha_l-1}{\alpha_l})\sigma} \zeta_{jHt}\chi_{Ht}\eta_{jt}^{-\sigma}$$

where η_{jt} can be since as a random optimization error. Substituting equation (6) into the RHS of the above equation, we get:

$$q_{jHt} = \left(\frac{\sigma-1}{\sigma}\right)^{\sigma} \alpha_l^{\sigma} A_{jt}^{\frac{\sigma}{\alpha_l}} K_{jt}^{\frac{\sigma\alpha_k}{\alpha_l}} \left(\frac{\zeta_{jHt}\chi_{Ht}\tau_{jt}^{\sigma}}{\zeta_{jFt}\chi_{Ft}}+1\right)^{(\frac{\alpha_l-1}{\alpha_l})\sigma} q_{jFt}^{(\frac{\alpha_l-1}{\alpha_l})\sigma} \zeta_{jHt}\chi_{Ht} \tag{A.40}$$

Taking log of equation (A.40), and approximating $ln\left(\frac{\zeta_{jHt}\chi_{Ht}\tau_{jt}^{\sigma}}{\zeta_{jFt}\chi_{Ft}}+1\right)$ to $ln\left(\frac{\zeta_{jHt}\chi_{Ht}\tau_{jt}^{\sigma}}{\zeta_{jFt}\chi_{Ft}}\right)$, we obtain the estimable equation (7).

A.1.2 Deriving Revenue Equations (12) and (13)

We express the FOC in equation (4) as: $q_{jHt} = \left(\frac{\sigma-1}{\sigma}\right)^{\sigma} \alpha_l^{\sigma} A_{jt}^{\frac{\sigma}{\alpha_l}} K_{jt}^{\frac{\sigma\alpha_k}{\alpha_l}} (q_{jHt}+q_{jFt})^{(\frac{\alpha_l-1}{\alpha_l})\sigma} \zeta_{jHt}\chi_{Ht}$. We also express equation (6) in terms of exports as $q_{jFt} = \frac{\zeta_{jft}\chi_{Ft}q_{jHt}}{\zeta_{jHt}\chi_{Ht}\tau_{jt}^{\sigma}}$. Substituting q_{jFt} into q_{jHt} we obtain:

$$q_{jHt} = \left(\frac{\sigma-1}{\sigma}\right)^{\sigma} \alpha_l^{\sigma} A_{jt}^{\frac{\sigma}{\alpha_l}} K_{jt}^{\frac{\sigma\alpha_k}{\alpha_l}} (\zeta_{jHt}\chi_{Ht}+\zeta_{jFt}\chi_{Ft}\tau_{jt}^{-\sigma})^{(\frac{\alpha_l-1}{\alpha_l})\sigma} q_{jHt}^{(\frac{\alpha_l-1}{\alpha_l})\sigma} (\zeta_{jHt}\chi_{Ht})^{\frac{1}{V}} \tag{A.41}$$

where $V = \frac{\alpha_l}{\alpha_l+\sigma(1-\alpha_l)}$. We express (A.41) as

$$q_{jHt}^{\frac{1}{V}} = \left(\frac{\sigma-1}{\sigma}\right)^{\sigma} \alpha_l^{\sigma} A_{jt}^{\frac{\sigma}{\alpha_l}} K_{jt}^{\frac{\sigma\alpha_k}{\alpha_l}} (\zeta_{jHt}\chi_{Ht}+\zeta_{jFt}\chi_{Ft}\tau_{jt}^{-\sigma})^{(\frac{\alpha_l-1}{\alpha_l})\sigma} (\zeta_{jHt}\chi_{Ht})^{\frac{1}{V}}$$

so that domestic sales can be re-written as:

$$q_{jHt} = \left(\frac{\sigma-1}{\sigma}\alpha_l\right)^{\sigma V} A_{jt}^{\frac{\sigma V}{\alpha_l}} K_{jt}^{\frac{\sigma\alpha_k V}{\alpha_l}} (\zeta_{jHt}\chi_{Ht}+\zeta_{jFt}\chi_{Ft}\tau_{jt}^{-\sigma})^{(\frac{\alpha_l-1}{\alpha_l})\sigma V} (\zeta_{jHt}\chi_{Ht}) \tag{A.42}$$

Domestic revenue is express as: $r_{jHt} = p_{jHt}q_{jHt} = q_{jHt}^{\frac{\sigma-1}{\sigma}}\zeta_{jHt}^{\frac{1}{\sigma}}\chi_{Ht}^{\frac{1}{\sigma}}$. Substituting (A.42) in r_{jHt}, we obtain domestic revenue Equation (12). Analogously, we can derive Equation (13).

A.1.3 Proof of Result 1

We proof a simpler case where we assume that all firms sell to both the domestic and export markets. The result generalises to the case where a subset of firms sell exclusively to the domestic market and the remaining sells to both the domestic and export markets. In this case where the all firms exports, the aggregate productivity can be re-expressed as:

$$\tilde{\psi}_t = (1+\tau^{-1})^{\frac{V-1}{V(\sigma-1)}}\left[\frac{1}{M_t}\left(M\tilde{\psi}^{V(\sigma-1)} + M_x\tau^{1-\sigma}\tilde{\psi}_x^{V(\sigma-1)}\right)\right]^{\frac{1}{V(\sigma-1)}} \tag{A.43}$$

and welfare per worker

$$W = \left(\frac{\rho}{\alpha}\right)^{\frac{1}{\alpha}} L^{\frac{1-\alpha}{\alpha}}(1+\tau^{-1})^{\frac{V-1}{V(\sigma-1)}}\left(M\tilde{\psi}^{V(\sigma-1)} + M_x\tau^{1-\sigma}\tilde{\psi}_x^{V(\sigma-1)}\right)^{\frac{1}{V(\sigma-1)}} \tag{A.44}$$

Taking logs of welfare per worker and differentiating with respect to tariffs τ we obtain:

$$\frac{\partial \ln W}{\partial \tau} = \underbrace{\frac{\partial\left(\frac{V-1}{V(\sigma-1)}\ln(1+\tau^{-1})\right)}{\partial \tau}}_{\text{New welfare losses from reduction in tariffs}} + \underbrace{\frac{\partial\left(\frac{1}{V(\sigma-1)}\ln[M\tilde{\psi}^{V(\sigma-1)} + M_x\tau^{1-\sigma}\tilde{\psi}_x^{V(\sigma-1)}]\right)}{\partial \tau}}_{\text{Welfare gains from tariffs reduction in Melitz (2003)}} \tag{A.45}$$

The first term is the new losses that could be realised from trade liberalization. The sign of this derivative is positive, which implies that this term is negative for tariffs reductions. The second term represents the welfare gains from trade liberalization in Melitz (2003). The only difference is the scaling constant V. We refer the reader to appendix E in Melitz (2003) for the detailed proof.

A.2 Robustness Results and First Stage Estimates

Table 5: Estimating the Effects of Foreign sales on Domestic Sales

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Estimator	OLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Dependent variable	ln of domestic sales							Δ ln of domestic sales	
ln export sales$_{it}$	-0.078	-0.088	0.033	-0.078	-0.113	-0.105	-0.147		
	(0.018)**	(0.029)**	(0.019)$^{+}$	(0.029)**	(0.024)**	(0.031)**	(0.025)**		
ln domestic demand$_{it}$	0.081	0.128		0.115	0.095	0.098	0.068		
	(0.013)**	(0.021)**		(0.020)**	(0.019)**	(0.016)**	(0.016)**		
ln productivity$_{it}$	0.500				0.519	0.531	0.653		
	(0.037)**				(0.039)**	(0.037)**	(0.050)**		
ln capital$_{it}$							0.336		
							(0.017)**		
ln number of firms$_{st}$		0.199							
		(0.162)							
ln industry domestic sales$_{st}$		0.285							
		(0.118)*							
ln export$_{it}\times$ export share$_{i0}$						-0.051			
						(0.070)			
Δln export sales$_{it}$								-0.046	-0.020
								(0.017)**	(0.024)
Δln domestic demand$_{it}$								0.042	0.013
								(0.010)**	(0.011)
Δln productivity$_{it}$								0.915	0.860
								(0.135)**	(0.097)**
Observations	38020	38020	38020	38020	38020	38020	38020	26353	24421
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Year Dummies	No	Yes	No	No	No	No	No	No	No
Industry $\times$ year dummies	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: We use the instrument $F_{jt}^{core} = \sum_d s_{jd}^{core} IM_{d,t}^{core}$ for foreign demand and $D_{jt}^{core} = IM_{HUN,t}^{core}$ for domestic demand. This instrument focuses on the firm's core products defined as the product (HS4) with the largest value of exports over the period. Robust standard errors, clustered by industry level are in parentheses. Firm fixed effect is included in all estimation except column (7). In column (1), I report the OLS, column (2)-(8) reports the IV results. Our instrument in (2)-(6) is the foreign demand in HS6 variety exported by the firm. In columns (7)-(8) we use the first difference of the foreign demand. $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$ are 1%, 5% and 10% significant levels respectively.

Table 6: Estimating the Effects of Foreign sales on Domestic Sales

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Estimator	OLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Dep. variable	ln of domestic sales							Δ ln of domestic sales	
ln export sales$_{it}$	-0.060	-0.095	0.038	-0.081	-0.111	-0.105	-0.139		
	(0.017)**	(0.037)*	(0.016)*	(0.033)*	(0.029)**	(0.038)**	(0.025)**		
ln domestic dem$_{it}$	0.031	0.064		0.057	0.047	0.048	0.033		
	(0.006)**	(0.014)**		(0.012)**	(0.011)**	(0.010)**	(0.008)**		
ln productivity$_{it}$	0.501				0.529	0.538	0.660		
	(0.036)**				(0.039)**	(0.037)**	(0.048)**		
ln capital$_{it}$							0.344		
							(0.014)**		
ln no. of firms$_{st}$		0.086							
		(0.171)							
ln sector domsales$_{it}$		0.373							
		(0.129)**							
ln export$_{it}\times$eshare$_{i0}$						-0.042			
						(0.077)			
Δln export sales$_{it}$								-0.057	-0.038
								(0.016)**	(0.021)$^{+}$
Δln domestic dem$_{it}$								0.019	0.009
								(0.005)**	(0.005)$^{+}$
Δ ln productivity$_{it}$								0.476	0.450
								(0.031)**	(0.028)**
Observations	40785	40785	40785	40785	40785	40785	40785	29629	27696
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Year Dummies	No	Yes	No	No	No	No	No	No	No
Sector$\times$yr FE	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kleib.-Paap stat.		204.77	1211.94	225.89	252.51	580.73	282.99	161.70	96.89

Notes: We exclude observations in industry 34 & 35. These are the manufacture of motor vehicles and other transport equipment industry. Robust standard errors, clustered by industry in parentheses. Firm fixed effects is included in all estimation except column (7). In column (1), I report the OLS, column (2)-(8) reports the IV results. Our instrument in (2)-(6) is the foreign demand in HS6 variety exported by the firm. In columns (7)-(8) we use the first difference of the foreign demand. $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$ are 1%, 5% and 10% significant levels respectively.

Table 7: Estimating the Effects of Foreign sales on Domestic Sales

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Estimator	OLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Dep. variable	ln of domestic sales							Δ ln of domestic sales	
ln export sales$_{it}$	-0.074	-0.255	-0.045	-0.261	-0.264	-0.282	-0.347		
	(0.013)**	(0.110)*	(0.041)	(0.128)*	(0.127)*	(0.195)	(0.126)**		
ln domestic demand$_{it}$	0.023	0.081		0.093	0.078	0.078	0.079		
	(0.011)*	(0.035)*		(0.039)*	(0.037)*	(0.035)*	(0.031)**		
ln productivity$_{it}$	0.450	0.561			0.565	0.551	0.745		
	(0.044)**	(0.070)**			(0.078)**	(0.045)**	(0.098)**		
ln capital$_{it}$							0.369		
							(0.049)**		
ln no. of firms$_{st}$		0.007							
		(0.170)							
ln sector domestic sales$_{st}$		0.212							
		(0.092)*							
ln export$_{it}\times$ export share$_{i0}$						0.097			
						(0.378)			
Δln export sales$_{it}$								-0.117	-0.056
								(0.108)	(0.118)
Δln export sales$_{it}$								0.025	0.003
								(0.029)	(0.032)
Δln productivity$_{it}$								0.828	0.650
								(0.209)**	(0.175)**
Observations	13830	13830	13830	13830	13830	13830	13830	6487	5636
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Year Dummies	No	Yes	No	No	No	No	No	No	No
Industry ×Year Dummy	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

We use weights for each HS6 product sold in the first year the firm enters the export market in constructing the instrument. Robust standard errors, clustered by industry in parentheses. Firm fixed effect is included in all estimation except column (6). In column (1), we report the OLS, column (2-9) reports the IV results. Our instrument in (2)-(7) is the foreign demand in HS6 variety exported by the firm. In column (8-9) we use the 1st difference of foreign demand. $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$ are 1%, 5% and 10% significance respectively.

Table 8: Estimating the Effects of Foreign sales on Domestic Sales

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Estimator	OLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Dep variable	ln of domestic sales							Δ ln of domestic sales	
ln export sales$_{it}$	-0.059	-0.099	0.041	-0.080	-0.109	-0.106	-0.140		
	(0.016)**	(0.025)**	(0.015)**	(0.039)*	(0.033)**	(0.043)*	(0.029)**		
ln domestic dem$_{it}$	0.030	0.066		0.057	0.046	0.046	0.033		
	(0.006)**	(0.009)**		(0.015)**	(0.013)**	(0.012)**	(0.010)**		
ln productivity$_{it}$	0.509				0.535	0.540	0.670		
	(0.036)**				(0.042)**	(0.037)**	(0.051)**		
ln capital$_{it}$							0.350		
							(0.016)**		
ln no. of firms$_{st}$		0.078							
		(0.079)							
ln sector domsales$_{it}$		0.371							
		(0.041)**							
ln export$_{it}\times$ eshare$_{it}$						-0.022			
						(0.086)			
Δ ln export sales$_{it}$								-0.053	-0.032
								(0.016)**	(0.021)
Δ ln domestic dem$_{it}$								0.018	0.007
								(0.006)**	(0.006)
Δ ln productivity$_{it}$								0.477	0.444
								(0.031)**	(0.028)**
Observations	41632	41632	41632	41632	41632	41632	41632	30259	30259
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Year Dummies	No	Yes	No	No	No	No	No	No	No
Sector$\times$yr FE	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kleib-Paap stat.	—	317.29	1041.82	353.93	390.65	445.98	413.25	245.84	139.35

We substract the values of yearly exports from Hungary of each HS6 from the imports of countries which Hungarian firms serviced. Robust standard errors, clustered by industry in parentheses. Firm fixed effects is included in all estimation except column (7). In column (1), I report the OLS, column (2)-(8) reports the IV results. Our instrument in (2)-(6) is the foreign demand in HS6 variety exported by the firm. In columns (7)-(8) we use the first difference of the foreign demand. $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$ are 1%, 5% and 10% significant levels respectively.

Table 9: First Stage Results: Baseline Instrument

	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent var	ln of export sales						Δ ln of export sales	
ln foreign demand$_{it}$	0.206	0.305	0.206	0.200	0.162	0.195		
	(0.015)**	(0.009)**	(0.019)**	(0.013)**	(0.007)**	(0.012)**		
ln domestic dem$_{it}$	0.153		0 .153	0.139	0.090	0.122		
	(0.020)**		(0.019)**	(0.019)**	(0.014)**	(0.017)**		
ln productivity$_{it}$				0.523	0.143	0.630		
				(0.030)**	(0.022)**	(0.037)**		
ln capital$_{it}$						0.320		
						(0.014)**		
ln no. of firms$_{st}$	0.590							
	(0.145)**							
ln isector domsales$_{it}$	0.086							
	(0.089)							
ln export$_{it}\times$ eshare$_{i0}$					1.283			
					(0.042)**			
Δln foreign demand$_{it}$							0.163	0.155
							(0.013)**	(0.016)**
Δln dom. demand$_{it}$							0.115	0.098
							(0.017)**	(0.018)**
Δln productivity$_{it}$							0.542	0.548
							(0.027)**	(0.026)**
Observations	41886	41886	41886	41886	41886	41886	30458	30458
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Year Dummies	No	Yes	No	No	No	No	No	No
Sector×yr FE	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes

First Stage results for our main specification. $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$ are 1%, 5% and 10% significant levels respectively

Table 10: First Stage Results: Estimating the Effects of Foreign sales on Domestic Sales

	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent var.	ln of export sales						Δ ln of export sales	
ln foreign demand$_{it}$	0.209	0.307	0.209	0.203	0.162	0.198		
	(0.015)**	(0.009)**	(0.014)**	(0.013)**	(0.007)**	(0.012)**		
ln domestic dem$_{it}$	0.151		0 .152	0.138	0.090	0.122		
	(0.020)**		(0.020)**	(0.019)**	(0.014)**	(0.018)**		
ln productivity$_{it}$				0.520	0.146	0.627		
				(0.031)**	(0.023)**	(0.038)**		
lcapital$_{it}$						0.315		
						(0.013)**		
ln no. of firms$_{st}$	0.545							
	(0.150)**							
ln industry dom. sales$_{it}$	0.089							
	(0.091)							
ln export$_{it}\times$ eshare$_{i0}$					1.290			
					(0.042)**			
Δln foreign demand$_{it}$							0.165	0.157
							(0.016)**	(0.016)**
Δln dom. demand$_{it}$							0.115	0.099
							(0.018)**	(0.018)**
Δln productivity$_{it}$							0.542	0.549
							(0.027)**	(0.026)**
Observations	40784	40784	40784	40784	40784	40784	29629	27696
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Year Dummies	No	Yes	No	No	No	No	No	No
Sector×year dummies	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes

We exclude industry 34 and 35 in this estimation. These are the automobile industry. Since there is a huge GVC in this section (e.g. audi), we exclude these industries in our estimation. $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$ are 1%, 5% stage rand 10% significance levels respectively.

Table 11: First Stage Results: Estimating the Effects of Foreign sales on Domestic Sales

	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Variable	ln of export sales						Δ ln of export sales	
ln foreign demand$_{it}$	0.083	0.160	0.074	0.074	0.052	0.068		
	(0.013)**	(0.011)**	(0.013)**	(0.012)**	(0.012)**	(0.014)**		
ln domestic demand$_{it}$	0.216		0.232	0.217	0.137	0.201		
	(0.024)**		(0.022)**	(0.023)**	(0.020)**	(0.024)**		
ln productivity$_{it}$	0.547			0.543	0.144	0.669		
	(0.028)**			(0.029)**	(0.033)**	(0.040)**		
ln capital$_{it}$						0.347		
						(0.026)**		
ln no of firms$_{st}$	0.404							
	(0.237)$^{+}$							
ln sector domestic sales$_{st}$	0.093							
	(0.119)							
ln export$_{it}\times$ export share$_{i0}$					1.640			
					(0.091)**			
Δln foreign demand$_{it}$							0.065	0.067
							(0.014)**	(0.011)**
Δln domestic demand$_{it}$							0.160	0.143
							(0.025)**	(0.031)**
Δln productivity$_{it}$							1.039	0.889
							(0.185)**	(0.149)**
Observations	13830	13830	13830	13830	13830	13830	6487	5636
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Year Dummies	Yes	No	No	No	No	No	No	No
Industry $\times$Year Dummy	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

First Stage results for the case where we use weights for each HS6 product sold in the first year the firm enters the export market. Standard errors in parentheses $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$

Table 12: First Stage Results: Core Product Instruments

	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent variable			ln of export sales				Δln of export sales	
ln foreign demand$_{it}$	0.220	0.288	0.219	0.211	0.169	0.205		
	(0.015)**	(0.012)**	(0.014)**	(0.012)**	(0.007)**	(0.011)**		
ln domestic demand$_{it}$	0.252		0.248	0.220	0.100	0.189		
	(0.020)**		(0.019)**	(0.019)**	(0.014)**	(0.018)**		
ln productivity$_{it}$				0.518	0.121	0.624		
				(0.040)**	(0.020)**	(0.049)**		
ln capital$_{it}$						0.307		
						(0.014)**		
ln number of firms$_{st}$	0.674							
	(0.189)**							
ln industry domestic sales$_{st}$	0.069							
	(0.086)							
ln export$_{it}\times$ export share$_{i0}$					1.298			
					(0.032)**			
Δln export sales$_{it}$							0.169	0.145
							(0.013)**	(0.015)**
Δln domestic demand$_{it}$							0.152	0.116
							(0.017)**	(0.016)**
Δln productivity$_{it}$							1.154	1.120
							(0.211)**	(0.186)**
Observations	38020	38020	38020	38020	38020	38020	26353	24421
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Year Dummies	Yes	No	No	No	No	No	No	No
Industry $\times$ year dummies	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

We use instruments based on core products of the firm. Robust standard errors clustered at the industry level
$^{+}$ in parentheses $p < 0.10$, * $p < .05$, ** $p < .01$

Table 13: First Stage Results: Estimating the Effects of Foreign sales on Domestic Sales

	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(8)
Dependent variable	ln of export sales						Δ ln of export sales	
ln foreign demand$_{it}$	0.198	0.301	0.198	0.193	0.157	0.187		
	(0.011)**	(0.009)**	(0.011)**	(0.010)**	(0.007)**	(0.009)**		
ln domestic demand$_{it}$	0.159		0 .159	0.144	0.090	0.128		
	(0.018)**		(0.018)**	(0.017)**	(0.012)**	(0.017)**		
ln productivity$_{it}$				0.523	0.141	0.631		
				(0.030)**	(0.022)**	(0.038)**		
ln capital$_{it}$						0.319		
						(0.014)**		
ln number of firms$_{st}$	0.560							
	(0.140)**							
ln industry dom. sales$_{it}$	0.081							
	(0.087)							
ln export$_{it}\times$ exp. share$_{i0}$					1.287			
					(0.042)**			
Δln foreign demand$_{it}$							0.156	0.150
							(0.010)**	(0.013)**
Δ ln domestic demand$_{it}$							0.118	0.102
							(0.015)**	(0.016)**
Δ ln productivity$_{it}$							0.541	0.545
							(0.027)**	(0.026)**
Observations	41632	41632	41632	41632	41632	41632	30259	30259
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Year Dummies	No	Yes	No	No	No	No	No	No
Sector$\times$year dummies	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes

First Stage results for the case where we substracted the values of yearly exports (HS6) from Hungary from imports of countries which imported from Hungary. $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$ are 1%, 5% and 10% significant levels respectively

Table 14: Estimating the Effects of Foreign sales on Domestic Sales

Dependent Variable	Δ^2 ln Domestic Sales (1)	Δ^3 ln Domestic Sales (2)	Δ^4 ln Domestic Sales (3)
Δ^2 ln Exports	-0.125		
	$(0.009)^{**}$		
Δ^2 ln Productivity	1.469		
	$(0.027)^{**}$		
Δ^2 ln Capital	0.163		
	$(0.005)^{**}$		
Δ^3 ln Exports		-0.121	
		$(0.011)^{**}$	
Δ^3 ln Productivity		1.413	
		$(0.031)^{**}$	
Δ^3 ln Capital		0.164	
		$(0.006)^{**}$	
Δ^4 ln Exports			-0.119
			$(0.012)^{**}$
Δ^4 ln Productivity			1.361
			$(0.033)^{**}$
Δ^4 ln Capital			0.164
			$(0.007)^{**}$
Observations	79248	67892	58698
Firm FE	yes	yes	yes
Industry-Year Dummies	yes	yes	yes
Demand Shocks	yes	yes	yes
Rsquared	0.655	0.636	0.619

Notes: This regression reports the results for the estimation of the increasing marginal cost structure for all manufacturing firms in Hungary. Robust standard errors clustered at the firm-level are in parentheses $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$.

B TFPR, Data Cleaning and Descriptive Statistics

B.1 TFPR Estimation

I estimate firm-level TFPR by assuming that firms use a Cobb-Douglas production technology with capital (k), labour (l) and materials (m) as production inputs. I estimate a separate production function for each 2-digit manufacturing sector[25] using the methodology in Ackerberg et al. (2015) . This methodology builds on the framework developed by Olley and Pakes (1996) (henceforth OP) and Levinsohn and Petrin (2000) (henceforth LP) which uses investment i_{it} (in OP) and material inputs m_{it} (in LP) to control for

[25]My data do not allow me to isolate single and multi-product manufacturing firms. This limitation do not allow us observe how inputs are allocated in production of specific inputs there introducing some bias in the estimation

correlation between input levels and unobserved productivity. The key contribution of Ackerberg et al. (2015) lies on the identification of the elasticity of labor which they show is unidentified in the first-stage of the OP and LP procedure[26]. I estimate a value-added Cobb-Douglas production function in the sense that m_{it} does not enter the estimated production function. This implies that the gross output production function is Leontief in the intermediate input[27]. Specifically, I estimate a production function of the form:

$$y_{it} = \beta_k k_{it} + \beta_l l_{it} + \omega_{it} + \epsilon_{it} \tag{B.1}$$

Where all variables are in logs. y_{it} is value added revenue of firm i in year t, ω_{it} is the TFPR, l_{it} is the labor input, k_{it} is the capital stock. We deflate all norminal variables using the NACE 2-digit industry specific price indices provided by Hungarian Statistical Office. Since more-productive firms self-select themselves into exports markets (Melitz (2003)), the productivity process becomes:

$$\omega_{it} = f(\omega_{it-1}) + \xi_{it} \tag{B.2}$$

where ξ_{it} is the innovation term which captures the unexpected productivity effects from exporting. The innovation term ξ_{it} is by OP/LP assumption uncorrelated with the firm's lagged choice variables.

In the first step of Ackerberg et al. (2015) procedure, we estimate the equation of the form:

$$y_{it} = \phi_t(k_{it}, l_{it}, \boldsymbol{x}_{it}) + \epsilon_{it}$$

where $\phi_t(k_{it}, l_{it}, \boldsymbol{x}_{it}) = \beta_k k_{it} + \beta_l l_{it} + g_t(m_{it}, k_{it}, l_{it}, \boldsymbol{x}_{it})$ and $g_t(m_{it}, k_{it}, l_{it}, \boldsymbol{x}_{it})$ is an inverse material demand function which proxies for unobserved productivity ω_{it} in equation (B.1). The vector $\boldsymbol{x_{it}}$ represents the sector and time dummies which represents sector-specific demand and aggregate demand components that affect material demand. We compute the estimate $\hat{\phi}_t(.)$.

In the second step, we use $\hat{\phi}_t(.)$ and together with initial guess of the coefficient vector

[26] Ackerberg et al. (2015) argues that labor elasticity can be identified under 3 very specific data generating process (DGP) namely: (1) a case where i.i.d. optimization error in l_{it} (after m_{it} or i_{it} have been choosen) and not in m_{it} or i_{it} (2) a case where i.i.d. shocks to the price of labor or output after i_{it} or m_{it} is chosen but before l_{it} is chosen, (3) in the case of OP procedure, labor is non-dynamic and chosen at $t - q$ $(0 < v < 1)$ as a function of productivity in period $t - v$ ω_{it-v} while i_{it} is chosen at t.

[27] Ackerberg et al. (2015) do not suggest that applying their procedure to production functions where m_{it} enters in the estimation because Bond and Söderbom (2005) have shown (for the cobb-douglas function) that under the scalar unobservable assumptions, their procedure and that of LP and OP, the gross output production function cannot identify coefficients of perfectly flexible inputs without input price variation except further assumptions are imposed. Infact, Gandhi et al. (2011) shows that both the gross output production function and value-added production function could still suffer from these identification issues and have proposed a new identification strategy that solves this problem.

$\boldsymbol{\beta_z} = \{\beta_k, \beta_l\}$ and for any other candidate vector of $\tilde{\boldsymbol{\beta}}_{\boldsymbol{z}}$, revenue productivity is computed as:

$$\omega_{it}(\tilde{\boldsymbol{\beta}}_{\boldsymbol{z}}) = \hat{\phi}_t(.) - (\tilde{\beta}_k k_{it} - \tilde{\beta}_{it} l_{it})$$

We use our productivity process (equation B.2) to recover the innovation term ξ_{it} by a non-parametric regression of $\omega_{it}(\tilde{\boldsymbol{\beta}}_{\boldsymbol{z}})$ on its own lag $\omega_{it-1}(\tilde{\boldsymbol{\beta}}_{\boldsymbol{z}})$ and prior exporting e_{it-1}. We define the moment condition below and iterate over candidate vector $\tilde{\boldsymbol{\beta}}_{\boldsymbol{z}}$

$$\boldsymbol{E}\left\{\xi_{it}(\tilde{\beta}_k, \tilde{\beta}_l) \begin{pmatrix} k_{it} \\ l_{it-1} \end{pmatrix} \right\} = 0 \tag{B.3}$$

Thus equation (B.3) states that for the optimal $\tilde{\boldsymbol{\beta}}_{\boldsymbol{z}}$, the innovation ξ_{it} is uncorrelated with our instruments $\begin{pmatrix} k_{it} \\ l_{it-1} \end{pmatrix}$. With the estimates of the coefficients for every sector, I compute the firm-level TFP $\hat{\omega_{it}}$:

$$\hat{\omega_{it}} = y_{it} - (\hat{\beta}_l l_{it} + \hat{\beta}_k k_{it}) \tag{B.4}$$

In the estimation, we use the stata *prodest* estimation function developed by Mollisi and Rovigatti (2017) because of its efficiency over other functions. We report sectoral estimates in table(17)

B.2 Data Cleaning and Descriptive Statistics

We follow the cleaning procedures described in preceding literatures (Békés et al. (2011), Bisztray (2016) etc). Specifically, for firms that appear in more than one sector, we assign such firm in a sector in which it appears the most. We fill in missing values of output using the average of the 1 previous and 1 subsequent period's output values. When both or any do not exist, we use the average of 2 or 1 -previous and 2 or 1 forward period's value. We only consider manufacturing firms in our econometic exercise. We list in table 15, the manufacturing sectors.

In Table (16), I present the descriptive statistics. See section 2.1 for the discussions.

Table 15: NACE 2.0 sectors and Description

Nace	description	σ	Nace	description	σ
15	Food and beverages	2.34	27	Basic metals	3.99
16	Tobacco products	3.18	28	Fabricated metal products	3.98
17	Textiles	4.01	29	Machinery and equipment n.e.cc	3.23
18	Wearing Apparels	4.06	30	Computer, electronic & optical products	2.73
19	Leather and related products	7.02	31	Electrical equipment	4.36
20	Wood except furniture	2.78	32	Consumer electronics & commu. equip	5.44
21	Paper and paper products	2.39	33	Optical instr. and photographic equip.	2.55
22	Printing and prod. of recorded media	2.65	34	Motor vehicles, trailers and semi-trailers	7.67
23	Coke and refined petroleum products	1.98	35	Other transport equipment	3.76
24	Chemical products &pharmaceuticals	2.86	36	Furniture	3.39
25	Rubber and plastic products	3.6	37	Recycling	2.67
26	Other non-metallic mineral products	2.8			

Table 16: Descriptive Statistics

Year	Non-exporting	Entrants	Active Expr	Total		Entrants/Active	Active/Total
1992	2811	0	0	2811			0.00
1993	3600	754	754	4354		1.00	0.17
1994	4283	730	1307	5590		0.56	0.23
1995	4610	799	1806	6416		0.44	0.28
1996	4892	805	2238	7130		0.36	0.31
1997	5495	630	2372	7867		0.27	0.30
1998	5976	734	2650	8626		0.28	0.31
1999	6251	673	2766	9017		0.24	0.31
2000	6586	669	2837	9423		0.24	0.30
2001	7270	628	2845	10115		0.22	0.28
2002	7260	605	3133	10393		0.19	0.30
2003	7445	526	3163	10608		0.17	0.30
2004	7249	724	3569	10818		0.20	0.33
2005	7475	685	3668	11143		0.19	0.33
2006	7520	623	3818	11338		0.16	0.34
2007	7110	721	4191	11301		0.17	0.37
2008	7156	766	4158	11314		0.18	0.37
2009	7100	822	4364	11464		0.19	0.38
2010	6823	793	4712	11535		0.17	0.41
2011	6600	772	4935	11535		0.16	0.43
2012	6174	755	4958	11132		0.15	0.45
2013	5541	724	5130	10671		0.14	0.48
2014	5008	644	5242	10250		0.12	0.51
Total:	140235	15582	74616	214851	**Average:**	0.23	0.34

This is the descriptive statistics of firms that sold in only the domestic market in at least one period and then to both the domestic and export markets in subsequent periods.

Table 17: Production Function Estimate by Sector

	Sectors - Teaor03							
Variables	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
log wages	0.849***	0.981***	0.686***	0.712***	0.693***	0.703***	0.637***	0.641***
	(0.001)	(0.210)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
log capital	0.0261***	0.404	0.135***	0.117***	0.126***	0.119***	0.120***	0.132***
	(0.005)	(0.300)	(0.011)	(0.004)	(0.013)	(0.003)	(0.010)	(0.006)
Observations	61717	132	16699	24567	6916	31235	6657	65381
No. of groups	9765	13	2750	4412	1097	5403	973	11869

	Sectors - Teaor03							
Variables	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
log wages	0.782	0.835***	0.711***	0.786***	0.794***	0.696***	0.676***	0.653***
	(0.859)	(0.001)	(0.001)	(0.001)	(0.031)	(0.001)	(0.019)	(0.002)
log capital	0.103	0.038	0.116***	0.126***	0.061***	0.107***	0.128***	0.174***
	(0.065)	(0.009)	(0.008)	(0.004)	(0.025)	(0.005)	(0.010)	(0.010)
Observations	191	10266	26741	18533	4602	78489	55837	2659
No. of groups	27	1371	3562	2933	627	11,664	8638	477

	Sectors - Teaor03						
Variables	(31)	(32)	(33)	(34)	(35)	(36)	(37)
log wages	0.629***	0.745***	0.682***	0.736***	0.740***	0.757***	0.795***
	(0.001)	(0.032)	(0.002)	(0.002)	(0.005)	(0.001)	(0.009)
log capital	0.156	0.108	0.110***	0.132***	0.130***	0.117***	0.090
	(0.007)	(0.019)	(0.011)	(0.011)	(0.032)	(0.009)	(0.057)
Observations	15270	13174	17681	5333	2791	34195	1383
No. of groups	2221	2130	2179	732	473	5816	326

Standard errors in parentheses. $***p < 0.01$, $**p < 0.05$, $**p < 0.1$

C Comparison With Similar Studies in the Literature

Table 18: Effects of Foreign sales on Domestic Sales -

	Δ ln domestic sales			
	(1)	(2)	(3)	(4)
Δ ln export sales	-0.009	-0.022	-0.036	-0.084
	(0.004)*	(0.005)**	(0.005)**	(0.005)**
Δ ln productivity				0.417
				(0.012)**
Sector-year FE	No	No	Yes	Yes
Firm FE	No	Yes	Yes	Yes
Observations	94493	94493	94493	93306
r2	0.000	0.001	0.032	0.093

This table estimates the baseline regression specification in Ahn et al. (2016) Table 5. Productivity is estimated by the ACF procedure. Robust standard errors clustered at firm-level in parentheses $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$

Table 19: Estimating the Effects of Foreign sales on Domestic Sales

Dependent Variable	log Exports		Δlog Exports	
	(1)	(2)	(3)	(4)
ln domestic sales	0.063	-0.061		
	(0.008)**	(0.008)**		
ln Productivity		0.650		
		(0.014)**		
ln Average Wages		0.621		
		(0.022)**		
Δ ln domestic sales			-0.097	-0.196
			(0.010)***	(0.010)***
Δ ln Productivity				0.601
				(0.015)***
Δ ln Average Wages				0.470
				(0.020)**
Observation	127278	127278	93306	93306
Firm-FE	Yes	Yes	Yes	Yes
Sector-Time FE	Yes	Yes	Yes	Yes
R-Squared	0.063	0.129	0.032	0.099

This table reports the OLS regression estimate for a regression specification in Alumnia et al (2018) Equation (9). Column (4) is the main specification of interest. Robust standard errors clustered at the firm-level are reported in parentheses $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$