Venting Out: Exports during a Domestic Slump*

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PRELIMINARY AND INCOMPLETE.

Abstract

Using Spanish firm level data for the period 2000-2013, we explore the differences in the export behavior of firms during the years of sustained economic growth, 2000-2008, and during the Great Recession years, 2009-2013. Exploiting geographical variation in the reduction in domestic demand caused by the financial crisis, we document empirically the existence of a robust, within-firm negative causal relationship between domestic sales and export flows: firms whose domestic sales were reduced by more during the crisis observed a larger increase in their export flows. This negative relationship between domestic sales and export flows reflects the capacity of export markets to counteract the negative impact of local demand shocks.

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1 Introduction

The Great Recession shook the core of many advanced economies. Few countries experienced the severe consequences of the global downturn as intensively as Spain did. From its peak in 2008, Spain's real GDP fell by an accumulated 9.2% in the following five years, until bottoming out in 2013. During the same period, private final consumption expenditure contracted by 14.0%, and the unemployment rate shot up from 9.6% to 26.9%. In the midst of this massive domestic slump, Spanish exports demonstrated an amazing resiliency during these years of turmoil. After tumbling by 19.2% during the global trade collapse of late 2008 and early 2009, Spanish merchandise exports quicky recovered and grew by 39.8% between 2009 and 2013. Overall, Spanish exports grew by an accumulated 12.9% during the 2008-2013 period, while in the rest of the Euro area, merchandise exports *decreased* by 0.7% during these same years. As a result, as shown in Figure 1, the share of Euro area merchandise exports to non-Euro area countries accounted for by Spain increased markedly during this period, despite the contemporaneous decline in the relative weight of Spain's GDP in the Euro area's GDP.[1]

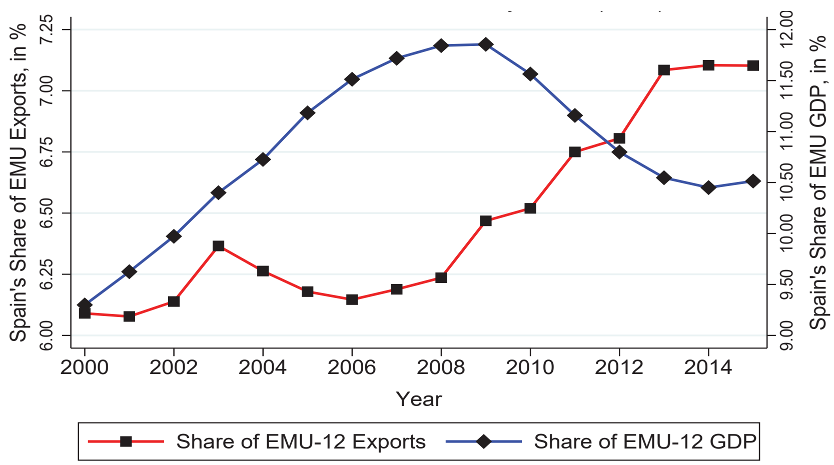


Figure 1: The Spanish Export Miracle

Two leading explanations have been offered to explain this so-called Spanish 'export miracle'. First, this remarkable performance is often attributed to an improvement in competitiveness resulting from the internal devaluation undergone by the Spanish economy since 2010. By 2013, unit labor costs in the manufacturing sector had fallen by 14% from their peak in 2009. A second explanation relates the growth in exports directly to the collapse in domestic demand: faced with excess capacity during the domestic slump, Spanish producers stepped up their efforts to seek new customers in foreign markets.

This second explanation for the Spanish export miracle resonates with the classical "vent-for-

[1] In Appendix A.1, we provide similar figures for the case of another country whose relative GDP dropped drastically during the Great Recession (Portugal) and for a country whose relative GDP increased (Germany). In both cases, we observe a negative relationship between the Euro area shares of goods exports to other countries and of GDP.

surplus" theory of international trade, which has a long tradition in Economics dating back (at least) to Adam Smith.[2] Still, the link between a domestic slump and export growth is hard to reconcile with modern workhorse models of international trade. The reason for this is that these models – including those emphasizing product differentiation and economies of scale – assume that firms face constant marginal costs of production, an assumption that renders the profitability of domestic and export sales at the firm level independent from each other. In other words, standard trade models are inconsistent with the intuitive notion that a slump in domestic demand – holding constant factor costs – might lead some firms to attempt to recoup part of their lost domestic revenue in foreign markets.

In this paper, we leverage the characteristics and severity of the Great Recession in Spain to study the empirical relevance of the "vent-for-surplus" mechanism. We use Spanish firm-level data on domestic sales and exports from 2002 to 2013, a period that covers the years of sustained economic growth, 2002-2008, as well as the Great Recession years, 2009-2013. We exploit geographic variation in the reduction in domestic demand caused by the financial crisis to document the existence of a robust, within-firm negative causal relationship between domestic sales and export flows. More specifically, firms whose domestic sales were reduced by more during the crisis period (relative to the expansionary period) experienced a larger increase in their export flows.

We begin our analysis in Section 2 by describing a baseline model of firm behavior in the spirit of Melitz (2003). This theoretical framework formalizes the independence between domestic sales and export sales built into models that assume firms face constant marginal costs. More importantly, it serves the role of identifying several empirical challenges that one encounters when empirically testing this independence assumption. In Section 4, we address these challenges and employ yearly data to asses the relationship between domestic sales and export volumes. Using Spanish firm-level data for the period 2000-13, we find robust evidence of a negative effect of demand-driven increases in firm-level domestic sales on the probability that a Spanish firm exports in a given year, and on the volume of exports conditional on exporting. Both the intensive and extensive margin elasticities are around 0.25: more precisely, a 10 percent decrease in domestic sales is, after controlling for possible supply determinants of this reduction, associated with a 2.65 percent increase in exports (by continuing exporters) and a 2.45 percent increase in the probability of exporting. These results do not appear to be driven by specific sectors. In all but one of 22 broadly defined manufacturing sectors, we find that a demand-driven reduction in domestic sales is associated with an increase in exports, with the sectoral elasticities being all in the neighborhood of the aggregate one.

We also explore variation in the impact of domestic demand shocks on exports across firms of different size and across time periods. Our results suggest that the extensive margin response of exporting to variation in domestic sales is concentrated in small firms: the probability of exporting of large firms is unaffected, while the effect for medium firms is negative but quantitatively very

[2] "When the produce of any particular branch of industry exceeds what the demand of the country requires, the surplus must be sent abroad, and exchanged for something for which there is a demand at home." (Adam Smith, *The Wealth of Nations*, 1776, Book II, Chapter V). The "vent-for-surplus" hypothesis was later popularized by Williams (1929) and Mynt (1958).

small. Conversely, the intensive margin response is active for all types of firms, and is slightly larger for larger firms. The intensive margin elasticity to domestic sales is slightly larger in the bust period (2009-13) than in the boom period (2000-08), but the extensive margin response is larger during the boom period.

Although our results in Section 4 lead us to reject the null hypothesis of independence between export decisions and domestic demand shocks, our theoretical framework in section 2 flags various sources of potential bias related to the possibility that, even after controlling for observed determinants of a firm's production costs, variation in domestic sales does not exclusively reflect variation in domestic demand. More specifically, and despite the fact that our empirical specifications include as controls firm and year fixed effects, as well as firm-specific trends and time-varying proxies for firms' labor costs and productivity levels, there may be firm- and time-specific export supply or demand shocks that are not properly accounted for in our regressions. Supply shocks would naturally lead to a positive co-movement between domestic and export sales. Firm export-demand shocks would not affect our estimates if uncorrelated with their domestic-demand shocks, and would also lead to a positive correlation between domestic and export sales in the plausible case in which firm-level demand shocks are positive correlated across domestic and foreign markets. For these reasons, it seems plausible that our results in Section 4 underestimate the extent to which reductions in domestic demand generate expansions in export markets. Nevertheless, the presence of potential biases lead us to treat our point estimates in Section 4 with caution.

Motivated by these caveats, in Section 5 we turn to an alternative empirical approach to assess the causal impact of a slump in domestic demand on the extensive and intensive margin of exporting. Our strategy builds on exploiting plausibly exogenous variation in the extent to which different firms in Spain were affected by a very large demand shock, namely the financial crisis of 2008-9 and the subsequent Great Recession. We proceed in three steps.

First, we divide our sample into a "boom" period (2000-08) and a "bust" period (2009-13), and assess the extent to which a decline in the domestic sales in the bust period relative to the boom period is associated with an increase in export sales (and the probability of exporting) in the bust period (again relative to the boom period). When following this difference-in-difference strategy, our OLS results are similar to those obtained in Section 4 using yearly data, though our point estimates for the elasticity of exports to domestic sales are slightly lower (0.14 rather than 0.26).

Second, we exploit the fact that the financial crisis and the Great Recession affected different geographical areas in Spain differentially to construct a measure of the change in aggregate demand experienced by different regions in Spain. More specifically, we rely on detailed yearly zip code-level data on the stock of vehicles per capita to construct a zip code-level proxy of the extent to which the Great Recession affected local demand. Armed with measure of changes in local demand, we use it as an instrument capturing plausibly exogenous variation in the reduction in the domestic sales of firms located in different parts of Spain. Our identification strategy is based on three main pillars, namely (i) that changes in vehicles purchases are a useful proxy for changes in 'local demand' (i.e., the overall propensity to consume) in a municipality in the years around the Great Recession, (ii) that changes in ‘local demand’ is a good predictor of the changes in domestic sales of Spanish firms producing in a given locality, and (iii) that changes in local car purchases are not correlated with unobserved covariates that have an independent effect on the exporting decisions of Spanish firms.

Although we cannot test hypotheses (i) and (ii) directly, we do find that the change in the zip code-level stock of vehicles between 2000-08 and 2009-13 has significant predictive power for the domestic (i.e., Spain-wide) sales of firms producing in that municipality.[3]

It is important to remark that, as different geographic areas of Spain were affected by the Great Recession in very heterogeneous degrees, the “vent-for-surplus” mechanism could have operated in such a way that those firms located in areas where local aggregate demand decreased more could have redirected their sales exclusively towards those regions in Spain in which local demand decreased less (or increased) during the Great Recession. If this had been the case, changes in local demand would have had no predictive power for changes in firms’ aggregate Spain-wide sales. However, the important impact that the change in the zip code-level stock of vehicles between 2000-08 and 2009-13 had on domestic sales reveals that the “vent-for-surplus” mechanism, if present, did not operate exclusively across local markets within national borders. Furthermore, if the “vent-for-surplus” mechanism had been important for determining the observed changes in the destination of firms’ sales during the Great Recession, changes in local demand should have had a larger impact on Spain-wide sales in those firms that were more likely to substitute sales in the local market for sales in foreign markets. We present evidence consistent with this hypothesis: a reduction in the zip code-level stock of vehicles was associated with a larger reduction in Spain-wide sales for those firms whose propensity to export (as measured by their export share in the pre-crisis period) was larger.

Armed with these different first stage regressions, we then show that a larger *predicted* drop in domestic sales in the bust period relative to the boom period is associated with significantly higher export sales (conditional on exporting) during the domestic slump (relative to the boom years). Furthermore, consistent with the biases in our OLS results anticipated above, these IV estimates are significantly larger (in absolute values) and point at elasticities in the neighborhood of 1.

A potential challenge to our identification approach is that the geographical variation in our instrument might be correlated with geographical variation in the extent to which wages (and, more broadly, production costs) fell in the bust period relative to the boom period. In our empirical specification, however, we control throughout for firm-level measures of productivity and wage costs, so a threat to identification would have to invoke a spatial correlation between the severity of the reduction in purchases of new vehicles by zip code and the extent to which unobserved production costs fell during the bust period. This correlation could have been quite strong for those zip codes that concentrate a significant share of firms operating in the auto industry. However, our results show that both the relevance of our instrument as well as the resulting estimates of the elasticity between domestic sales and exports are robust to excluding from the estimate sample: (a) all firms

[3]This result is consistent with Hillberry and Hummels (2008), who indicate that U.S. shipments are extremely localized, with firms’ shipments within the 5-digit zip code where they are located being three times as large as shipments outside the zip code.

in the auto industry, no matter where they are located; (b) all firms located in any zip code in which at list one firm in the auto industry is located; (c) all firms located in any zip code that is geographically close to a zip code that hosts a significant share of all Spanish firms in the auto industry.[4]

Our paper connects with several branches of the literature. As mentioned above, we relate the Spanish export miracle to Adam Smith's vent-for-surplus theory. The international trade literature has largely ignored this hypothesis as exemplified by the fact that we have only found one mention (in Fisher and Kakkar, 2004) of the term "vent-for-surplus" in all issues of the *Journal of International Economics*. Nevertheless, there has been an active recent international trade literature which has relaxed the assumption of constant marginal costs in the canonical (Melitz) model of firm-level trade, and has shown that, in the presence of increasing marginal costs, there is a natural substitutability between domestic sales and exports for which there is supporting empirical evidence. This literature includes the work of Vannoorenberghe (2012), Blum et al. (2013), Soderbery (2014), and Ahn and McQuoid (forthcoming).[5] The results in those papers very much resonate with the OLS results we obtain in Section 4. Relative to this prior literature, our paper provides a more explicit discussion of the endogeneity concerns associated with simple OLS reduced-form regressions. More importantly, our paper also attempts to identify the causal effect of a domestic slump on exporting by exploiting plausibly exogenous variation in domestic sales during a particularly salient episode.

2 A Benchmark Model with Constant Marginal Costs

Let's index all firms producing in Spain in a given 2-digit manufacturing sector by $i = 1, \ldots, I$, markets in which they sell by $j = \{d, x\}$, and time periods by $t = 1, \ldots, T$. Each firm i faces the following isoelastic demand in j at period t,

$$Q_{ijt} = \frac{P_{ijt}^{-\sigma}}{P_{jt}^{1-\sigma}} E_{jt} \xi_{ijt}^{\sigma-1}, \qquad \sigma > 1,$$

where Q_{ijt} denotes the number of units of output of firm i demanded in market j at period t if it sets a price P_{ijt}, P_{jt} is the price index, E_{jt} is the total expenditure in market j expressed in units of the numeraire; and ξ_{ijt} is a firm-market-year specific demand shifter.

Firm i's total cost of producing Q_{ijt} for each market j is

$$c_{ijt} Q_{ijt} \qquad \text{with} \qquad c_{ijt} \equiv \tau_{jt} \frac{1}{\varphi_{it}} \omega_{it},$$

[4] Our results are also robust to using province-level (instead of zip code-level) changes in the stock of vehicles per capita as a proxy for changes in local demand. While there are over 11,000 zip codes in Spain, there are only 52 provinces. Provinces are therefore significantly larger than exports.

[5] See also Krugman (1984) for a framework exploring the interaction between domestic sales and exports but in a model with *decreasing* marginal cost, in which import protection is shown to potentially serve as export promotion. Morales et al. (2017), and Antràs et al. (2017) are other recent contributions emphasizing interdependencies in the margins of exporting and importing, respectively.

where c_{ijt} denotes the marginal cost to firm i of selling one unit of output in market j, τ_{jt} denotes an iceberg trade cost, φ_{it} is a measure of firm-specific productivity (possibly changing over time), and ω_{it} is the cost of a bundle of inputs. Additionally, we assume that firm i needs to pay an exogenous fixed cost F_{ijt} to sell a positive amount in market j at t.

Firm i chooses optimally the quantity offered in each market j, Q_{ijt}, taking the price index, P_{jt}, and the size of the market, E_{jt}, as given. As the marginal production cost is constant and the per-market fixed export cost are independent of firms' export participation in other markets, the optimization problem of the firms is separable across markets. Specifically, conditional on exporting to a market j at period t, firm i solves the following optimization problem

$$\max_{\{Q_{ijt}\}} \left\{ Q_{ijt}^{\frac{\sigma-1}{\sigma}} P_{jt}^{\frac{1-\sigma}{\sigma}} E_{jt}^{\frac{1}{\sigma}} \xi_{ijt}^{\frac{\sigma-1}{\sigma}} - \tau_{jt} \frac{1}{\varphi_{it}} \omega_{it} Q_{ijt} \right\}.$$

This delivers sales by firm i to market j at period t as

$$R_{ijt} = P_{ijt} Q_{ijt} = \left(\frac{\sigma - 1}{\sigma} \frac{\xi_{ijt} \varphi_{it}}{\tau_{jt} \omega_{it}} \right)^{\sigma-1} \frac{E_{jt}}{P_{jt}^{1-\sigma}}.$$

For the case of exports ($j = x$), and taking logs, we can rewrite this expression as:

$$r_{ixt} = \kappa + (\sigma - 1) \left[\ln \xi_{ixt} + \ln \varphi_{it} - \ln \omega_{it} \right] - (\sigma - 1) \ln \left(\tau_{xt} - P_{xt} \right) + \ln E_{xt}, \tag{1}$$

where κ is a constant. In order to transition into an estimating equation, we model the demand, productivity and cost levels as:

$$\begin{aligned}
\ln(\xi_{ixt}) &= \xi_{ix} + \xi_{xt} + \tilde{\xi}_{ix} \times t + u_{ixt}^{\xi}, \\
\ln(\varphi_{it}) &= \varphi_i + \varphi_t + \tilde{\varphi}_i \times t + \ln(\varphi_{it}^*) + u_{it}^{\varphi}, \\
\ln(\omega_{it}) &= \omega_i + \omega_t + \tilde{\omega}_i \times t + \ln(\omega_{it}^*) + u_{it}^{\omega}.
\end{aligned}$$

Note that we are decomposing these into a time-invariant firm fixed effect, a firm-invariant year fixed effect, a firm-specific linear trend, and any observable part of these shocks in the case of productivity (φ_{it}^*) and input bundle costs (ω_{it}^*). Given these decompositions, we can re-write equation (1) as:

$$r_{ixt} = \kappa + \gamma_{ix} + \gamma_{xt} + \tilde{\gamma}_{ix} \times t + (\sigma - 1) \ln(\varphi_{it}^*) - (\sigma - 1) \ln(\omega_{it}^*) + \varepsilon_{ixt}, \tag{2}$$

where $\gamma_{ix} \equiv (\sigma - 1) \left[\xi_{ix} + \varphi_i - \omega_i \right]$, $\gamma_{xt} \equiv (\sigma - 1) \left[\xi_{xt} + \varphi_t - \omega_t \right] - (\sigma - 1) \ln \left(\tau_{xt} - P_{xt} \right) + \ln E_{xt}$, $\tilde{\gamma}_{ix} \equiv (\sigma - 1) \left[\tilde{\xi}_{ix} + \tilde{\varphi}_i - \tilde{\omega}_i \right]$, and

$$\varepsilon_{ixt} = (\sigma - 1) \left[u_{ixt}^{\xi} + u_{it}^{\varphi} - u_{it}^{\omega} \right]. \tag{3}$$

Now consider the expression for revenues in the local market. Following the exact same steps, we can derive

$$r_{idt} = \kappa + \gamma_{id} + \gamma_{dt} + \tilde{\gamma}_{id} \times t + (\sigma - 1)\ln(\varphi^*_{it}) - (\sigma - 1)\ln(\omega^*_{it}) + \varepsilon_{idt}, \tag{4}$$

where $\gamma_{id} \equiv (\sigma - 1)\left[\xi_{id} + \varphi_i - \omega_i\right]$, $\gamma_{dt} \equiv (\sigma - 1)\left[\xi_{dt} + \varphi_t - \omega_t\right] - (\sigma - 1)\ln\left(\tau_{dt} - P_{dt}\right) + \ln E_{dt}$, $\tilde{\gamma}_{id} \equiv (\sigma - 1)\left[\tilde{\xi}_{id} + \tilde{\varphi}_i - \tilde{\omega}_i\right]$, and

$$\varepsilon_{idt} = (\sigma - 1)\left[u^{\xi}_{idt} + u^{\varphi}_{it} - u^{\omega}_{it}\right]. \tag{5}$$

We use equations (2) to (5) to generate predictions for the asymptotic properties of different estimators. Specifically, these equations indicate that, under some orthogonality conditions, OLS estimators of certain regression coefficients should converge to zero. Using the data described in Section 3.1, we test whether we can reject the null hypothesis that these regression coefficients are zero.

Consider estimating the parameters of the following regression using OLS, which includes domestic sales in the above econometric specification for export revenue with the various fixed effects denoted with d's:

$$r_{ixt} = \kappa + d_i + d_t + \tilde{d}_i \times t + (\sigma - 1)\ln(\varphi^*_{it}) - (\sigma - 1)\ln(\omega^*_{it}) + \beta r_{idt} + \varepsilon_{ixt}. \tag{6}$$

From equations (3) and (6), the probability limit of the OLS estimator of β is

$$\begin{aligned} plim(\hat{\beta}_{OLS}) &= \frac{(\sigma - 1)\, cov(u^{\xi}_{ixt} + u^{\varphi}_{i} + u^{\varphi}_{it} - u^{\omega}_{it}, r_{idt} | d_i, d_t, \tilde{d}_i \times t, \varphi^*_{it}, \omega^*_{it})}{var(r_{idt} | d_i, d_t, \tilde{d}_i \times t, \varphi^*_{it}, \omega^*_{it})}, \\ &= \frac{(\sigma - 1)^2\, cov(u^{\xi}_{ixt} + u^{\varphi}_{it} - u^{\omega}_{it}, u^{\xi}_{idt} + u^{\varphi}_{it} - u^{\omega}_{it} | d_i, d_t, \tilde{d}_i \times t, \varphi^*_{it}, \omega^*_{it})}{var(r_{idt} | d_i, d_t, \tilde{d}_i \times t, \varphi^*_{it}, \omega^*_{it})}. \end{aligned} \tag{7}$$

We draw two main conclusions from equation (7). First, as long as productivity and production factor costs are not perfectly observable or captured by the firm and year fixed effects, and firm-specific trends, there will be a spurious positive correlation between exports and domestic sales that, in large samples, would lead one to estimate a positive value of $\hat{\beta}_{OLS}$ even when export and domestic decisions are really independent due to constant marginal costs. Second, even when one proxies for productivity and factor costs perfectly, in the presence of a non-zero correlation in the residual (partialling out fixed effects) demand faced by firms in domestic and foreign markets, the OLS estimator of β will also converge to a non-zero value. Because this residual variation in demand does not capture market-specific macro shocks (which are controlled for through the year-fixed effect d_t), it seems particularly plausible that u^{ξ}_{ixt} and u^{ξ}_{idt} will be positively correlated, leading one again to estimate a positive value of $\hat{\beta}_{OLS}$.

Notice that if we had not controlled for the various fixed effects, the probability limit of the OLS estimator of β would be even larger. To give an example, in the absence of firm fixed effects, the estimator $\hat{\beta}_{OLS}$ would be affected by the fact that firms' productive efficiency and factor costs would no longer be controlled for in the regression in equation (6) and, consequently, would operate as an additional source of correlation between the error term in this regression and the firm's domestic sales, r_{idt}. More formally, the probability limit of $\hat{\beta}_{OLS}$ in the absence of firm fixed effects is:

$$plim(\hat{\beta}_{OLS}) = \frac{(\sigma-1)^2\, cov(u^{\xi}_{ixt} + \xi_{ix} + \varphi_i - \omega_i + u^{\varphi}_{it} - u^{\omega}_{it}, u^{\xi}_{idt} + \xi_{id} + \varphi_i - \omega_i + u^{\varphi}_{it} - u^{\omega}_{it} | d_t, \tilde{d}_i \times t, \varphi^*_{it}, \omega^*_{it})}{var(r_{idt} | d_t, \tilde{d}_i \times t, \varphi^*_{it}, \omega^*_{it})}.$$

Let us then imagine that, instead of using OLS to estimate β, we use an IV estimator for β. Let's further define the instrument for r_{idt} as z_{idt}. In this case, the probability limit of the of the IV estimator of β is

$$plim(\hat{\beta}_{IV}) = \frac{(\sigma-1)^2\, cov(u^{\xi}_{ixt} + u^{\varphi}_{it} - u^{\omega}_{it}, z_{idt} | d_i, d_t, \tilde{d}_i \times t, \varphi^*_{it}, \omega^*_{it})}{cov(r_{idt}, z_{idt} | d_i, d_t, \tilde{d}_i \times t, \varphi^*_{it}, \omega^*_{it})}.$$

The constant-marginal-cost model will then predict that $plim(\hat{\beta}_{IV}) = 0$ as long as the instrument z_{idt} verifies two conditions: (a) it is correlated with the domestic sales of firm i in period t, after controlling for firm and year fixed effects as well as a firm-specific time trend; (b) it is mean independent of the firm-year specific unobserved productivity, u^{φ}_{it}, factor costs, u^{ω}_{it}, and export demand shocks, u^{ξ}_{ixt}.

3 Data

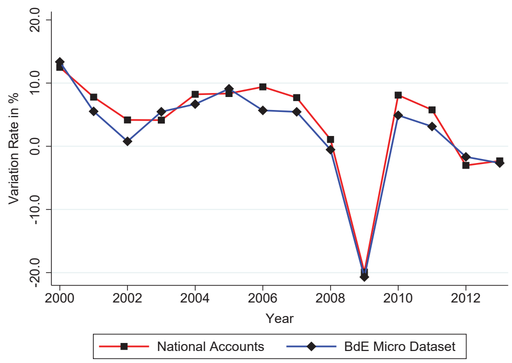
3.1 Data Sources

Our data covers the period 2002-2013 and comes from two separate administrative confidential data sources. The first is the Commercial Registry (*Registro Mercantil Central*). It contains the annual financial statements of around 85% of registered firms in the non-financial market economy in Spain. For each firm, among other variables, it includes information on: fiscal identifier; sector of activity (4-digit NACE Rev. 2 codes); 5-digit zip code location; annual net operating revenue; material expenditures (cost of all raw materials and services purchased by the firm in the production process); labor expenditures (total wage bill, including social security contributions); and total fixed assets.[6]

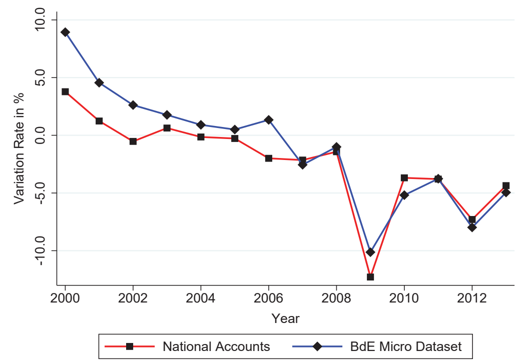
The second dataset is the foreign transactions registry collected by the Central Bank of Spain (*Banco de España*). For both imports and exports, it contains transaction-level information on: the fiscal identifier of the Spanish firm involved in the transaction; the type of transaction (export or import); the amount transacted; the product code (SITC Rev. 4); the country of the foreign client or provider; and the exact date of the operation (no matter when the payment was performed). For each firm, we aggregate this transaction-level data to obtain information on total export volume

[6]NACE (*Nomenclature générale des activités économiques dans les Communautés Européennes*) is the European statistical classification of economic activities. It classifies manufacturing firms into 24 different sub-sectors.

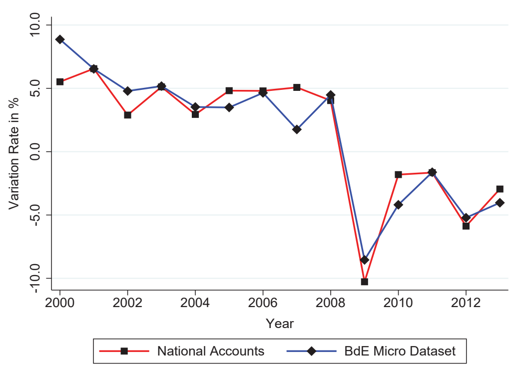
Figure 2: Output, Employment, Wage Bill and Export Dynamics



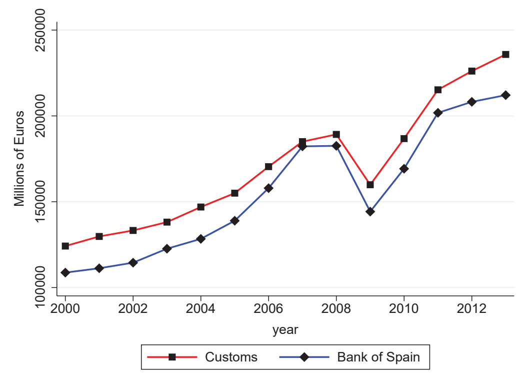
Panel (a): Output



Panel (b): Employment



Panel (a): Wage Bill



Panel (b): Exports

by firm and year. This database has an administrative nature because *Banco de España* legally requires financial institutions and external (large) operators to report this information for external transactions above a fixed monetary threshold. Until 2007, the minimum reporting threshold was fixed at 12,500 euros per transaction. Since 2008, information must be reported for all transactions performed by a firm during a natural year as long as at least one of these transactions exceeds 50,000 euros. In order to homogenize the sample, for the period 2002-2007, we only keep information from legal entities that have at least one transaction exceeding 50,000 euros.

In both datasets, a firm is defined as a business constituted in the form of a Corporation (*Sociedad Anónima*), a Limited Liability Company (*Sociedad Limitada*), or Cooperative. We merge both datasets using the fiscal identifier of each firm. Using the merged database, we define each firm's domestic sales as the difference between its total annual net operating revenue and its total export volume.

To confirm the validity of the information contained in these two data sources, we compare the coverage of our resulting dataset with the official publicly available aggregate data on output, employment and total wage bill (from National Accounts) and on goods exports (from Customs). Figure 2 shows that our dataset tracts nearly perfectly the aggregate evolution of output, employment, total payments to labor, and exports over time.

We complement the firm-level panel of manufacturers described above with yearly 5-digit zip code information on the total stock of vehicles per inhabitant. This information is provided by the Spanish Registry of Motor Vehicles (*Dirección General de Tráfico*).

4 Exports and Domestic Sales: Year-to-Year Variation

In this section, we explore the relationship between domestic sales and exports at the firm-year level. To do so, we present in Section 5.2 estimates from several variants of the regression described in equation (6). These specifications aim to measure the impact that changes in domestic sales have on export flows conditional on participating in foreign markets. In Section 4.2, we extend our analysis and explore the relationship between changes in domestic sales and the decision of whether to participate in export markets.

4.1 Intensive Margin

Table 1 presents OLS estimates from different specifications in which the volume of exports of a firm in a given year is regressed on its volume of domestic sales in the corresponding year and different sets of controls. As discussed in Section 2, when no firm-specific controls are included in the regression, we should expect to observe a positive relationship between a firm's domestic sales in a given year and its volume of exports. This positive relationship is observed in column 1 of Table 1, in which we estimate an elasticity of export flows to domestic sales of 0.668. In the remaining columns of Table 1, we aim to control for differences in marginal production costs across firms.

In column 2, we introduce firm fixed effects, controlling thus for differences in firm characteristics that are constant over time and that may impact their productivity, factor prices and demand shifters. The resulting estimated elasticity is very close to zero, -0.031, consistent with the predictions of the constant marginal cost model described in Section 2. Columns 2 and 3 additionally control for observed time-varying determinants of firms' marginal costs. Specifically, in column 2 we control for a measure of firm's productivity estimated following the procedure in Gandhi et al. (2016), and in column 3 we control for average wages, as reported by the firms in their financial statements. Consistently with the discussion in Section 2, controlling for these supply shocks reduces the positive bias affecting the OLS estimator of the coefficient on domestic sales in regression (6) and, consequently, the OLS estimates that we obtain become smaller. Columns 5 and 6 aim to additionally control for unobserved determinants of firms' marginal costs that are time varying. To do so, we additionally include as controls firm-specific time trends. The resulting estimates indicate that a 1% increase in a firm's domestic sales, keeping its productivity and average wages constant, implies a 0.25% reduction in its aggregate export flows.

The last two columns in Table 1 re-estimate the regression models in columns 2 and 6 using an specification in first-differences (instead of using firm-year fixed effects). The differences between the

Table 1: Intensive Margin

Dependent Variable:	Ln(Exports)						ΔLn(Exports)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln(Domestic Sales)	0.668***	-0.031**	-0.185***	-0.220***	-0.175***	-0.264***		
	(0.010)	(0.014)	(0.013)	(0.013)	(0.014)	(0.014)		
Ln(TFP)			0.970***	1.269***		0.992***		
			(0.032)	(0.037)		(0.045)		
Ln(Average Wages)				-0.651***		-0.477***		
				(0.033)		(0.036)		
ΔLn(Domestic Sales)							-0.181***	-0.282***
							(0.010)	(0.011)
ΔLn(TFP)								0.851***
								(0.035)
ΔLn(Average Wages)								-0.390***
								(0.026)
Observations	70,033	70,033	70,033	70,033	70,033	70,033	70,033	70,033
R-squared	0.313	0.863	0.871	0.874	0.932	0.935	0.012	0.230
Firm FE	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-specific trends	No	No	No	No	Yes	Yes	No	No

Note: Standard errors clustered by firm in parentheses. Exports, domestic sales and average wages are in constant 2011 euros. For any variable X, $\Delta\text{Ln}(X)$ is the difference in $\text{Ln}(X)$ between two consecutive years. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

coefficients on the domestic sales covariates in columns 2 and 7 (higher in the specification in levels than in that in first differences) reflect the fact that, while some of the unobserved covariates in these two specifications (i.e. firms' time-varying productivity and average wages) are strongly serially correlated and share common underlying trends with the corresponding firm's domestic sales, their year-to-year variation is less correlated with the yearly changes in domestic sales. Consistently with this interpretation, once we control for these serially correlated determinants of firms' marginal costs, the coefficient on domestic sales in the fixed effects specification (column 6) becomes very similar to that in the first-differences specification (column 8). Given that the specifications in columns 6 and 8 yield very similar estimates, but the latter is computationally easier to estimate, we focus on the specification in first differences in the remaining tables presented in this section.

Columns 2 to 4 in Table 2 explores the extent to which the negative elasticity between domestic sales and export flows reported in Table 1 is heterogeneous across firms depending on their size. Specifically, we estimate different elasticities for firms with less than 10 employees (small), firms between 10 and 50 employees (medium), and firms with more than 50 employees (large). We classify firms using their average number of employees during the years they are active. While the first group includes the smallest 25% of exporting firms in our sample, the third one includes the largest 25% of exporting firms. The remaining 50% firms are classified as medium-sized firms. The results indicate that there is indeed interesting heterogeneity across firms depending on their size: larger

Table 2: Intensive Margin - Heterogeneity by Firm Size and by Time Period

Dependent Variable:	ΔLn(Exports)					
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Small	Medium	Large	Boom	Bust
ΔLn(Domestic Sales)	-0.282***	-0.180***	-0.241***	-0.299***	-0.267***	-0.315***
	(0.011)	(0.047)	(0.022)	(0.013)	(0.014)	(0.018)
ΔLn(TFP)	0.851***	0.127	0.679***	0.926***	0.810***	0.835***
	(0.035)	(0.149)	(0.088)	(0.040)	(0.048)	(0.057)
ΔLn(Average Wages)	-0.390***	-0.042	-0.307***	-0.431***	-0.320***	-0.435***
	(0.026)	(0.112)	(0.060)	(0.030)	(0.032)	(0.047)
Observations	66,871	1,315	7,028	58,480	36,121	28,772
R-squared	0.230	0.380	0.280	0.230	0.346	0.227
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: Standard errors clustered by firm in parentheses. Domestic sales and average wages are in constant 2011 euros. For any variable X, $\Delta\text{Ln}(X)$ is the difference in $\text{Ln}(X)$ between two consecutive years. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

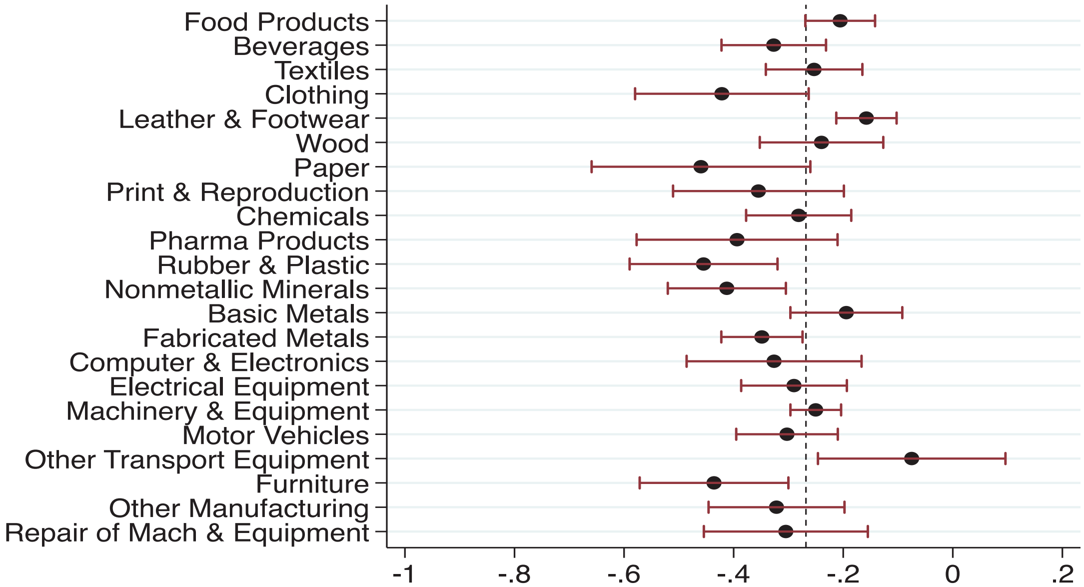
firms' exports react more on average to changes in their domestic sales than smaller firms' exports do.

Columns 5 and 6 in Table 2 explore whether the elasticity of exports to changes in domestic sales in the "boom" years (2002 to 2008) is different from that in the "bust" years (2009-2013). During the "boom" years most firms in the sample experienced a positive growth in their domestic sales, which turned negative during the "bust" years. Therefore, a comparison of the estimates in columns 5 and 6 allows us to study whether the transmission of local demand shocks into exports is different when these demand shocks are positive (generating an increase in domestic sales) and when they are negative (generating a reduction in domestic sales). While the "bust" estimate is slightly larger, the difference with the "boom" estimate does not seem large enough to be economically meaningful. Therefore, the negative substitutability between domestic sales and exports that tables 1 and 2 reveal seems to be symmetric and independent of whether firms experience a positive or negative demand shock in their domestic market.

Figure 3 complements this analysis by showing sector-specific estimates. The main conclusion is that the negative elasticity between domestic sales and exports document in tables 1 and 2 seems to be pervasive across nearly all manufacturing sectors, the only exception being the "other transport equipment sector", whose 95% confidence interval is large enough such that we cannot reject the null that, after controlling for firm-specific fixed effects and time trends, and observed measures of productivity and labor costs, domestic sales and exports, are independent. For all remaining sectors, the estimated elasticity of interest oscillates between -0.158 (manufacture of leather and related products) and -0.460 (manufacture of paper and paper products).

As discussed in the Introduction, despite the fact that the empirical specifications discussed

Figure 3: Intensive Margin - Heterogeneity by Sector



Note: The dotted vertical line reflects the average estimate reported in column 8 of Table 1. The black dots reflect the sector-specific point estimates; the red lines reflect the 95% confidence interval for each of the sectoral estimates.

in this section include as controls firm and year fixed effects, as well as firm-specific trends and time-varying proxies for firms' labor costs and productivity levels, there may still be unobserved export supply or demand shocks entering the error term in our specifications. Supply shocks would equally affect export flows and domestic sales and, consequently, would lead to a positive bias in our estimates of the elasticity of the former with respect to the latter. Export demand shocks would not bias our estimates as long as they are uncorrelated with domestic demand shocks, and would also lead to a positive bias in they likely case that firm-specific demand shocks are positively correlated across markets. Consequently, it is reasonable to expect that the OLS estimates presented in tables 1 and 2 and Figure 3 underestimate the extent to which reductions in domestic demand generate expansions in export markets.

4.2 Extensive Margin

Local demand shocks may generate not only a change in the export volume of those firms that participate in export markets but may also bring firms to either start exporting or to stop participating in foreign markets. We explore in this section the effect that changes in domestic sales have on the probability that a firm exports. To do so, we estimate three different types of binary choice models: static conditional logit models (columns 1 to 5 in Table 3), static linear probability models (columns 6 and 7), and a dynamic linear probability model (column 8).

The results for the impact of domestic sales on the extensive margin of exports are similar to those described above for its impact on the intensive margin. When we do not include any control

Table 3: Extensive Margin

Model:	Conditional Logit						Linear
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ln(Domestic Sales)	0.668***	0.160***	0.266***	-0.166***	-0.311***	-0.031***	-0.040***
	(0.013)	(0.018)	(0.019)	(0.023)	(0.025)	(0.001)	(0.001)
Ln(TFP)				1.549***	2.136***	0.067***	0.067***
				(0.049)	(0.061)	(0.003)	(0.003)
Ln(Average Wages)					-0.966***	-0.034***	-0.034***
					(0.048)	(0.002)	(0.002)
Lagged Participation							0.162***
							(0.002)
Observations	795,217	142,838	142,838	142,838	142,838	795,217	536,202
Firm FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Year FE	Yes	No	Yes	Yes	Yes	Yes	Yes
Firm-specific trends	No	No	No	No	No	Yes	No
Elasticities	0.584	0.014	0.012	-0.152	-0.311	-0.245	-0.317

Note: Columns 1 to 5 present Maximum Likelihood estimators of the corresponding conditional logit model. Column 2 to 5 specifically present estimates computed following the procedure in Chamberlain (1980). Columns 6 and 7 present OLS estimates of the corresponding linear probability models. Column 8 presents estimates computed following the procedure in Arellano and Bond (1991). The number of observations in columns 1, 6 and 7 correspond to the number of firm-years that we observe in our sample when taking into account all firms. The number of observations in columns 2 to 5 correspond to the number of firm-years that we observe in our sample when taking into account only those firms that change their export status at least once during the sample period. Standard errors in parentheses. Exports, domestic sales and average wages are in constant 2011 euros. For any variable X, $\Delta\text{Ln}(X)$ is the difference in $\text{Ln}(X)$ between two consecutive years. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

for firm specific marginal costs, we observe a positive correlation between a firm's domestic sales and its probability of exporting. As columns 2 and 3 in Table 3 illustrate, controlling either for firm fixed effects only or for firm and sector-year fixed effects reduces the coefficient on domestic sales in absolute value but preserves its positive sign. Only when we start to include observed controls for time-varying determinants of a firm's marginal cost, the elasticity of export participation with respect to domestic sales becomes negative. The most general conditional logit specification that we run accounts for firms' fixed effects, sector-year fixed effects, and firm-year specific measures of productivity and average wages (column 5); the resulting elasticity of the export probability with respect to domestic sales is -0.311.[7]

Contrary to the specifications discussed in Section 5.2, those discussed in columns 1 to 5 of Table 3 do not account for firm-specific linear time trends. Accounting for both firm fixed effects and firm-specific time trends in a conditional logit model would be problematic for two reasons.

[7] As indicated in the notes to Table 3, the parameters in columns 2 to 5 have been estimated following the procedure in Chamberlain (1980). This estimation procedure maximizes a conditional likelihood function that does not depend on the firm fixed effects and, consequently, does not yield estimates of these unobserved effects. However, given the nonlinear nature of the model, the elasticity of the export probability with respect to domestic sales does depend on these unobserved effects. For the exclusive purposes of computing the elasticities reported in the last row of Table 3, we have set all these unobserved effects equal to zero.

First, it would be computationally very challenging. Second, it would give rise to an incidental parameters problem (Chamberlain, 1980), resulting in inconsistent estimates of the elasticity of export participation with respect to domestic sales.[8] Consequently, to test the robustness of our estimates to account for firm-specific time trends, we resort to the linear probability model specification. The estimates in column 6 of Table 3 predict an elasticity of export participation with respect to domestic sales of -0.245, very similar to that predicted by the conditional logit model in column 5.

As shown in Das et al. (2007) and Morales at al. (2017), the export decision of firms is dynamic, depending both on their prior export status as well as on their expectations of future potential profits that a firm may earn by entering export markets. While correctly accounting for firms' expectations of future export profits is beyond the scope of this paper (see Dickstein and Morales, 2017), accounting for the prior export status of each firm only requires additionally controlling for a dummy that captures each firm's one-year lagged in export participation (see Roberts and Tybout, 1997). We introduce this control in column 7 of Table 3: the resulting estimate of the export participation elasticity with respect to domestic sales is -0.317, very similar to those obtained in columns 5 and 6.

5 Exploiting a Proxy for Local Aggregate Demand

The consistency of the estimators discussed in Section 4 strongly depends on the assumption that, after controlling for firm and year fixed effects, as well as firm-specific trends and time-varying proxies for firms' labor costs and productivity levels, any remaining determinant of the firm's decision to export or of the firm's potential export revenues conditional on exporting is mean independent of its domestic sales. In this section, we aim to relax this identification assumption by exploiting the spatial variation in changes in local aggregate demand for manufacturing goods that Spain experienced in the years around the Great Recession.

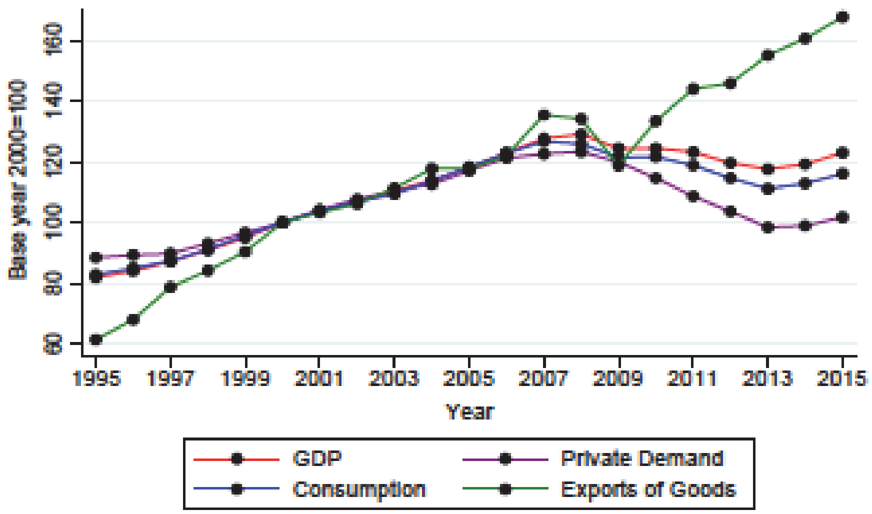
5.1 The Great Recession in Spain: Description

Between the year 2000 and the peak of the cycle in 2008, Spain's GDP, private demand, and consumption grew approximately 30% in real terms. In the five subsequent years, private demand decreased to the level of the year 2000, private final consumption contracted by 14% and real GDP fell by an accumulated 9.2% (see Figure 4). The evolution of Spain's aggregate exports during the crisis year was significantly different. After a significant 19.2% drop during the global trade collapse of late 2008 and early 2009, in the period 2010 to 2013, aggregate exports grew at an even faster rate than during the boom years. Specifically, while exports had grown a cumulated 35% in the 8-year period 2000-2008, they grew an additional cumulated 33% in the four years between 2009

[8] Charbonneau (2017) introduces a new estimator that allows to consistently estimate binary logit models in the presence of an individual-specific fixed effect and a choice-specific fixed effect. This estimator does not apply to our context, in which both sets of unobserved effects are firm-specific.

and 2013. This acceleration in export growth thus happened at the same time as all indicators of domestic demand were showing a clear and significant drop. As a consequence, the fall in real GDP was significantly smaller than the fall in domestic demand.

Figure 4: The Great Recession in Spain



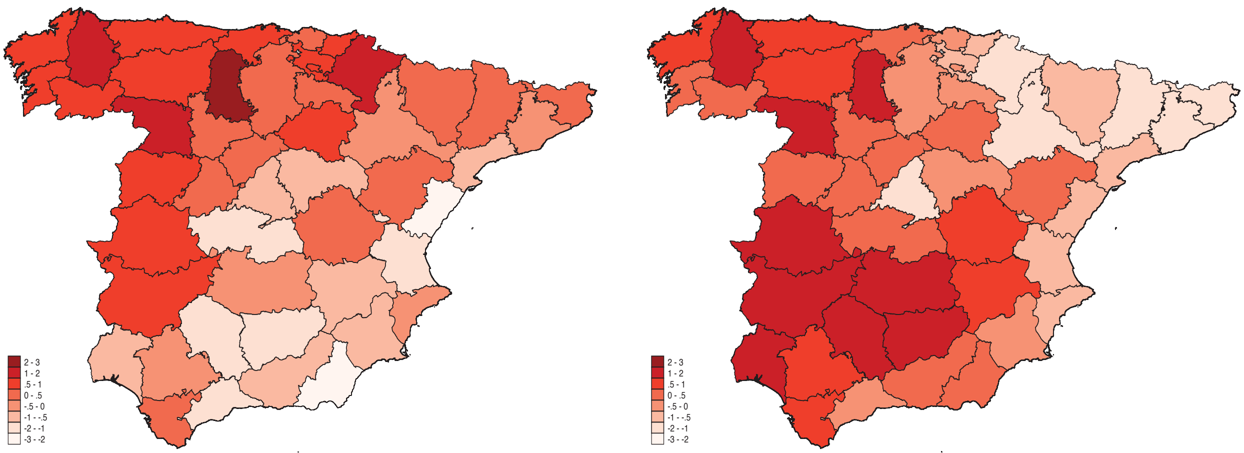
One possible explanation of the good performance of Spanish exports during the period 2009-2013 could be related to exchange rate movements. However, as Figure 1 in the Introduction shows, Spain's GDP drop faster than it did for the remaining 11 countries that have belonged to the Euro area for all the period 2000 to 2013 and, at the same time, its exports towards all remaining countries in the world did comparatively better. Specifically, while Spain's share of the Euro area GDP dropped from approximately 12% in 2008 to approximately 10.5% in 2013, it's export share towards non-Euro countries increased from 6.25% to 7.15%.

One specific characteristic of the Great Recession in Spain is that it affected different regions very differently. Panel (a) in Figure 5 indicates the standardized percentage change in domestic sales for the average firm located in each of the 52 Spanish provinces and operating in at least one year of the boom period (2000-2008) and at least one year during the bust (2009-2013).[9] The regions where the average firm experienced a reduction in domestic sales smaller than the average are in darker color, while those provinces where the average firm experienced a larger reduction in domestic sales are in lighter color. Specifically, Figure 5 illustrates that firms located in the northern and western regions saw changes in domestic sales larger (less negative) than the average, while firms located in the center of the country and in southern and eastern regions experienced relatively large domestic sales reductions.

The heterogeneity in the changes in domestic sales that we document in panel (a) of Figure 5

[9]Figure A.2 in Appendix A.2 shows the average number of firms and number of exporters by province for the period 2000-2008. Economic activity in Spain is concentrated mostly in the coast (Galicia, Paś Vasco, Cataluña, Comunidad Valenciana, Murcia and Andalucía) and in the center (Madrid). Exporting firms are concentrated in the center (Madrid) and in the Mediterranean coast (Cataluña and Comunidad Valenciana).

Figure 5: The Great Recession in Spain: Variation Across Provinces



(a) Relative Change in Domestic Sales

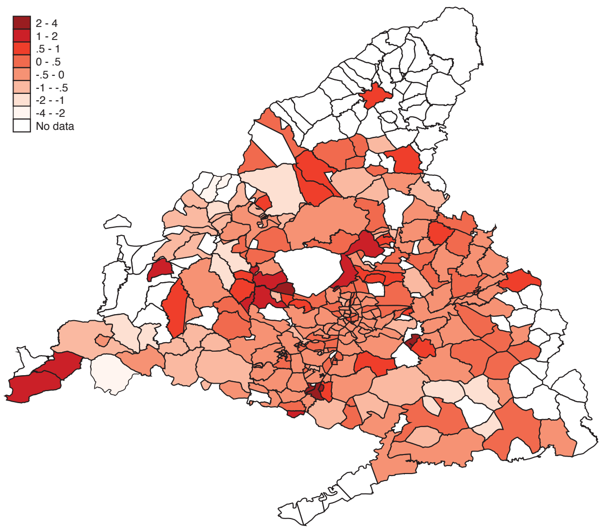
(b) Relative Change in Cars per Capita

Panel (a) illustrates the standardized percentage change in average firm-level domestic sales between the period 2000-2008 and the period 2009-2013. Therefore, if this variable takes any given value p for a given province, it means that the average firm located in this province experienced a relative change in average yearly domestic sales between 2000-2008 and 2009-2013 that was p standard deviations above the change experienced by a firm located in the mean province. Panel (b) illustrates the standardized percentage change in cars per capita between the period 2000-2008 and the period 2009-2013. Therefore, if this variable takes any given value p for a given province, it means that this province experienced a relative change in vehicles per capita between 2000-2008 and 2009-2013 that was p standard deviations above the change experienced by the mean province.

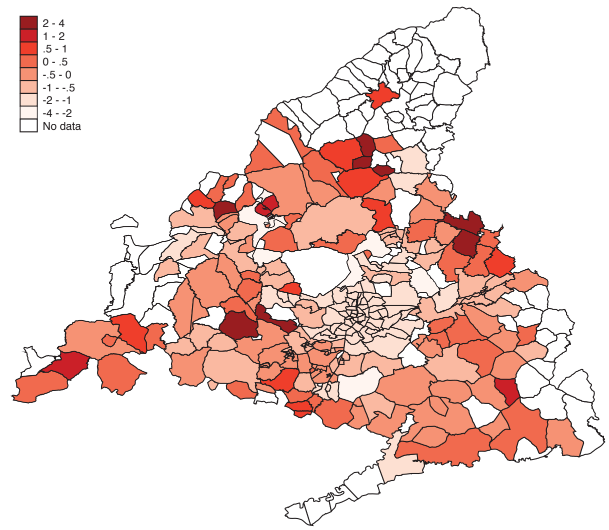
could have been caused by heterogeneity in supply factors or by heterogeneity in factors affecting local demand for manufacturing goods. In the following section, we will explore variation in local demand for manufacturing goods to estimate the substitutability between firm-level domestic sales and export flows. To do so, we will proxy changes in local demand for manufacturing goods using observed changes in demand per capita for one particular type of manufacturing products: vehicles. Changes in the number of vehicles per capita between the boom and the bust years could have been due either to purchases of new vehicles or scrapping of old ones. Panel (b) in Figure 5 shows that there is substantial variation in the degree to which the number of vehicles per capita changed across provinces between the boom and the bust years. Specifically, the provinces in the Northwest and in the Southwest experienced a relative increase in the number of vehicles per capita, while the region of Madrid and the provinces in the Northeast and along the Mediterranean cost experienced a relative reduction.

By illustrating within-province averages, the maps in Figure 5 hide substantial spatial variation at the sub-province level in both the boom-to-bust changes firm-level averages in domestic sales and in zipcode averages in the number of vehicles per capita. We illustrate this local variation in Figure 6 for the case of the two most populated provinces in Spain: Madrid and Barcelona. To facilitate the comparison of the within-province across-zip codes variation to the across-province variation illustrated in Figure 5, the average zip code changes illustrated in Figure 6 have been normalized using the Spain-wide mean and standard deviation of the corresponding variable. Panels (a) and

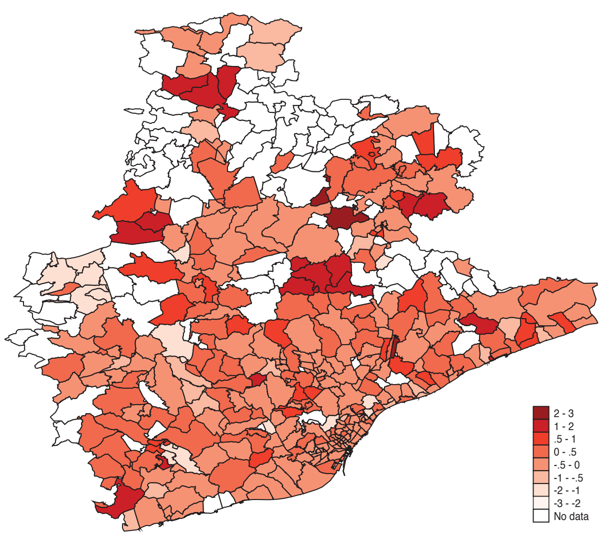
Figure 6: The Great Recession in Madrid and Barcelona: Variation Across Zip Codes



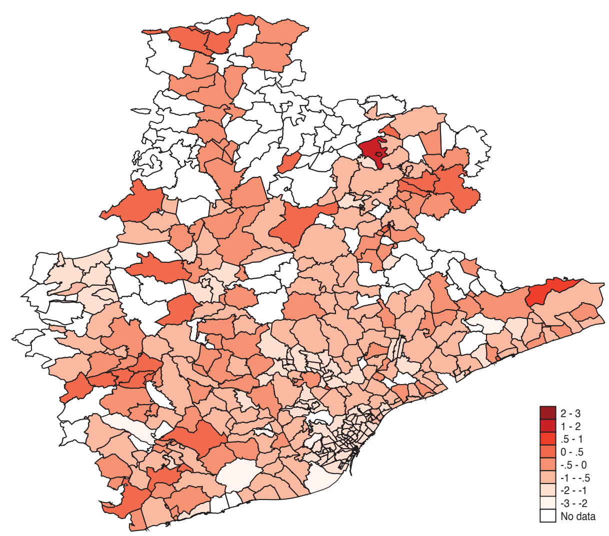
(a) Relative Change in Domestic Sales (Madrid)



(b) Relative Change in Cars per Capita (Madrid)



(c) Relative Change in Domestic Sales (Barcelona)



(d) Relative Change in Cars per Capita (Barcelona)

Panel (a) illustrates the standardized percentage change in average firm-level domestic sales between the period 2000-2008 and the period 2009-2013. Therefore, if this variable takes any given value p for a given zip code, it means that the average firm located in this zip code experienced a relative change in average yearly domestic sales between 2000-2008 and 2009-2013 that was p standard deviations above the change experienced by a firm located in the (Spain-wide) mean zip code. Panel (b) illustrates the standardized percentage change in cars per capita between the period 2000-2008 and the period 2009-2013. Therefore, if this variable takes any given value p for a given zip code, it means that this zip code experienced a relative change in vehicles per capita between 2000-2008 and 2009-2013 that was p standard deviations above the change experienced by the (Spain-wide) mean zip code. Zip codes that do not host any of the firms in our dataset appear in white, with the label "No data".

(b) reveal a large heterogeneity in changes both in domestic sales and vehicles per capita across zip codes in the region of Madrid: while the center area of the region that contains a large number of tightly packed zip codes (this area corresponds to the city of Madrid) experienced small (relative to the Spain-wide average) reductions in firm average domestic sales, surrounding zip codes experience changes in domestic sales that were more than two standard deviations above the national average. Similarly, while the zip codes belonging to the city of Madrid experienced a large reduction in the number of vehicles per capita (more than two standard deviations smaller than the Spain-wide average), other zip codes to the east, north and west of the city of Madrid saw increases in vehicles per capita significantly above the national average. Panels (c) and (d) provide analogous information for the region of Barcelona. Although the heterogeneity in the change in domestic sales and vehicles per capita across zip codes located in the province in Barcelona is smaller than that observed within the Madrid region, panel (c) still shows how certain zip codes experience growth rates smaller than the national average while others experienced changes in firm average domestic sales more than a standard deviation above that average.

5.2 Intensive Margin

In this section, we exploit the variation illustrated in figures 5 and 6 to identify the impact that a local demand shock has on a firm's exports through its effect on the firm's domestic (Spain-wide) sales. Specifically, we divide our sample into a "boom" period (2000-08) and a "bust" period (2009-13), and assess the extent to which a demand-driven decline in the domestic sales in the bust period relative to the boom period is associated with a relative increase in export sales in the bust period. With this aim, we will use observed "boom-to-bust" changes in the stock of vehicles per capita at the province or zip code level as a proxy for the changes in the aggregate demand for manufacturing goods that the corresponding geographical area experienced in the bust relative to the boom. Equipped with this proxy for local goods demand, we will use it to instrument for firm-level changes in domestic sales.

Our identification strategy is based on three main pillars, namely (i) that changes in vehicles purchases are a useful proxy for changes in 'local demand' (i.e., the overall propensity to consume) in a municipality in the years around the Great Recession, (ii) that changes in 'local demand' is a good predictor of the changes in domestic sales of Spanish firms producing in a given locality, and (iii) that changes in local car purchases are not correlated with unobserved supply shocks that have an independent effect on the exporting decisions of Spanish firms. While (i) and (ii) cannot be directly tested, we provide evidence below that "boom-to-bust" changes in the number of vehicles per capita in a zip code or province are correlated with the observed "boom-to-bust" average changes in the domestic (Spain-wide) sales of the firms located in the corresponding zip code or province. While requirement (iii) cannot be directly tested either, we try to address the endogeneity concern that would arise from it being violated in three different ways.

First, we control in our specifications for sector fixed effects and for firm-specific measures of productivity and labor costs. By controlling for sector fixed effects, we base our identification on observing how domestic sales and exports changed between the boom and the bust periods for different firms operating in the same sector but located in regions that experienced different changes in the stock of vehicles per capita. For example, these sector fixed effects control for shocks such as the expiration of the Multi Fiber Arrangement (MFA) on January 1 2005, which eliminated all European Union quotas for textiles imported from China and which had a large impact on both the domestic sales and exports of Spanish textile manufacturers. If sector fixed effects had not been included in our specifications and textile firms were to be on average located in Spanish regions that suffered larger negative local demand shocks, our estimates would confound the impact of the MFA expiration and the negative local shocks.

During the period 2009-2013, the unemployment rate increased and the average wage decreased significantly relative to the boom years. Furthermore, the local changes in unemployment rates and wages were very different across different regions, with average wages falling more in those provinces in which the drop in aggregate demand was more significant. By controlling for changes in wages at the firm level, we aim to identify the effect that changes in local demand had on firms' exports through channels other than the wage devaluation channel.

Second, in all regressions presented in this section, we exclude all firms operating in the auto industry (NACE Rev. 2 code 29). The evolution of the stock of vehicles in a location is naturally affected both by demand and by supply shocks. By excluding all firms in the auto industry from the estimation sample, we aim to identify the impact that changes in domestic sales (driven by changes in the stock of vehicles) have on export flows only for those firms whose unobserved supply shocks are less likely to directly impact the stock of vehicles available in a location.

Third, we show that the baseline results are robust to excluding all firms located in: (a) a zip code that hosts at least one firm in the auto industry; (b) in a zip code that concentrates the auto industry or in any zip code neighboring with it. Through local value chains, supply shocks affecting firms that are upstream or downstream from firms operating in the auto industry will affect these firms' marginal production costs and, consequently, be potentially correlated with the stock of vehicles per capita in a location. Under the assumption that downstream and upstream firms tend to be located geographically close to the firm from which they buy to whom they sell, by trimming the estimation sample in the ways described by (a) and (b), we aim to be left with a set of firms whose "boom-to-bust" changes in unobserved supply shocks are on average uncorrelated with the "boom-to-bust" changes in the stock of vehicles per capita of the zip code or province where they are located.

Table 4 presents OLS estimates of the elasticity of "boom-to-bust" changes in firms' export flows with respect to "boom-to-bust" changes in domestic sales. Similarly to Table 1, when no controls are included, we observe in column 1 that changes in domestic sales are positively correlated with changes in exports. This is consistent with firms' export supply shocks impacting similarly the firm's sales in every market. However, once we control for sector fixed effects and observable determinants of firms' marginal costs, the estimated elasticity of exports with respect to domestic sales approximates -1.5, an estimate similar in magnitude to those estimates reported in Table 1.

Table 4: Intensive Margin: Ordinary Least Squares Estimates

Dependent Variable:	ΔLn(Exports)			
	(1)	(2)	(3)	(4)
ΔLn(Domestic Sales)	0.160***	-0.102***	-0.169***	-0.143***
	(0.024)	(0.027)	(0.027)	(0.028)
ΔLn(TFP)		0.996***	1.185***	1.211***
		(0.048)	(0.050)	(0.051)
ΔLn(Avg. Wages)			-0.525***	-0.477***
			(0.050)	(0.054)
Observations	8,045	8,045	8,045	8,045
R-squared	0.003	0.213	0.270	0.301
Sector FE	No	No	No	Yes

Note: Robust standard errors in parenthesis. For any X, $\Delta \text{Ln}(X)$ is the difference in $\text{Ln}(X)$ between its average in the 2002-2008 period and its average in the 2009-2013 period. The estimation sample includes all firms selling in at least one year in the period 2002-2008 and in the period 2009-2013. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

Table 5 presents estimates from projecting the "boom-to-bust" changes in exports of each firm on the "boom-to-bust" changes in our measures of local demand for manufacturing goods. Independently of the controls included in the regression, all columns in table 5 indicate that firms' export flows increased more in those firms located in zip codes (for the case of columns 1 to 4) or provinces (for the case of columns 5 to 8) that experienced a larger decline in the stock of vehicles per capita. Interestingly, the coefficient on our measures of local demand increase (in absolute value) as we control for our proxy for firms' productivity and decrease (in absolute value) as we additionally control for our proxy of firms' labor costs. This reflects that, relative to the pre-crisis levels, firms located in those regions where the drop in local demand was more intense during the Great Recession years experienced a smaller decline in measured productivity and, after controlling for these changes in productivity, a larger decline in measured wages.

One feature of the estimates reported in Table 5 is that the elasticity of a firm's change in exports with respect to the change in the province-level stock of vehicles per capita (slightly smaller than -1) is larger in absolute value than the elasticity with respect to the change in the zip code-level stock of vehicles per capita (slightly larger than 0.3). A possible interpretation of these estimates consistent with the "vent-for-surplus" hypothesis relies the following pillars: (i) the Spain-wide market is perceived by firms not as a single market but as a collection of geographically distinct markets; (ii) in the face of a negative local demand shock, firms substitute sales across geographic markets, both within the larger Spain-wide market as well as towards foreign countries; (iii) a negative demand shock at the zip code level allows firms to substitute sales across zip codes within a province, while a negative shock at the province level forces firms to reallocate sales to other provinces or to the foreign market. Consequently, the substitution of sales towards foreign markets will be more prevalent the larger the geographic area affected by the negative local demand shock.

Table 5: Intensive Margin: Reduced-Form Specifications

Dependent Variable:	ΔLn(Exports)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔLn(Vehicles p.c.)	-0.544***	-0.444***	-0.455***	-0.278***				
(In Zip Code)	(0.113)	(0.106)	(0.103)	(0.101)				
ΔLn(Vehicles p.c.)					-1.733***	-1.055*	-1.121**	-1.116***
(In Province)					(0.571)	(0.528)	(0.514)	(0.368)
ΔLn(TFP)		0.915***	1.026***	1.084***		0.901***	1.015***	1.069***
		(0.044)	(0.046)	(0.049)		(0.036)	(0.039)	(0.042)
ΔLn(Avg. Wages)			-0.442***	-0.412***			-0.442***	-0.412***
			(0.050)	(0.056)			(0.065)	(0.049)
Observations	8,045	8,045	8,045	8,045	8,045	8,045	8,045	8,045
R-squared	0.004	0.085	0.096	0.136	0.005	0.083	0.094	0.133
Sector FE	No	No	No	Yes	No	No	No	Yes

Note: Standard errors clustered by zip code in columns 1 to 4 and by province in columns 5 to 8. For any X, $\Delta\text{Ln}(X)$ is the log difference between the average of X in 2002-2008 and its average in 2009-2013. *Vehicles p.c* denotes the stock of vehicles per capita. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

While the estimates in Table 5 are consistent with the hypothesis that firms located in regions that experienced larger declines in local demand for their products were forced to reduce their domestic sales and opted for "venting out" their products in the export market, it is only suggestive of this hypothesis in so far as it does not exploit any information on the extent to which firms experienced reductions in their domestic sales during in the bust years. We exploit this additional information and, consequently, perform a stronger test of the venting out hypothesis in Table 6.

In Table 6, we report two-stage least squares estimates of the elasticity of the firm's "boom-to-bust" change in exports with respect to its "boom-to-bust" change in domestic sales. Panel A uses changes in the stock of vehicles per capita at the zip code level, panel B uses changes at the province level, and panel C combines both instruments in a single specification. The first-stage estimates (reported in columns 1 to 4) reveal that firms' located in regions that experienced a larger drop in the stock of vehicles per capita also suffered a larger decline in their domestic (Spain-wide) sales. This relationship is robust to controlling for sector fixed effects and for our measures of firms' changes in productivity and labor costs: the statistic of an F test for the null hypothesis that changes in the stock of vehicles per capita in a region have no impact on the domestic sales of the firms located in that region is always above ten. The second stage estimates (reported in columns 5 to 8) indicate that, once we control for changes in our measure of the firm's productivity, the elasticity of exports with respect to domestic sales is between -1 and -1.5. This elasticity is significantly larger (in absolute value) than the OLS estimated elasticities reported in tables 1 and 4. This is consistent with the hypothesis, formalized in equation (7), that, even after controlling for sector fixed effects and firms' measured productivity and average labor costs, there still exists unobserved determinants of firms' marginal costs that induce a spurious positive correlation between their sales in the domestic and foreign markets.

Table 6: Intensive Margin: Two-Stage Least Squares Estimates

Panel A: Exploiting Variation in Demand Across Zip Codes

Dependent Variable:	ΔLn(Domestic Sales)				ΔLn(Exports)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔLn(Domestic Sales)					-2.083***	-1.270***	-1.355***	-1.041***
					(0.612)	(0.320)	(0.318)	(0.373)
ΔLn(Vehicles p.c.)	0.261***	0.349***	0.336***	0.267***				
(In Zip Code)	(0.059)	(0.055)	(0.055)	(0.055)				
ΔLn(TFP)		0.802***	0.939***	0.905***		1.933***	2.297***	2.026***
		(0.029)	(0.027)	(0.030)		(0.260)	(0.303)	(0.340)
ΔLn(Avg. Wages)			-0.544***	-0.473***			-1.179***	-0.905***
			(0.032)	(0.036)			(0.193)	(0.194)
F-statistic	19.63	40.72	37.82	23.82				

Panel B: Exploiting Variation in Demand Across Provinces

Dependent Variable:	ΔLn(Domestic Sales)				ΔLn(Exports)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔLn(Domestic Sales)					-4.236**	-1.032**	-1.186***	-1.408***
					(1.796)	(0.406)	(0.395)	(0.333)
ΔLn(Vehicles p.c.)	0.409**	1.022***	0.945***	0.793***				
(In Province)	(0.189)	(0.199)	(0.199)	(0.187)				
ΔLn(TFP)		0.815***	0.947***	0.911***		1.742***	2.138***	2.351***
		(0.028)	(0.022)	(0.019)		(0.322)	(0.368)	(0.302)
ΔLn(Avg. Wages)			-0.516***	-0.446***			-1.054***	-1.040***
			(0.051)	(0.054)			(0.237)	(0.193)
F-statistic	4.71	26.37	22.44	17.93				

Panel C: Exploiting Variation in Demand Across Zip Codes and Provinces

Dependent Variable:	ΔLn(Domestic Sales)				ΔLn(Exports)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔLn(Domestic Sales)					-2.210***	-1.135***	-1.259***	-1.193***
					(0.632)	(0.272)	(0.287)	(0.345)
ΔLn(Vehicles p.c.)	0.249***	0.248***	0.245***	0.191***				
(In Zip Code)	(0.066)	(0.058)	(0.057)	(0.057)				
ΔLn(Vehicles p.c.)	0.081	0.698***	0.626***	0.549***				
(In Province)	(0.187)	(0.163)	(0.158)	(0.161)				
ΔLn(TFP)		0.809***	0.944***	0.910***		1.825***	2.207***	2.163***
		(0.029)	(0.028)	(0.030)		(0.221)	(0.274)	(0.314)
ΔLn(Avg. Wages)			-0.543***	-0.473***			-1.127***	-0.977***
			(0.032)	(0.036)			(0.177)	(0.183)
F statistic	10.12	31.34	27.89	17.66				
Sargan-test p-value					0.04	0.41	0.55	0.48

Note: Standard errors clustered by zip code in panel A and by province in panels B and C. For any X, $\Delta\text{Ln}(X)$ is the log difference between the average of X in 2002-2008 and its average in 2009-2013. *Vehicles p.c* denotes the stock of vehicles per capita. Columns 1-4 contain first-stage estimates; columns 5-8 contain second-stage estimates. *F-statistic* denotes the corresponding statistic for the *Vehicles p.c* covariates. In all regressions, the number of observations is 8,045. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

While the sample used to compute the estimates presented in Table 6 excludes firms classified in the manufacturing of motor vehicles, trailers and semi-trailers sector, it does not exclude those firms operating in other sectors but that however operate as their suppliers. Therefore, while unlikely in the context of the Spanish Great Recession, it is conceivable that the reduction in the stock of vehicles per capita observed in the data partly reflects supply or marginal costs shocks affecting those firms located upstream from firms manufacturing motor vehicles. In order to evaluate the robustness of our estimates to this hypothesis, we would ideally like to additionally drop from our sample any firm that supplies a significant share of its production to a motor-vehicles manufacturer. We have however no information on the specific set of clients to which each firm in our sample sells. In order to overcome this data limitation, we impose the assumption that firms that have a producer of motor vehicles as an important client will tend to locate close to this client and, consequently, drop those firms that are located close to any firm belonging to the motor vehicles industry. Table 7 contains the resulting estimates. No matter whether we exclude from our sample all firms located in a zip code in which at least one motor-vehicles producer (panel A in Table 7), or all firms located in a zip code that ranks in the top 25% of zip codes by number of motor-vehicles producers located in it (panel B), or all firms located either in this last set of zip code or any other zip code sharing the first four digits with it (panel C), we obtain first-stage and second-stage estimates that are very similar to the baseline estimates reported in Table 6. Specifically, the first-stage estimates still show a significant correlation between the change in the stock of vehicles per capita and the change in firms' domestic sales, and the second-stage estimates are such that, at any generally used significance level, we cannot reject the null hypothesis that the elasticity of exports with respect to domestic sales is equal to any given number between -1 and -1.5.

The first-stage specifications in tables 6 and 7 do not allow for heterogeneity across firms in the elasticity of domestic (Spain wide) sales with respect to a negative local demand shock. However, under the "vent-for-surplus" hypothesis, one could conceive that, even if all firms were to sell an equal share of their total sales in the local (zip code or province) market, the impact of a local demand shock on their overall sales in Spain will depend on how likely these firms are to substitute sales from their own zip code or province to either other geographic markets within Spain or to export markets. Specifically, if all substitution happens within domestic markets, we should expect our estimates of the coefficient on our measure of local demand in the first-stage specifications in tables 6 and 7 to not be statistically different from zero. We test these implications of the "vent-for-surplus" hypothesis in Table 8.

In Table 8, we proxy the propensity of a firm to substitute sales from the zip code (in panel A) or province (in panel B) towards foreign markets by the export share of the firm in a pre-period year. Specifically, for the purpose of computing the estimates in Table 8, we use the observed export shares in the first year of our sample, the year 2000; the results are however robust to using instead export shares in any later year. The estimates in columns 1 to 4 of Table 8 show that the correlation between the "boom-to-bust" change in the local stock of vehicles per capita and overall sales in Spain is very different depending on the firm's initial export share. For those firms

Table 7: Intensive Margin: Robustness to Excluding Zip Codes Linked to Auto Industry

Panel A: Excluding Top 25% of Zip Codes by Number of Auto Firms								
Dependent Variable:	ΔLn(Domestic Sales)				ΔLn(Exports)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔLn(Domestic Sales)					-2.577***	-1.513***	-1.471***	-1.134***
					(0.892)	(0.397)	(0.364)	(0.409)
ΔLn(Vehicles p.c.)	0.263***	0.369***	0.376***	0.305***				
(In Zip Code)	(0.070)	(0.066)	(0.065)	(0.065)				
ΔLn(TFP)		0.787***	0.923***	0.891***		2.086***	2.360***	2.063***
		(0.032)	(0.030)	(0.033)		(0.318)	(0.343)	(0.369)
ΔLn(Avg. Wages)			-0.524***	-0.455***			-1.184***	-0.889***
			(0.034)	(0.038)			(0.216)	(0.209)
F-statistic	14.04	31.39	33.36	22.23				
Panel B: Excluding all Zip Codes Hosting At Least One Auto Firm								
Dependent Variable:	ΔLn(Domestic Sales)				ΔLn(Exports)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔLn(Domestic Sales)					-3.499**	-1.933***	-1.812***	-1.581**
					(1.507)	(0.561)	(0.504)	(0.642)
ΔLn(Vehicles p.c.)	0.242***	0.365***	0.382***	0.283***				
(In Zip Code)	(0.092)	(0.090)	(0.090)	(0.086)				
ΔLn(TFP)		0.805***	0.939***	0.909***		2.467***	2.724***	2.508***
		(0.039)	(0.037)	(0.041)		(0.454)	(0.475)	(0.581)
ΔLn(Avg. Wages)			-0.506***	-0.431***			-1.338***	-1.087***
			(0.041)	(0.044)			(0.285)	(0.304)
F-statistic	6.91	16.42	17.98	10.89				
Panel C: Excluding Top 25% of Zip Codes by Number of Auto Firms And All Neighboring Zip Codes								
Dependent Variable:	ΔLn(Domestic Sales)				ΔLn(Exports)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔLn(Domestic Sales)					-2.768***	-1.572***	-1.526***	-1.203**
					(1.024)	(0.449)	(0.411)	(0.485)
ΔLn(Vehicles p.c.)	0.250***	0.360***	0.367***	0.283***				
(In Zip Code)	(0.073)	(0.070)	(0.070)	(0.068)				
ΔLn(TFP)		0.792***	0.921***	0.885***		2.158***	2.422***	2.133***
		(0.032)	(0.031)	(0.034)		(0.360)	(0.385)	(0.433)
ΔLn(Avg. Wages)			-0.509***	-0.438***			-1.179***	-0.901***
			(0.035)	(0.039)			(0.234)	(0.234)
F statistic	11.67	26.40	27.83	17.31				

Note: Standard errors clustered by zip code. Exports, domestic sales and wages are in constant 2011 euros. For any X, $\Delta\text{Ln}(X)$ is the log difference between the average of X in 2002-2008 and its average in 2009-2013. *Vehicles p.c* denotes the stock of vehicles per capita. Columns 1 to 4 contain first-stage estimates; columns 5 to 8 contain the corresponding second-stage estimates. *F-statistic* denotes the corresponding statistic for the *Vehicles p.c* covariates. The number of observations is: 4,441 in panel A; 6,394 in panel B; and 5,885 in panel C. In panel C, any zip code that shares the first four digits with a particular zip code is defined as "neighboring" it. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

Table 8: Intensive Margin: Heterogeneity by Firms' Initial Export Share

Panel A: Exploiting Variation in Demand Across Zip Codes								
Dependent Variable:	ΔLn(Domestic Sales)				ΔLn(Exports)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔLn(Domestic Sales)					-1.512***	-1.285***	-1.303***	-1.178***
					(0.267)	(0.206)	(0.196)	(0.203)
ΔLn(Vehicles p.c.)	-0.057	-0.030	-0.053	-0.082				
	(0.071)	(0.064)	(0.062)	(0.063)				
ΔLn(Vehicles p.c.) × Export Share	1.893***	2.032***	2.049***	1.934***				
	(0.242)	(0.231)	(0.226)	(0.225)				
ΔLn(TFP)		0.804***	0.939***	0.900***		1.888***	2.197***	2.116***
		(0.030)	(0.027)	(0.030)		(0.175)	(0.195)	(0.195)
ΔLn(Avg. Wages)			-0.545***	-0.465***			-1.189***	-0.991***
			(0.033)	(0.038)			(0.141)	(0.137)
F-statistic	36.28	44.72	45.53	39.62				

Panel B: Exploiting Variation in Demand Across Provinces								
Dependent Variable:	ΔLn(Domestic Sales)				ΔLn(Exports)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔLn(Domestic Sales)					-1.377***	-1.082***	-1.162***	-1.210***
					(0.237)	(0.173)	(0.173)	(0.166)
ΔLn(Vehicles p.c.)	-0.294	0.133	0.018	-0.064				
	(0.212)	(0.186)	(0.174)	(0.170)				
ΔLn(Vehicles p.c.) × Export Share	5.153***	5.416***	5.353***	5.171***				
	(0.771)	(0.683)	(0.693)	(0.664)				
ΔLn(TFP)		0.824***	0.953***	0.912***		1.734***	2.073***	2.147***
		(0.037)	(0.026)	(0.024)		(0.145)	(0.172)	(0.158)
ΔLn(Avg. Wages)			-0.515***	-0.437***			-1.080***	-0.973***
			(0.056)	(0.059)			(0.175)	(0.157)
F-statistic	24.32	36.66	34.62	37.13				

Note: Standard errors clustered by zip code in panel A and by province in panel B. For any X, $\Delta\text{Ln}(X)$ is the log difference between the average of X in 2002-2008 and its average in 2009-2013. *Vehicles p.c* denotes the stock of vehicles per capita. *Export share* denotes the firm-specific ratio of exports to total sales in the year 2000. Columns 1 to 4 contain first-stage estimates; columns 5 to 8 contain the corresponding second-stage estimates. *F-statistic* denotes the corresponding statistic for the *Vehicles p.c* covariates. In all regressions, the number of observations is 6,809. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

that were not exporting in the year 2000, we cannot reject the null hypothesis that their overall domestic sales do not respond to local demand shocks. This would be consistent with these firms "venting out" towards other geographic markets within Spain. Conversely, for those firms that were participating in the export market already in the year 2000, the response of their domestic sales to our measured local demand shock is increasing in their initial export share.

Bringing in the export share information into our first-stage specification increases the strength of the instrument (the F statistic becomes now close to 40) and, consequently, increases the precision of our second-stage estimates of the elasticity of exports to domestic sales, which is now more tightly estimated around -1.2.

6 Conclusion

[PRELIMINARY]

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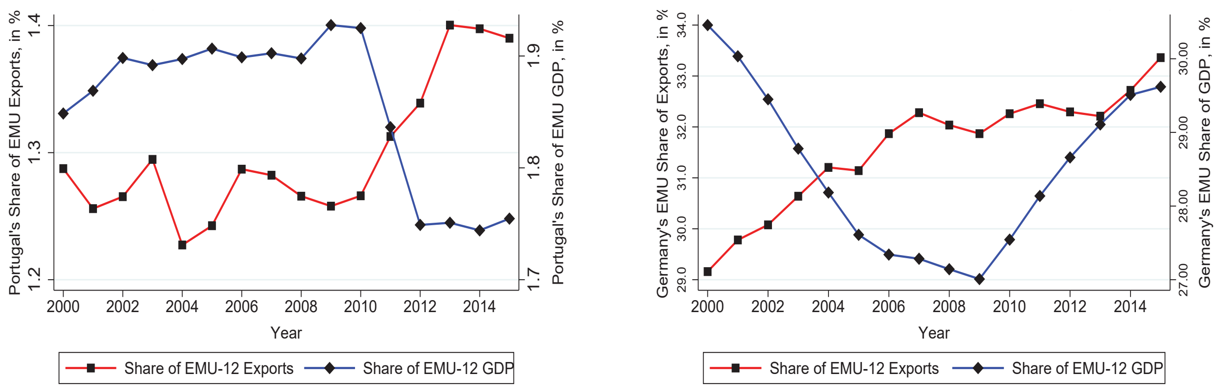
A Appendix Figures

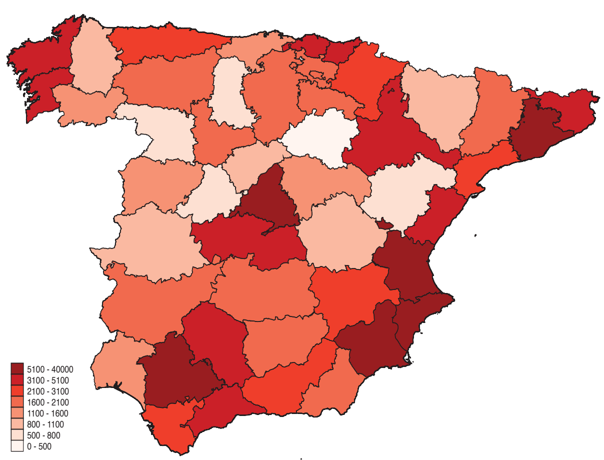
A.1 Share of Exports and GDP Within the European Union

Figure A.1: Share of Exports to non-EU Countries and GDP

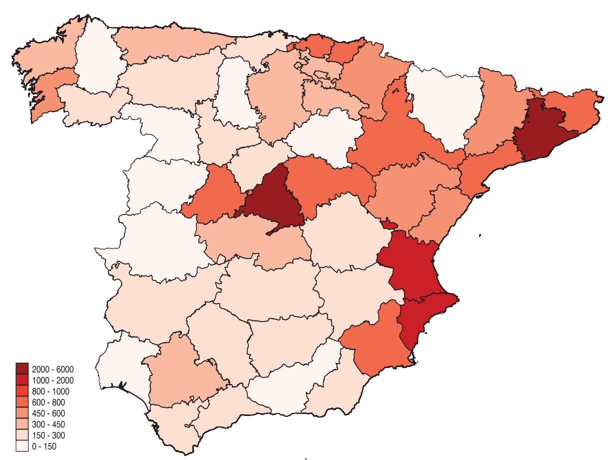


A.2 Spatial Distribution of Economic Activity in Spain

Figure A.2: Distribution of Economic Activity in Spain: Variation Across Provinces



(a) Number of Firms



(b) Number of Exporting Firms

B Appendix Tables: Elasticities by Sector

Table B.4: Intensive Margin - Heterogeneity by Sector

Dependent Variable:	ΔLn(Exports)						
Sector	Food	Beverages	Textiles	Clothing	Leather	Wood	Paper
NACE code	(10)	(11)	(13)	(14)	(15)	(16)	(17)
ΔLn(Domestic Sales)	-0.206***	-0.327***	-0.253***	-0.421***	-0.158***	-0.240***	-0.460***
	(0.032)	(0.049)	(0.045)	(0.081)	(0.028)	(0.058)	(0.102)
ΔLn(TFP)	0.790***	0.507***	0.605***	0.720***	0.557***	0.833***	0.952***
	(0.098)	(0.159)	(0.125)	(0.213)	(0.123)	(0.148)	(0.240)
ΔLn(Average Wages)	-0.376***	-0.056	-0.452***	-0.431***	-0.303***	-0.241*	-0.598***
	(0.066)	(0.108)	(0.103)	(0.149)	(0.073)	(0.134)	(0.174)
Observations	8,485	2,392	2,846	1,272	2,971	2,085	1,612
R-squared	0.275	0.267	0.398	0.351	0.364	0.329	0.298

Sector	Printing	Chemicals	Pharma.	Plastic	Non-metals	Basic Met.	Fabr. Met.
NACE code	(18)	(20)	(21)	(22)	(23)	(24)	(25)
ΔLn(Domestic Sales)	-0.355***	-0.281***	-0.394***	-0.455***	-0.412***	-0.194***	-0.348***
	(0.080)	(0.049)	(0.094)	(0.069)	(0.055)	(0.052)	(0.038)
ΔLn(TFP)	0.919***	0.994***	0.705***	1.175***	0.986***	0.679***	1.079***
	(0.288)	(0.160)	(0.186)	(0.126)	(0.160)	(0.090)	(0.125)
ΔLn(Average Wages)	-0.646***	-0.500***	-0.234	-0.474***	-0.381***	-0.146	-0.343***
	(0.219)	(0.101)	(0.154)	(0.093)	(0.126)	(0.094)	(0.093)
Observations	1,534	5,281	1,455	4,251	3,609	2,810	7,735
R-squared	0.314	0.292	0.231	0.357	0.341	0.281	0.309

Sector	Computers	Electronics	Machine	Vehicles	Oth.Transp.	Furniture	Repair
NACE code	(26)	(27)	(28)	(29)	(30)	(31)	(32)
ΔLn(Domestic Sales)	-0.326***	-0.290***	-0.250***	-0.303***	-0.075	-0.436***	-0.305***
	(0.081)	(0.049)	(0.024)	(0.047)	(0.087)	(0.069)	(0.076)
ΔLn(TFP)	0.584***	0.548***	1.033***	1.036***	1.038***	1.137***	1.044***
	(0.174)	(0.145)	(0.143)	(0.165)	(0.264)	(0.190)	(0.272)
ΔLn(Average Wages)	-0.190	-0.301**	-0.497***	-0.651***	-0.681**	-0.509***	-0.571***
	(0.145)	(0.129)	(0.111)	(0.138)	(0.303)	(0.130)	(0.212)
Observations	1,790	2,585	8,238	3,248	922	1,633	1,581
R-squared	0.303	0.331	0.261	0.262	0.301	0.369	0.317

Note: All specifications contain firm fixed effects and year fixed effects. Standard errors clustered by firm in parentheses. Exports, domestic sales and average wages are in constant 2011 euros. For any variable X, $\Delta\text{Ln}(X)$ is the difference in $\text{Ln}(X)$ between two consecutive years. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.