Venting Out: Exports During a Domestic Slump

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February 2020

The Spanish Economy During the Great Recession

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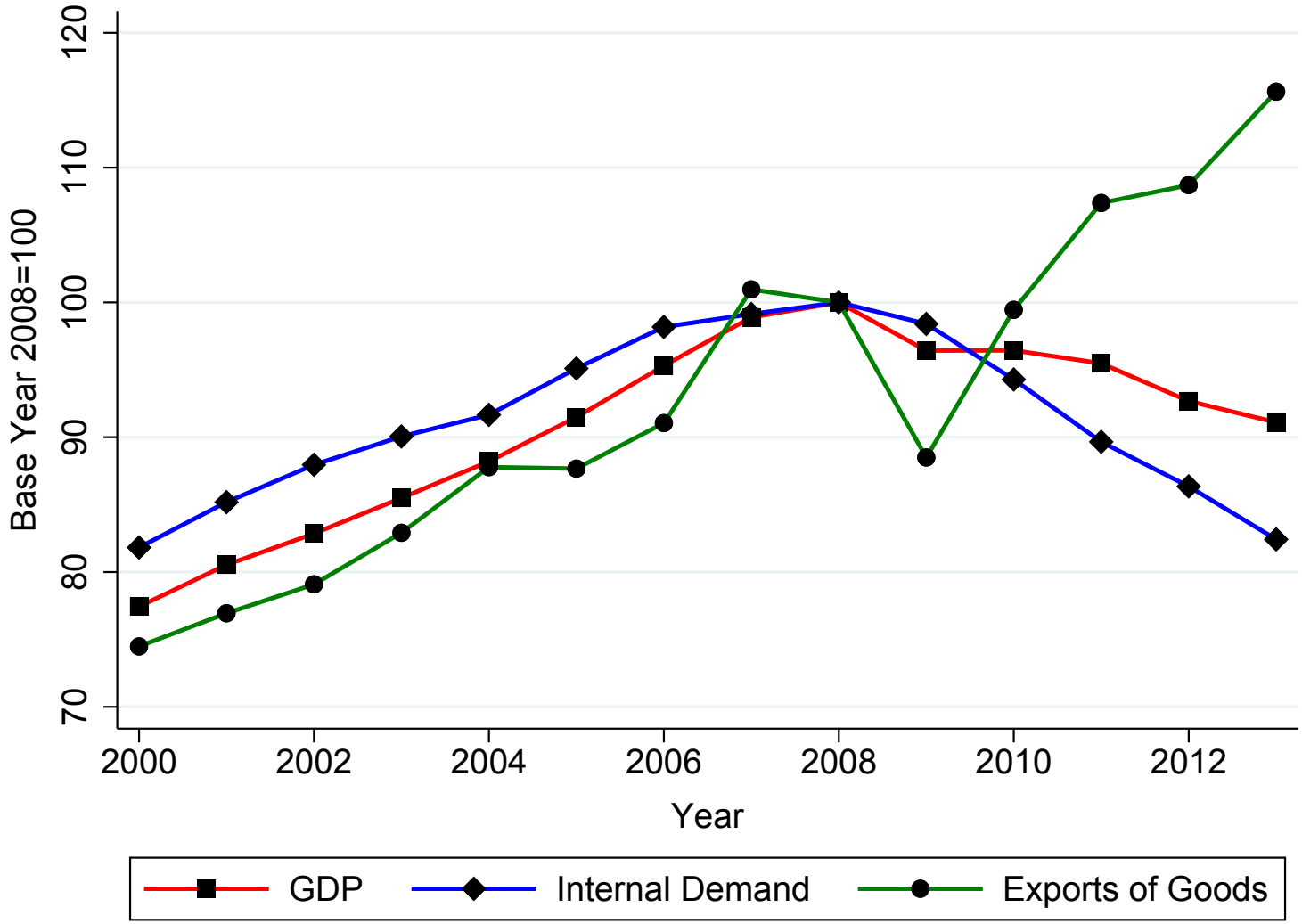

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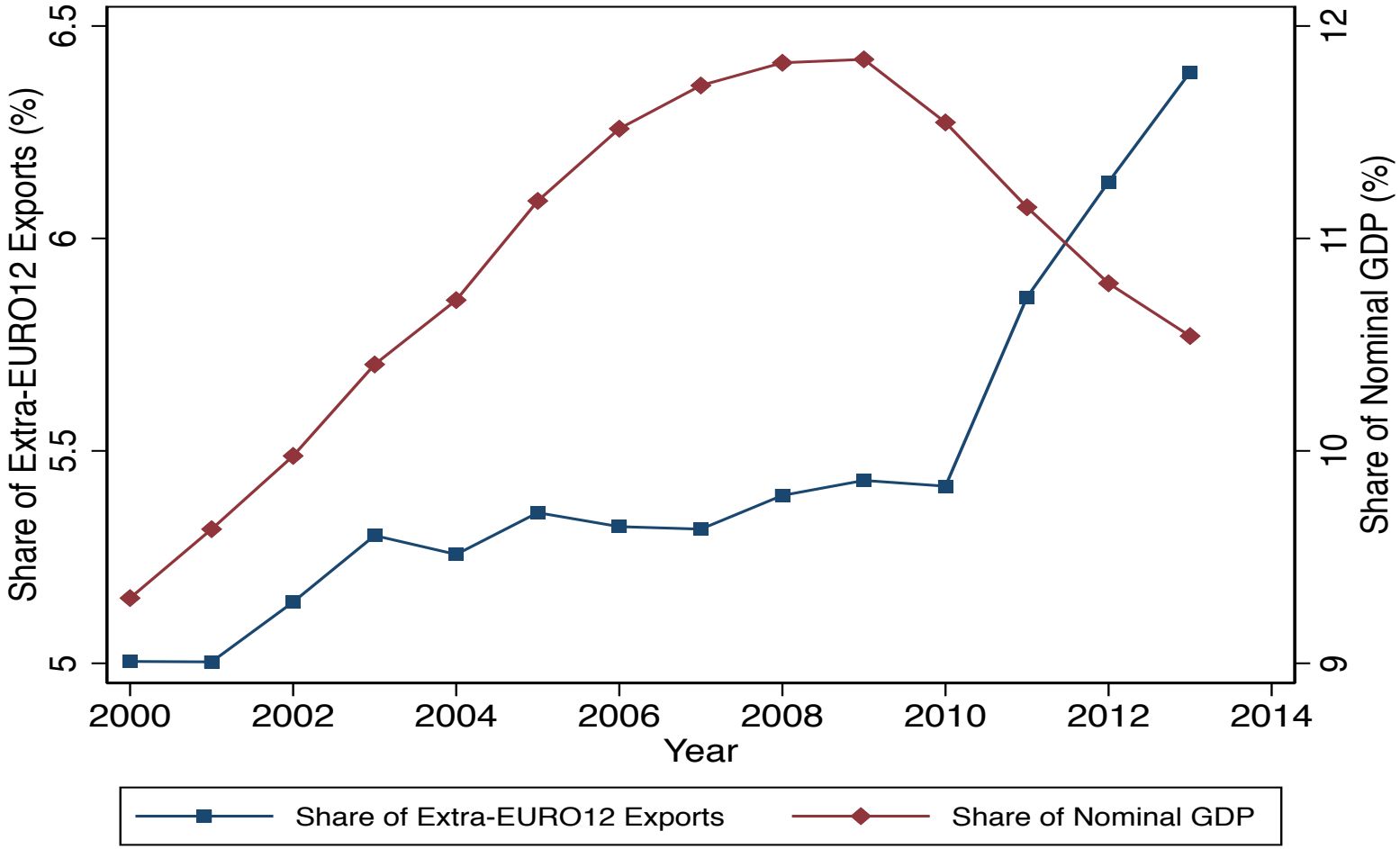
- . . . and few euro area countries experienced export growth during the downturn as intensively as Spain did.



Explanations for the Spanish "Export Miracle"

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- "Vent-for-surplus" mechanism implies a negative *causal* relationship between domestic demand and exports operating through the firm's domestic sales:

$$\text{Domestic demand} \Downarrow \longrightarrow \text{Domestic sales} \Downarrow \underset{\uparrow}{\longrightarrow} \text{Exports} \Uparrow$$

Holding factor prices and productivity fixed

- "Vent-for-surplus" mechanism is a *firm-level partial equilibrium* relationship.

Contribution and Identification Strategy

- Contribution of this paper: test for the presence and quantify the contribution of the vent-for-surplus mechanism to the Spanish "export miracle".
- Main identification strategy:
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  - From this, construct an instrument of the domestic (Spain-wide) sales of manufacturing firms and use it to estimate the effect of changes in domestic sales on extensive and intensive margin of exports.

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  - Control for firm-specific wages, financial costs and proxy for productivity.

Main Results

- Intensive-margin results:
  - Robust negative causal relationship between firms' demand-driven changes in domestic sales and exports, controlling for firms' marginal cost shifters.
  - Elasticity of exports with respect to domestic sales is approximately -1.6.
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- Extensive margin results:
  - No evidence of "vent-for-surplus" operating through firms starting to export.
- Quantification:
  - "Vent-for-surplus" mechanism accounts for about half of the 2009-13 increase in Spanish exports.

Literature

- "Vent-for-surplus" theory:
  - Adam Smith (1776), Williams (1929), Myint (1958), Fisher and Kakkar (2004)
  - **Contribution:** we apply the "vent-for-surplus" intuition at the firm level and illustrate its importance as a mechanism to smooth out local shocks.

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  - **Contribution:** we apply the "vent-for-surplus" intuition at the firm level and illustrate its importance as a mechanism to smooth out local shocks.

- Firm-level interdependencies across markets:
  - Trade models with increasing marginal costs: Vannoorenberghe (2002), Blum et al. (2013), Soderbery (2014), Blanchard and Portugal (2016), Ahn and McQuoid (2017), Liu (2017).
  - Impact of export demand on domestic sales: Berman et al. (2015).
  - Extensive margin complementarities: Antràs et al (2017), Morales et al (2017)
  - **Contribution:** study export impact of a large negative domestic demand shock, and use an IV strategy to test for a negative causal relationship between demand-driven changes in domestic sales and exports.

Road Map

- Baseline Model: Partial-equilibrium Version of Melitz (2003)
- Data
- Identification Approach
- Baseline Results
- Robustness
- Model with Increasing Marginal Costs
- Quantification
- Summary

BASELINE MODEL:
PARTIAL-EQUILIBRIUM VERSION OF MELITZ (2003)

Environment

- Each firm i in sector s faces the following demand in market $j = \{d, x\}$,

$$Q_{ij} = \frac{P_{ij}^{-\sigma}}{P_{sj}^{1-\sigma}} E_{sj} \xi_{ij}^{\sigma-1}, \qquad \sigma > 1.$$

- Firm i's total cost of producing Q_{ij} for market j is,

$$c_{ij} Q_{ij} \qquad \text{with} \qquad c_{ij} \equiv \tau_{sj} \frac{1}{\varphi_i} \omega_i.$$

- Firm i needs to pay an exogenous fixed cost F_{ij} to sell in market j.

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$$c_{ij} Q_{ij} \qquad \text{with} \qquad c_{ij} \equiv \tau_{sj} \frac{1}{\varphi_i} \omega_i.$$

- Firm i needs to pay an exogenous fixed cost F_{ij} to sell in market j.
- Firm i chooses optimally the quantity offered in each market j, Q_{ij}, taking the price index, P_{sj}, as given.
- As marginal production costs are constant and per-market fixed costs are independent of the firm's participation in other markets, the optimization problem of the firm is separable across markets.

Market-Specific Sales Revenue

- Model predicts that log-changes in sales between two periods are given by

$$\widehat{R}_{ij} = (\sigma - 1)\left[\widehat{\xi}_{ij} + \widehat{\varphi}_i - \widehat{\omega}_i\right] - (\sigma - 1)\left(\widehat{\tau}_{sj} - \widehat{P}_{sj}\right) + \widehat{E}_{sj},$$

- $\widehat{R}_{ix}$ is not impacted by $\widehat{R}_{id}$; thus, this model implies that the causal impact of $\widehat{R}_{id}$ on $\widehat{R}_{ix}$ (which we denote as β) equals zero; i.e. $\beta = 0$.

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- To understand properties of $\hat{\beta}_{ols}$ and $\hat{\beta}_{iv}$, useful to decompose

$$\begin{aligned}
\widehat{\xi}_{ij} &= \xi_{sj} + u^{\xi}_{ij}, \\
\widehat{\varphi}_i &= \varphi_s + \delta_{\varphi}\widehat{\varphi}^*_i + u^{\varphi}_i, \\
\widehat{\omega}_i &= \omega_s + \delta_{\omega}\widehat{\omega}^*_i + u^{\omega}_i,
\end{aligned}$$

  and, thus, we can rewrite

$$\widehat{R}_{ij} = \gamma_{sj} + (\sigma - 1)\,\delta_{\varphi}\widehat{\varphi}^*_i - (\sigma - 1)\,\delta_{\omega}\widehat{\omega}^*_i + \underbrace{(\sigma - 1)\left(u^{\xi}_{ij} + u^{\varphi}_i - u^{\omega}_i\right)}_{\varepsilon_{ij}}.$$

Properties of OLS Estimator

- Consider using OLS to estimate the parameter β in a regression of $\widehat{R}_{ix}$ on $\widehat{R}_{id}$ controlling for sector fixed effects, region fixed effects, and our proxies for productivity and production factor costs.
- Given previous expression for $\widehat{R}_{ij}$, the probability limit of $\hat{\beta}_{ols}$ is:

$$plim(\hat{\beta}_{ols}) = \frac{cov(\widehat{\mathcal{R}}_{ix}, \widehat{\mathcal{R}}_{id})}{var(\widehat{\mathcal{R}}_{id})} = \frac{cov(u_{ix}^{\xi} + u_i^{\varphi} - u_i^{\omega}, u_{id}^{\xi} + u_i^{\varphi} - u_i^{\omega})}{var(u_{id}^{\xi} + u_i^{\varphi} - u_i^{\omega})}.$$

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- Therefore, $plim(\hat{\beta}_{ols}) > 0$ as long as firms'
  - productivity and production factor costs are not perfectly observable; or
  - market- and firm-specific residual demand positively correlated across markets.
- Thus, the OLS estimator $\hat{\beta}_{ols}$ is likely to be upward biased:
  - $\hat{\beta}_{ols} > 0$ is not very informative about the sign of the true value of β.
  - $\hat{\beta}_{ols} < 0$ is informative: it suggests the true value of β is negative and, thus, indicates the need for a different model to explain the data available to us.

Properties of IV Estimator

- Consider an instrumental variable approach with an instrument $\widehat{Z}_i$ for the log change in domestic sales $\widehat{R}_{id}$.
- We then have

$$plim(\hat{\beta}_{iv}) = \frac{cov(\widehat{\mathcal{R}}_{ix}, \widehat{\mathcal{Z}}_i)}{cov(\widehat{\mathcal{R}}_{id}, \widehat{\mathcal{Z}}_i)} = \frac{cov(u_{ix}^{\xi} + u_i^{\varphi} - u_i^{\omega}, \widehat{\mathcal{Z}}_i)}{cov(u_{id}^{\xi} + u_i^{\varphi} - u_i^{\omega}, \widehat{\mathcal{Z}}_i)}.$$

- Note that $plim(\hat{\beta}_{iv}) = 0$ if $\widehat{\mathcal{Z}}_i$ is:
  1. correlated with the firm's idiosyncratic domestic demand;
  2. uncorrelated with the firm's idiosyncratic export demand;
  3. uncorrelated with the residual determinants of the firm's marginal costs.
- If $\widehat{\mathcal{Z}}_i$ satisfies these three conditions, $\hat{\beta}_{iv} \neq 0$ is informative in that it suggests the need for a different model to explain the data available to us.

DATA

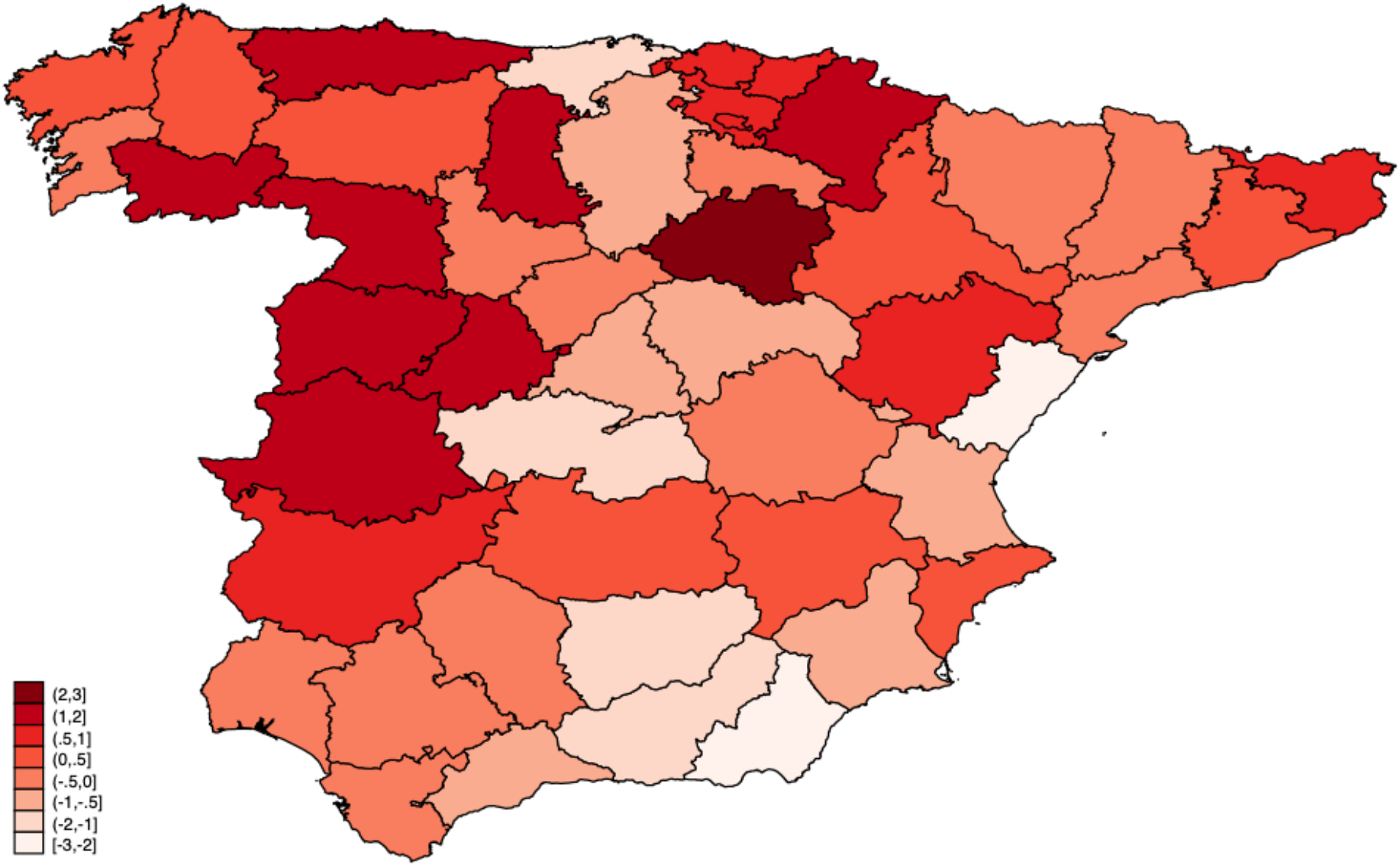
Data Sources

We have data on Spanish manufacturing firms for the period 2002-2013.

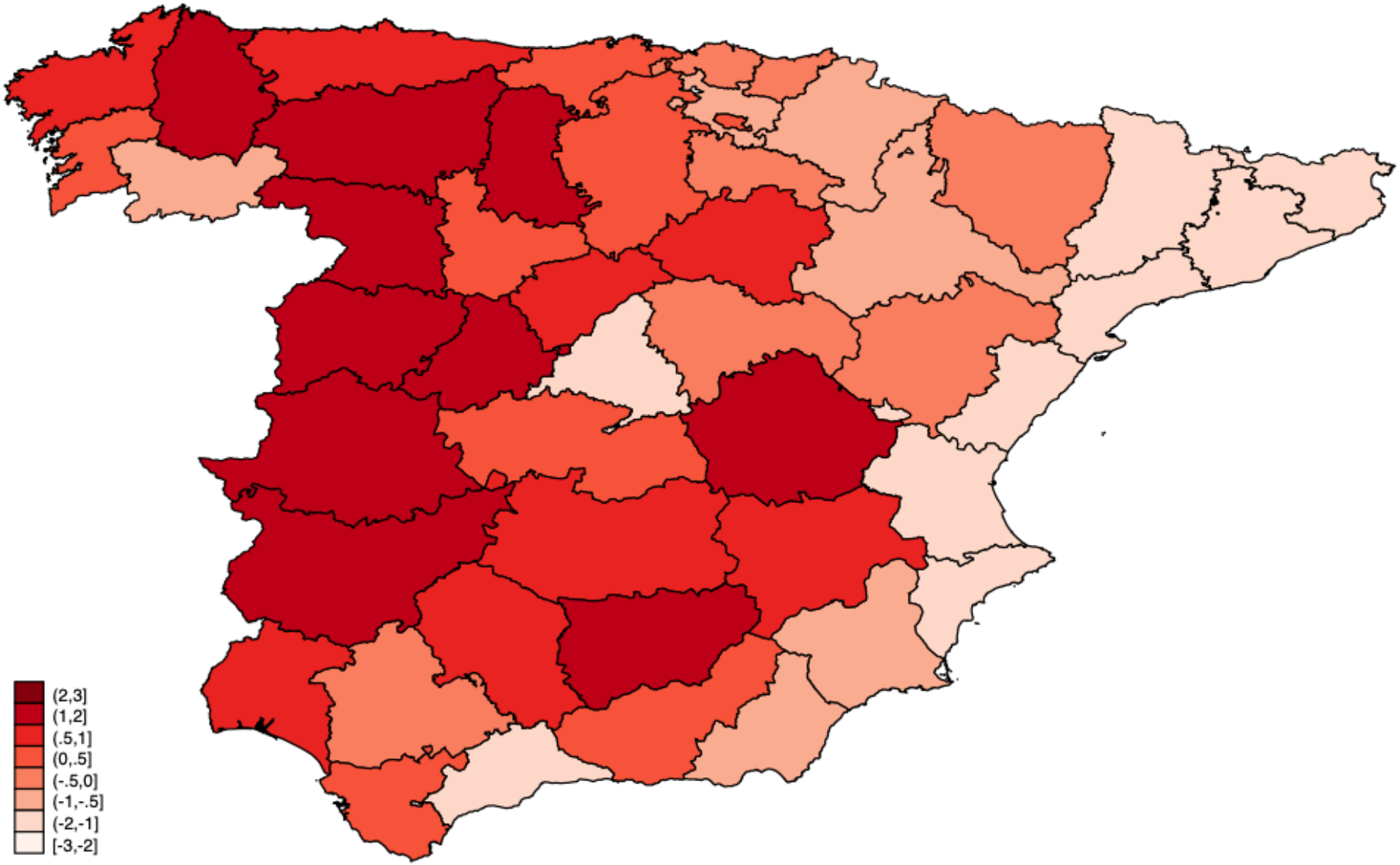
Sources:

1. Central de Balances (Bank of Spain and Commercial Registry, *Registro Mercantil Central*)
   - Sector of activity (4-digit), 5-digit zip code of location
   - Total sales (turnover), labor expenditures (including SS contributions), number of employees, material expenditures, value of fixed assets.
2. Foreign transactions registry (Bank of Spain)
   - All export transactions at firm level, above a threshold (€12.5k, then €50k)
3. Registry of Motor Vehicles (*Dirección General de Tráfico*).
   - Stock of vehicles at the municipality-year level
4. Tax records of firm-level sales within Spain for manufacturing firms (Spanish Tax Authority, *AEAT*)
   - Including municipality-to-municipality bilateral flows

Average Log Change in Domestic Sales by Province



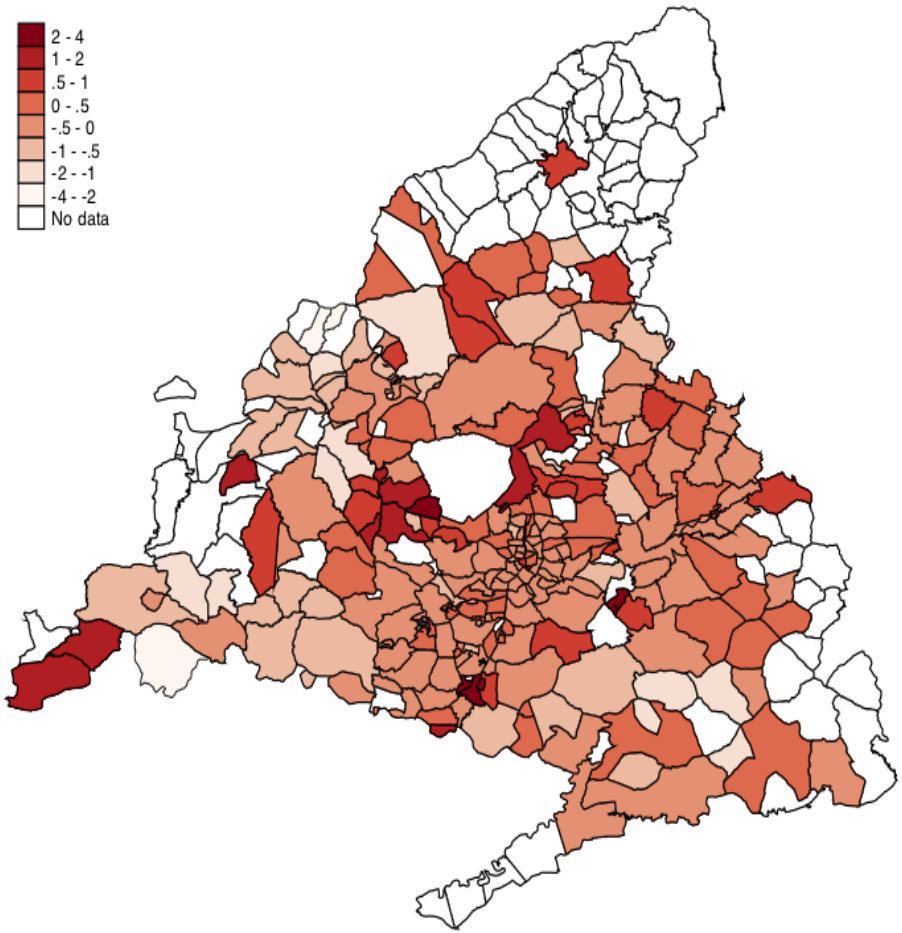
Average Log Change in Stock of Cars per Capita



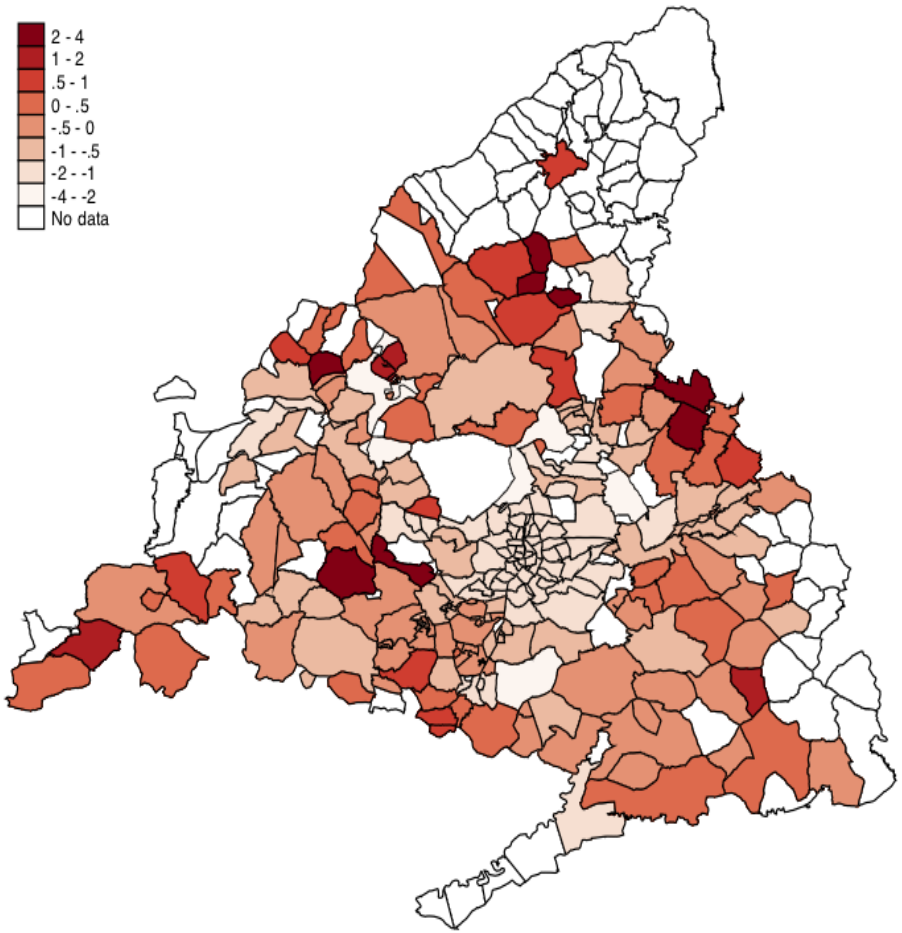
Stock of Vehicles per Capita (National Average)

Variation Across Zip Codes: Madrid

Relative Change in Domestic Sales

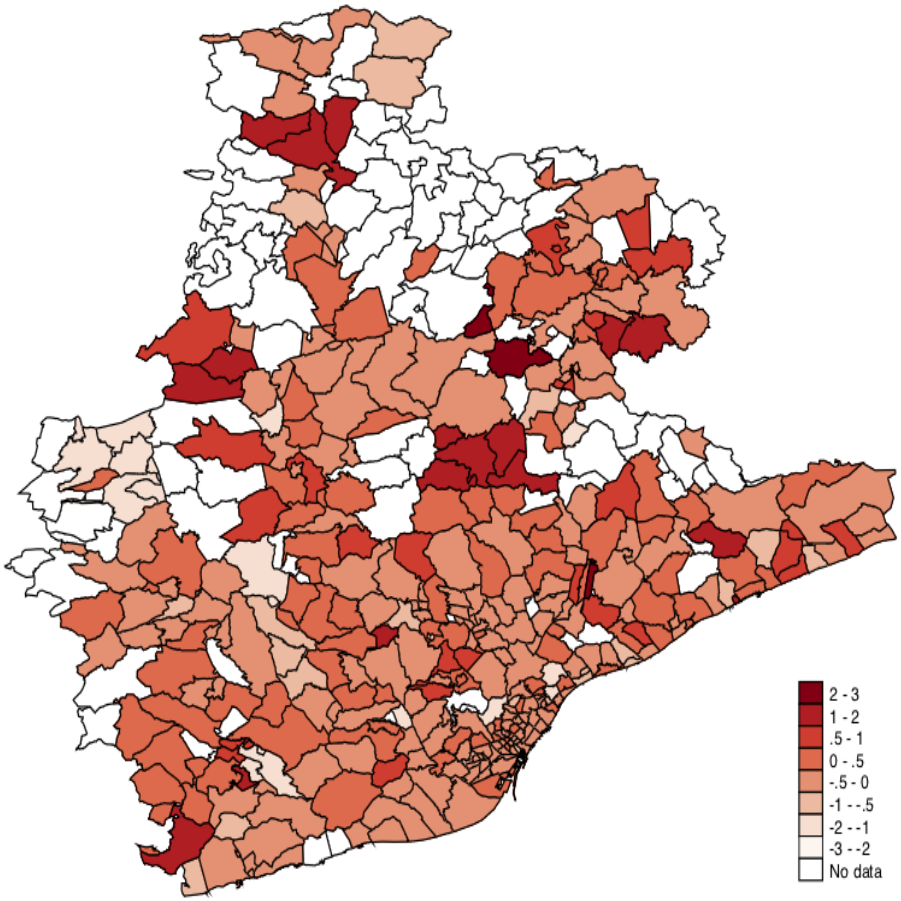


Relative Change in Vehicles per Capita

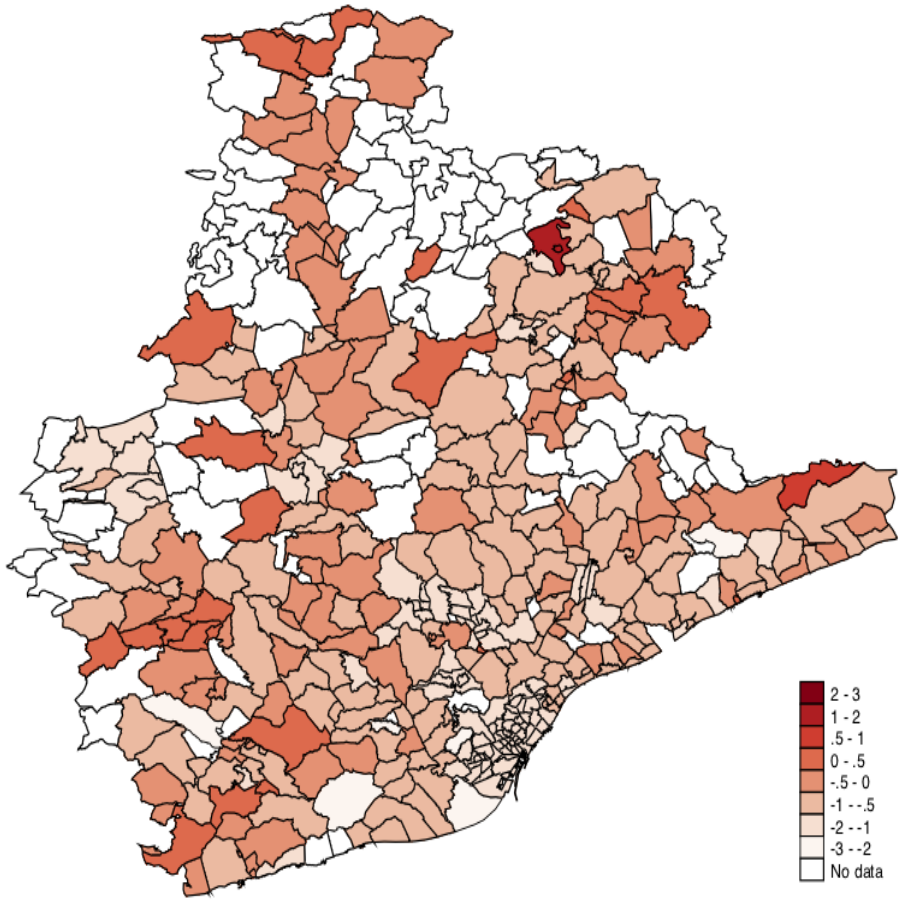


Variation Across Zip Codes: Barcelona

Relative Change in Domestic Sales



Relative Change in Cars per Capita



Intensive-Margin OLS Estimates

Dependent Variable:	ΔLn(Exports)					
	(1)	(2)	(3)	(4)	(5)	(6)
ΔLn(Domestic Sales)	0.063	-0.209^a	-0.298^a	-0.292^a	-0.284^a	-0.271^a
	(0.044)	(0.049)	(0.043)	(0.032)	(0.032)	(0.036)
ΔLn(TFP)		1.142^a	1.448^a	1.535^a	1.522^a	1.514^a
		(0.043)	(0.046)	(0.057)	(0.055)	(0.057)
ΔLn(Average Wages)			-0.744^a	-0.723^a	-0.712^a	-0.706^a
			(0.062)	(0.072)	(0.070)	(0.067)
Observations	8,009	8,009	8,009	8,009	8,009	7,502
R-squared	0.001	0.100	0.126	0.162	0.171	0.278
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	No	No	No	No	Yes	No
Municipality FE	No	No	No	No	No	Yes

Significance levels: $a = 1\%$, $b = 5\%$, $c = 10\%$. Standard errors clustered at province level.

- Note: $corr(\Delta\text{Ln(TFP)}, \Delta\text{Ln(Total Sales)}) \approx 0.5$.

EXPORTS AND DOMESTIC SALES: EXPLOITING A PROXY FOR LOCAL DEMAND

Identification Approach

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  3. changes in our instrument for firms' domestic sales are uncorrelated with unobserved supply or export demand shocks affecting the firms located in that municipality.
- First two requirements: stock of vehicles per capita is a relevant instrument.
- Last requirement: stock of vehicles per capita is a valid instrument.

Construction of the Baseline Instrument

- Goal: capture a firm's exposure to domestic demand changes, proxied by changes in the stock of vehicles per capita
- Domestic demand may come from anywhere in Spain, so we estimate a **gravity equation** at the municipal level (m = origin; n = destination):

$$\ln F_{m,n} = \rho \ln Pop_n + \delta \ln Dist_{m,n} + \mu_m + \varepsilon_{m,n}$$

- Use the coefficients on distance (δ) and population (ρ) to calculate a weighted sum of the change in the stock of vehicles per capita

$$Z_{m,t} = \sum_{n \neq m} w_{m,n} \cdot V_{n,t}, \quad where \;\; w_{m,n} \equiv Pop_n^{\hat{\rho}} \cdot Dist_{m,n}^{\hat{\delta}}$$

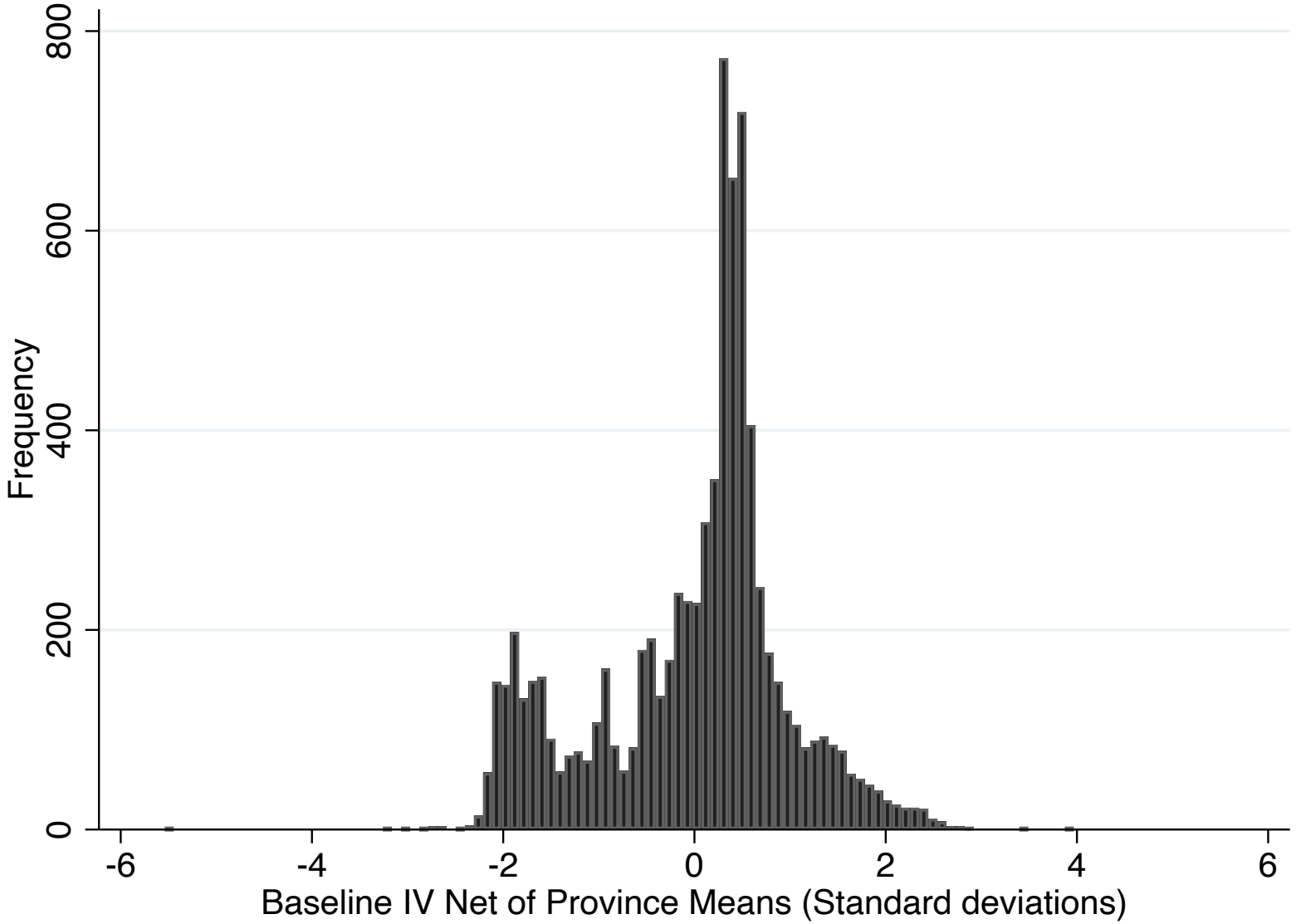
- We exclude the firm's municipality of origin from the weighted average to avoid capturing local supply shocks

Gravity Equations at Municipal Level

Dependent Variable:	Ln(Bilateral Trade Flows between Municipalities)				
	(1)	(2)	(3)	(4)	(5)
Ln(Population)	0.493^a	0.490^a	0.485^a	0.300^a	0.322^a
	(0.031)	(0.031)	(0.030)	(0.012)	(0.015)
Ln(Distance)	-0.429^a	-0.378^a		-0.150^a	-0.145^a
	(0.011)	(0.019)		(0.021)	(0.019)
Dummy for own-munic. flows		1.607^a			
		(0.111)			
Dummy for own-prov. flows		0.131^b			
		(0.065)			
Observations	417,936	417,936	417,936	675,715	675,589
R-squared	0.30	0.31	0.30	0.15	0.31
Municipality-Origin FE	Yes	Yes	Yes	Yes	No
Dummies for dist. intervals	No	No	Yes	No	No
Sector FE	No	No	No	Yes	No
Firm FE	No	No	No	No	Yes

Significance levels: $a = 1\%$, $b = 5\%$, $c = 10\%$. Standard errors clustered at province level.

Within-Province Variation in the Baseline Instrument



2SLS with Gravity-Weighted Vehicles p.c. as IV

Dependent Variable:	ΔLn(Domestic Sales)				ΔLn(Exports)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔLn(Domestic Sales)					-10.068^a	-2.081^a	-1.751^a	-1.607^a
					(3.454)	(0.319)	(0.238)	(0.248)
ΔLn(Dist-Pop-Weighted	0.339^a	1.194^a	1.346^a	1.312^a				
Vehicles p.c.)	(0.121)	(0.145)	(0.135)	(0.119)				
ΔLn(TFP)		0.829^a	1.031^a	1.023^a		2.623^a	2.876^a	2.810^a
		(0.028)	(0.029)	(0.028)		(0.241)	(0.222)	(0.213)
ΔLn(Average Wages)			-0.621^a	-0.526^a			-1.620^a	-1.387^a
			(0.037)	(0.047)			(0.174)	(0.151)
F-statistic	7.85	67.47	99.84	122.44				
Observations	8,009	8,009	8,009	8,009	8,009	8,009	8,009	8,009
Sector FE	No	No	No	Yes	No	No	No	Yes

Significance levels: $a = 1\%$, $b = 5\%$, $c = 10\%$. Standard errors clustered at province level.

Magnitude of Results

- Elasticity of -1.6 does not imply a more-than-complete substitution of exports for domestic sales.
- If domestic demand falls by €100:
  - a firm with 25% export share recoups €53.3;
  - a firm with 33% export share recoups €80.
- Median export share in the sample is 16.2%.
- Estimates are incompatible with the model with constant marginal costs: an alternative model is needed to explain the relationship between demand-driven changes in domestic sales and exports observed in Spain in the years around the Great Recession.

Extensive Margin

Dependent Variable:		Export Dummy		Proportion of Years	
	1st Stage	OLS	2nd Stage	OLS	2nd Stage
	(1)	(2)	(3)	(4)	(5)
Ln(Domestic Sales)		0.021^a	-0.099^a	0.008^b	0.040^b
		(0.005)	(0.034)	(0.004)	(0.019)
Ln(Dist-Pop-Weighted	1.024^a				
Vehicles p.c.)	(0.110)				
Ln(TFP)	1.169^a	0.068^a	0.204^a	0.062^a	0.024
	(0.018)	(0.007)	(0.039)	(0.005)	(0.020)
Ln(Average Wages)	-0.589^a	-0.046^a	-0.114^a	-0.041^a	-0.022^b
	(0.015)	(0.007)	(0.022)	(0.004)	(0.010)
Observations	125,054	125,054	125,054	125,054	125,054
R-squared	0.983	0.842	-0.017	0.920	0.012
Firm FE	Yes	Yes	Yes	Yes	Yes
Sector-Period FE	Yes	Yes	Yes	Yes	Yes
F-statistic	86.32				
Mean of Dep. Var.		0.171	0.171	0.115	0.115
Ext-Margin Elasticity		0.121	-0.582	0.067	0.352

Significance levels: $a = 1\%$, $b = 5\%$, $c = 10\%$. Standard errors clustered at province level.

ROBUSTNESS

Robustness

1. Regressions with four periods instead of boom-to-bust.
2. Eliminate zip codes exposed to supply shocks in the motor vehicles industry.
3. Alternative instruments.
4. Confounding factors: control for additional marginal cost shifters.
5. Alternative measure of productivity (TFP) based on value added instead of total revenue from sales.

2SLS Intensive-Margin Estimates with Four Periods

Dependent Variable:	ΔLn(Exports)			
	(1)	(2)	(3)	(4)
Ln(Domestic Sales)	-1.773^a	-2.085^a	-1.853^a	-2.070^a
	(0.315)	(0.483)	(0.447)	(0.363)
Ln(TFP)	2.952^a	3.131^a	3.064^a	3.238^a
	(0.306)	(0.463)	(0.418)	(0.350)
Ln(Average Wages)	-1.951^a	-1.928^a	-1.371^a	-1.435^a
	(0.244)	(0.277)	(0.219)	(0.187)
1st-Stage Coefficient	0.731^a	1.206^a	1.168^a	1.457^a
F-statistic	104.89	23.13	24.13	47.80
Observations	24,036	24,036	24,036	23,995
Firm FE	Yes	Yes	Yes	Yes
Period FE	No	Yes	No	No
Sector-Period FE	No	No	Yes	Yes
Municipality-specific trend	No	No	No	Yes

Significance levels: $a = 1\%$, $b = 5\%$, $c = 10\%$. Std. errors clustered at province level. The four periods considered are 2002-05, 2006-08, 2009-11 and 2012-13. Sample includes all firms with complete data in at least 3 of the 4 periods.

Excluding Zip Codes Linked to the Auto Industry (I)

	Panel A: Exclude zip codes w/ high auto employment share			*Panel B: Exclude zip codes with at least one sizeable auto maker*		
Dependent Variable:	ΔLn(Exp)	ΔLn(DSales)	ΔLn(Exp)	ΔLn(Exp)	ΔLn(DSales)	ΔLn(Exp)
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	1st Stage	2nd Stage	OLS	1st Stage	2nd Stage
ΔLn(Domestic Sales)	-0.305^a		-1.693^a	-0.294^a		-1.663^a
	(0.036)		(0.277)	(0.040)		(0.371)
ΔLn(Dist-Pop-Wght.		1.290^a			1.372^a	
Vehicles p.c.)		(0.119)			(0.166)	
ΔLn(Average Wages)	-0.691^a	-0.511^a	-1.372^a	-0.714^a	-0.505^a	-1.364^a
	(0.075)	(0.052)	(0.166)	(0.114)	(0.070)	(0.222)
ΔLn(TFP)	1.519^a	1.022^a	2.867^a	1.505^a	1.006^a	2.801^a
	(0.063)	(0.034)	(0.243)	(0.072)	(0.050)	(0.300)
F-statistic		118.30			68.58	
Observations	7,180	7,180	7,180	4,595	4,595	4,595

Significance levels: $a = 1\%$, $b = 5\%$, $c = 10\%$. Standard errors clustered at province level.

Excluding Zip Codes Linked to the Auto Industry (II)

	Panel C: Exclude zip codes neighboring' those in Panel A			*Panel D: Exclude sectors w/ I-O links to automakers*		
Dependent Variable:	ΔLn(Exp)	ΔLn(DSales)	ΔLn(Exp)	ΔLn(Exp)	ΔLn(DSales)	ΔLn(Exp)
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	1st Stage	2nd Stage	OLS	1st Stage	2nd Stage
ΔLn(Domestic Sales)	-0.277[a]		-1.693[a]	-0.255[a]		-1.864[a]
	(0.036)		(0.317)	(0.032)		(0.343)
ΔLn(Dist-Pop-Wght.		1.311[a]			1.238[a]	
Vehicles p.c.)		(0.132)			(0.130)	
ΔLn(Avg. Wages)	-0.664[a]	-0.490[a]	-1.325[a]	-0.718[a]	-0.491[a]	-1.459[a]
	(0.083)	(0.053)	(0.183)	(0.079)	(0.049)	(0.165)
ΔLn(TFP)	1.465[a]	1.008[a]	2.817[a]	1.464[a]	1.010[a]	3.011[a]
	(0.063)	(0.037)	(0.277)	(0.064)	(0.036)	(0.285)
F-statistic		98.78			91.09	
Observations	6,131	6,131	6,131	6,072	6,072	6,072

Significance levels: $a = 1\%$, $b = 5\%$, $c = 10\%$. Standard errors clustered at province level.

Alternative Instruments

Dependent Variable:	ΔLn(Domestic Sales)					
	(1)	(2)	(3)	(4)	(5)	(6)
ΔLn(Dist-Pop-Wght. Vehicles p.c.)	1.312[a]					
Gravity: mun-mun flows (Baseline)	(0.119)					
ΔLn(Dist-Pop-Wght. Vehicles p.c.)		1.321[a]				
Baseline incl. own mun. dummy		(0.118)				
ΔLn(Dist-Pop-Wght. Vehicles p.c.)			0.954[a]			
Gravity: distance dummies			(0.128)			
ΔLn(Dist-Pop-Wght. Vehicles p.c.)				1.303[a]		
Gravity: firm-mun flows				(0.106)		
ΔLn(Weighted Vehicles p.c.)					0.521[a]	
Weights: firm-level mun. shares					(0.111)	
Δ(Dist-Pop-Wght. Vehicles p.c.)						0.967[a]
Baseline in levels						(0.115)
	ΔLn(Exports)					
ΔLn(Domestic Sales)	-1.607[a]	-1.613[a]	-1.336[a]	-1.642[a]	-2.162[a]	-1.701[a]
	(0.248)	(0.214)	(0.228)	(0.245)	(0.412)	(0.262)
P-value for Sargan test	0.72	0.08	0.08	0.72	0.11	0.06
Observations	8,009	8,009	8,009	7,906	7,850	8,009

Significance levels: $a = 1\%$, $b = 5\%$, $c = 10\%$. Standard errors clustered at province level.

More Alternative Instruments

As alternative instruments, we exploit differences across Spanish regions in exposure to factors believed to have caused the Great Recession:

- Differences in pre-boom share of "buildable" urban land;
- Differences in importance of tourism in overall economic activity.
- Differences in importance of construction sector in employment;

More Alternative Instruments

Dependent Variable:	ΔLn(Domestic Sales)				
	(1)	(2)	(3)	(4)	(5)
Ln(Urban Land Supply Ratio in 1995)	0.197^{b}				
(Weighted by Dist-Pop)	(0.098)				
Δ Ln(foreign tourists) ×		0.256^{a}			
2001 foreign tourists p.c. in prov.		(0.092)			
Δ Ln(construction wage bill) ×			0.381^{a}		
2001 wage bill share in munic.			(0.062)		
Δ Ln(construction employment) ×				0.428^{a}	
2001 empl. share in munic.				(0.074)	
Δ Ln(construction turnover) ×					0.160^{a}
2001 turnover share in munic.					(0.025)
Dependent Variable:	ΔLn(Exports)				
Δ Ln(Domestic Sales)	-1.401^{b}	-1.023^{a}	-1.229^{b}	-0.875	-1.533^{a}
	(0.634)	(0.286)	(0.532)	(0.626)	(0.524)
Observations	8,009	8,009	7,935	7,935	7,935
F-statistic	4.04	7.66	37.28	33.49	40.59
P-value for Sargan test	0.80	0.10	0.78	0.25	0.93

Significance levels: $a = 1\%$, $b = 5\%$, $c = 10\%$. Standard errors clustered at province level.

Confounding Factors

Dependent Variable:	ΔLn(Exports)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ΔLn(Domestic Sales)	-1.607^a	-1.639^a	-1.618^a	-1.632^a	-1.678^a	-1.680^a	-1.611^a
	(0.248)	(0.251)	(0.263)	(0.259)	(0.251)	(0.257)	(0.264)
ΔShare of Temp. Workers		-0.250^a					
(firm level)		(0.089)					
ΔShare of Temp. Workers			-0.019				
(munic. level)			(0.170)				
ΔManufacturing Empl. p.c.				-0.272^a			
(munic. level)				(0.050)			
ΔLn(Financial Costs)					-0.027^c		
(firm level)					(0.014)		
Financial Costs in Boom						-0.008	
(firm level)						(0.015)	
Financial Costs in Boom							-0.039
(munic. level)							(0.041)
Observations	8,009	7,640	7,743	7,745	6,879	6,945	7,741
F-Statistic	122.44	131.97	138.65	136.93	88.43	89.27	139.26

Significance levels: $a = 1\%$, $b = 5\%$, $c = 10\%$. Standard errors clustered at province level.

Alternative TFP Measure

Dependent Variable:	ΔLn(Exports)			
	(1)	(2)	(3)	(4)
	OLS	IV	OLS	IV
ΔLn(Domestic Sales)	-0.292[a]	-1.607[a]	0.020	-1.057[a]
	(0.032)	(0.248)	(0.038)	(0.197)
ΔLn(Average Wages)	-0.723[a]	-1.387[a]	-0.753[a]	-1.024[a]
	(0.072)	(0.151)	(0.070)	(0.100)
ΔLn(TFP Sales): Baseline	1.535[a]	2.810[a]		
	(0.057)	(0.213)		
ΔLn(TFP Value-Added)			1.014[a]	1.338[a]
			(0.076)	(0.096)
Observations	8,009	8,009	8,009	8,009
F-Statistic		122.44		66.29

- $corr(\Delta \text{Ln(TFP Value Added)}, \Delta \text{Ln(Total Sales)}) = 0.23$.
- $corr(\Delta \text{Ln(TFP Sales)}, \Delta \text{Ln(Instrument)}) = -0.18$
- $corr(\Delta \text{Ln(TFP Value Added)}, \Delta \text{Ln(Instrument)}) = -0.33$.

MODEL WITH INCREASING MARGINAL COSTS

Increasing Marginal Costs

- Prior results are inconsistent with a model with constant marginal costs.
- Maintain CES demand function and monopolistic competition.
- More general cost structure: total variable cost of producing Q_{id} for the domestic market and Q_{ix} for the foreign market is equal to

$$\frac{1}{\varphi_i}\omega_i \frac{1}{\lambda+1}\left(\tau_{sd}Q_{id}+\tau_{sx}Q_{ix}\right)^{\lambda+1}, \quad \lambda \geq 0.$$

- This model leads to the following expression for market-specific sales:

$$\widehat{R}_{ij} = d_s + d_\ell + \frac{(\sigma-1)}{1+\lambda}\delta_\varphi \widehat{\varphi}_i^* - \frac{(\sigma-1)}{1+\lambda}\delta_\omega \widehat{\omega}_{it}^* - \frac{(\sigma-1)\,\lambda}{1+\lambda}\widehat{R}_i + \varepsilon_{ij},$$

  where $R_i \equiv R_{id} + R_{ix}$ and $\varepsilon_{ix} \equiv u_{ix}^{\xi} + \frac{(\sigma-1)}{1+\lambda}(u_i^{\varphi} - u_i^{\omega})$.
- Specification identical to that in prior regressions but introducing the change in total sales $\widehat{R}_i$ (instead of domestic sales $\widehat{R}_{id}$) as RHS variable.

Estimation: Relevant Elasticity

Dependent Variable:	ΔLn(Exp) (1) OLS	ΔLn(TotSales) (2) 1st Stage	ΔLn(Exp) (3) 2nd Stage	ΔLn(TotSales) (4) 1st Stage	ΔLn(Exp) (5) 2nd Stage
Δ Ln(Total Sales)	0.724^a		-2.374^a		-2.590^a
	(0.050)		(0.526)		(0.606)
Δ Ln(Dist-Pop-Weighted		0.888^a		0.838^a	
Vehicles p.c.)		(0.103)		(0.107)	
Δ Ln(TFP)	0.509^a	1.063^a	3.690^a	1.015^a	3.739^a
	(0.055)	(0.026)	(0.482)	(0.027)	(0.539)
Δ Ln(Average Wages)	-0.217^a	-0.509^a	-1.750^a	-0.493^a	-1.801^a
	(0.063)	(0.043)	(0.250)	(0.041)	(0.282)
Δ Ln(Stock of Capital)				0.101^a	0.382^a
				(0.009)	(0.067)
Observations	8,009	8,009	8,009	8,009	8,009
Sector FE	Yes	Yes	Yes	Yes	Yes
F-statistic		75.00		61.30	

Significance levels: $a = 1\%$, $b = 5\%$, $c = 10\%$. Standard errors clustered at province level.

Relevant Elasticity: Heterogeneity

Dependent Variable:	Δ Ln(Exports)			
	(1)	(2)	(3)	(4)
Δ Ln(Total Sales)	-1.715^a	-2.508^a	-3.635^a	-2.688^a
	(0.381)	(0.755)	(1.134)	(0.579)
Δ Ln(Total Sales) × High	-1.477			
Output elasticity wrt Capital	(1.000)			
Δ Ln(Total Sales) × High		0.462		
Output elasticity wrt Materials		(0.782)		
Δ Ln(Total Sales) × High			2.205^c	
Output elasticity wrt Labor			(1.143)	
Δ Ln(Total Sales) × High				3.963^a
Output elast. wrt Labor				(1.350)
× Temp. Ratio				
Observations	8,009	8,009	8,009	7,889
Sector FE	Yes	Yes	Yes	Yes
P-value for $H_0 : \beta_1 + \beta_2 = 0$	0.00	0.00	0.00	0.23

Significance levels: $a = 1\%$, $b = 5\%$, $c = 10\%$. Standard errors clustered at province level.

QUANTIFICATION

Quantification Exercise

- We attempt to evaluate the quantitative importance of the "vent-for-surplus" channel for explaining Spanish export growth during period 2009-13.
- Explore impact on exports of counterfactual changes in aggregate demand shifters $\{Q_{sd}\}_s$ imposing two restrictions:
  1. Aggregate exports price index P_{sx} evolves according to actual path, thus implicitly assuming Spain is a "small" economy.
  2. Marginal cost and foreign demand shifters evolve according to actual path:

$$(\Delta \ln \varphi_i, \Delta \ln \omega_i, \Delta \ln \tau_{sx}, \Delta \ln \tau_{sd}, \Delta \ln Q_{sx})'$$

$$=$$

$$(\Delta \ln \varphi_i, \Delta \ln \omega_i, \Delta \ln \tau_{sx}, \Delta \ln \tau_{sd}, \Delta \ln Q_{sx});$$

(partial-equilibrium counterfactual that isolates "vent-for-surplus" channel)

Quantification

- Measuring the contribution of the vent-for-surplus mechanism to exports is equivalent to answering the question

  Which change in exports would we have observed if there had been no change in the aggregate demand shifters?

- To answer this question, we compute our counterfactual for a value of Γ_Q such that $Q'_{sd1} = Q_{sd0}$; i.e. for

$$\Gamma_Q = \Gamma_Q^* \qquad \text{where} \qquad \Gamma_Q^* \equiv (Q_{sd1}/Q_{sd0})^{-1}.$$

- Note that $1/\Gamma_Q^* - 1$ equals the actual change in the aggregate demand shifters (conditional on this change being common across sectors).

Quantification

- How do we measure Γ_Q^*?
- Three steps:
  1. Use the model-implied relationship,

$$\widehat{R}_{ix} = d_s + d_\ell + \frac{(\sigma-1)}{1+\lambda}\delta_\varphi \widehat{\varphi}_i^* - \frac{(\sigma-1)}{1+\lambda}\delta_\omega \widehat{\omega}_i^* - \frac{(\sigma-1)\,\lambda}{1+\lambda}\widehat{R}_i + \varepsilon_{ix},$$

     and our instrument to compute $var(\widehat{R}_i^*)/var(\widehat{R}_i)$, where $\widehat{R}_i^* \equiv \widehat{R}_i - \mathbb{E}[\widehat{R}_i|\varepsilon_{ix}]$. We find $var(\widehat{R}_i^*)/var(\widehat{R}_i) = 41\%$.
  2. Assume that changes in aggregate demand shifters caused 41% of the actual boom-to-bust drop in total sales.
  3. Equate our measure of Γ_Q^* to the value of Γ_Q for which our counterfactual exercise predicts a change in total sales equal to 41% of the actual drop in total sales. We find $\Gamma_Q^* = 1.09$.
- Note that this calibration of Γ_Q^* implies a boom-to-bust drop in aggregate demand of -8.26%.

Quantification

- If we set $\Gamma_Q = \Gamma_Q^*$ and, thus, compute the model predictions for the case in which there had been no change in the aggregate demand shifters between the boom and bust, the counterfactual predictions of our model are:
  1. total sales would have dropped by 6.04% (vs. a 10.23% observed drop);
  2. exports would have grown by 5.79% (vs. a 11.99% observed growth);
  3. domestic sales would have dropped by 9.10% (vs. a 15.91% observed drop).

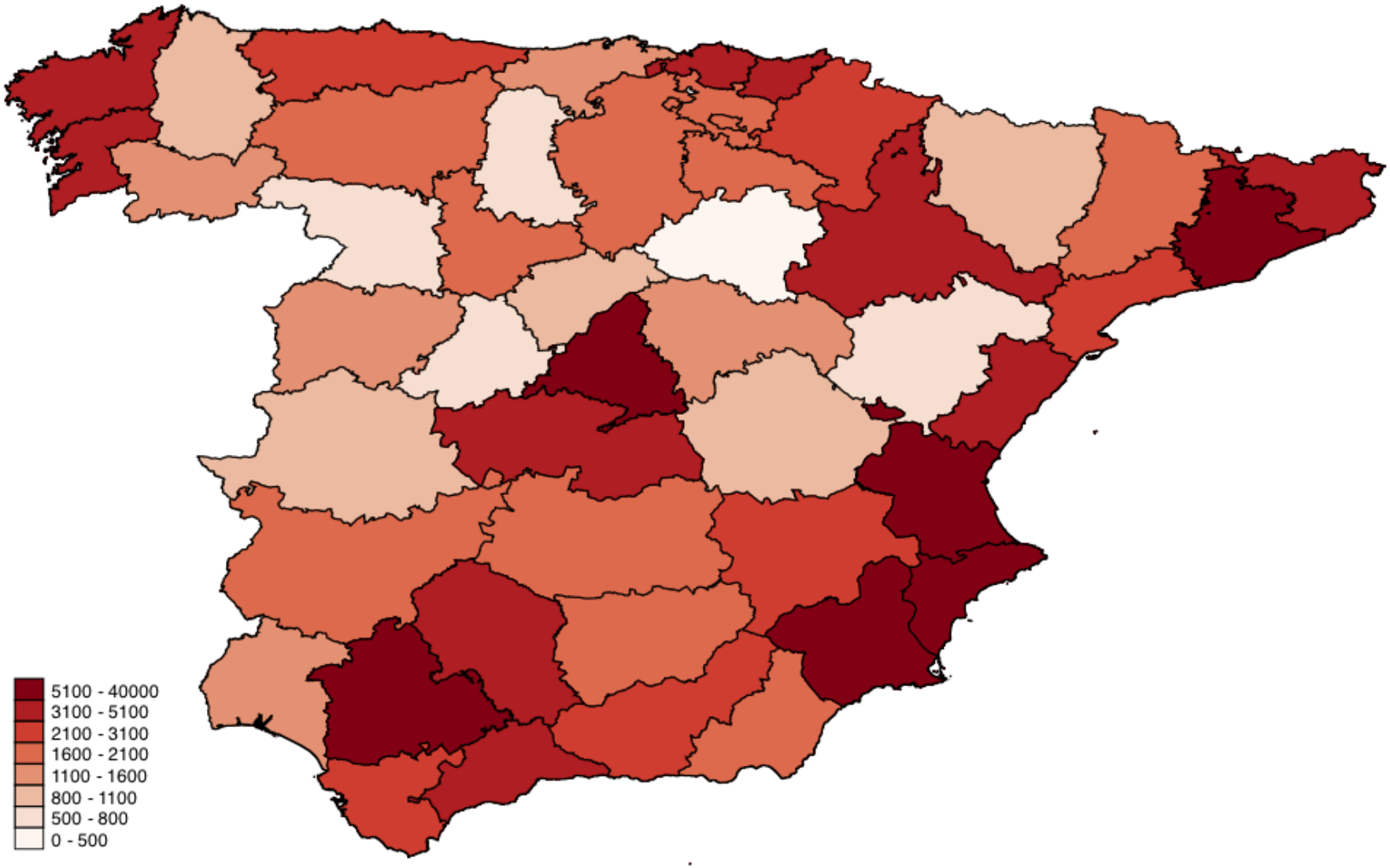
- Thus, we can conclude that the vent-for-surplus mechanism explains 51.71% (=5.79%/11.99%) of the observed boom-to-bust growth in exports.

Summary

- We have provided evidence for the substitutability between domestic and foreign markets at short/medium-term horizons.
- If a model with constant marginal costs does not fit the data, perhaps trade economists should embrace models with variable marginal costs (e.g., due to capacity constraints).
- Quantification: the vent-for-surplus channel can explain a substantial part of the Spanish "export miracle" of 2009-13.

EXTRA SLIDES

Number of Manufacturing Firms by Province



Number of Manufacturing Exporters by Province