

The Gains from Foreign Multinationals in an Economy with Distortions

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Motivation

- ▶ Countries and regions within countries compete fiercely for the attraction of foreign multinationals (MNEs) – as an “import” of know-how and capital
- ▶ In less developed countries, distortions are prevalent and likely to influence the (mis)allocation of resources
 - * Highly distorted establishments/locations remain inefficiently small
- ▶ We know little about the effects of foreign MNEs on resource reallocations across distorted segments of the economy
 - * If resources reallocate towards more distorted segments then allocative efficiency ↑

The gains from foreign multinationals in an economy with distortions

1. Framework to study the welfare effects of foreign MNEs in setting w/ distortions

- * As Baqaee and Farhi (2023a), FOA & allow for arbitrary tax-like wedges/distortions (primitives)
- * Add external spillovers, frictions to move across sectors, internal migration
- * Highlight parameters & data needed to quantify the effect of MNEs and role of alloc. effic.

2. MX: combine panel data on cell-level (estab.-type \times CZ) outcomes w/ cell-level distortions

- * Economic Census panel b/n 1994-2019 on foreign MNEs (maquila or non-maquila) + domestic establishments (formal or informal). Cell: estab.-type \times CZ
- * Output and input distortions (e.g., crime, corruption, taxes, subsidies) by estab.-type \times CZ

3. Estimate the CZ-level effect of MNE employment growth on the domestic economy

- * IV based on the past spatial clustering by origin country of the foreign MNEs
- * Average effects; split by maquila/non-maquila MNEs; on formal vs. informal sector

4. Use estimates from reduced form to calibrate the model and conduct counterfactuals

- * Model shock as an increase in TFP of MNEs
- * Quantify the overall effect of MNE expansion and importance of alloc. effic. margin

Outline

Framework

Data and context

Effects of foreign MNEs on the domestic economy

Calibration and counterfactuals

Conclusion

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General model environment

- ▶ There are different entities i and j . An entity can be:
 - * Representative consumer in location c (CZs in MX + RoW)
 - * Representative producers $s \in \mathcal{N}$; \mathcal{N}_c in c
 - * Factors of production $f \in \mathcal{F}$; \mathcal{F}_c in c
- ▶ Four producer types (one of each type in each c)
 - * Foreign MNEs (maquila or non-maquila) and domestic (formal or informal)
- ▶ Three factors of production (one of each type in each c)
 - * Capital (freely mobile), low- and high-skill workers (imperfectly mobile)
- ▶ Revenue expenditure matrix Ω :
 - * Ω_{ij} : expenditure of entity i on goods/factor j as a share of its total revenue/income
- ▶ An arbitrary set of distortions μ_{ij} that create wedges between p and mc
 - * $\tilde{\Omega}_{ij} = \mu_{ij}\Omega_{ij}$, where $\tilde{\Omega}$ is the expenditure matrix based on the price paid by the buyer

Preferences and production

- ▶ Producer s uses intermediate inputs and factors of production:

$$y_s = A_s F_s (\{x_{sk}\}_{k \in \mathcal{N}}, \{l_{sf}\}_{f \in \mathcal{F}_c})$$

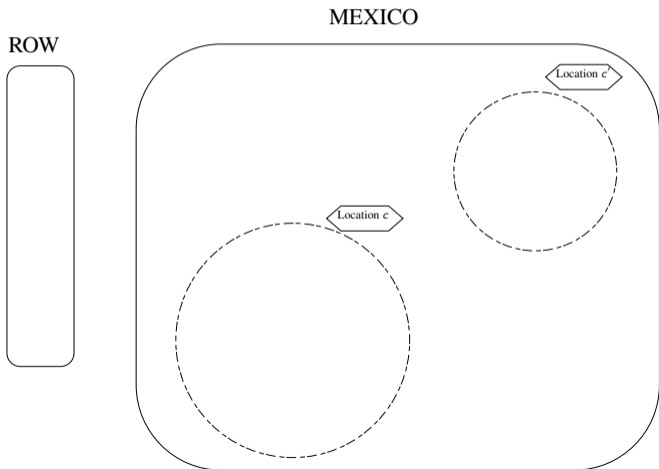
- ▶ The representative household in each c has HOD(1) utility
- ▶ Real income W_c :

$$W_c = \frac{I_c}{P_c}, \quad I_c = \underbrace{\sum_{f \in \mathcal{F}_c} \sum_{s \in \mathcal{N}_c} w_{fs} L_{fs}}_{\text{Factor income}} + R_c + D_c,$$

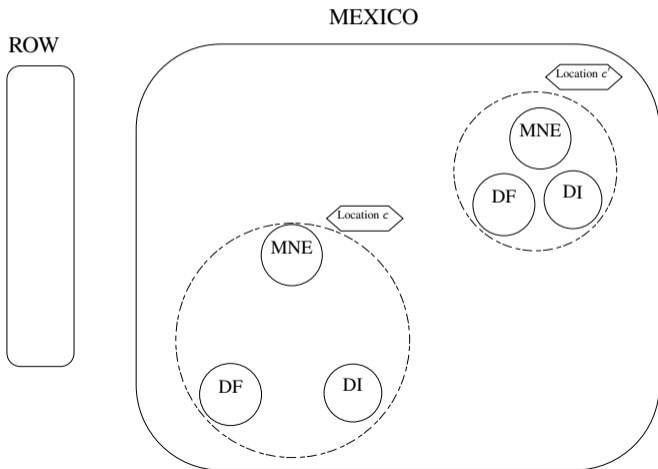
where R_c is the revenue from distortions and D_c are transfers/deficits

- ▶ We use the change in real income as a proxy for the change in welfare

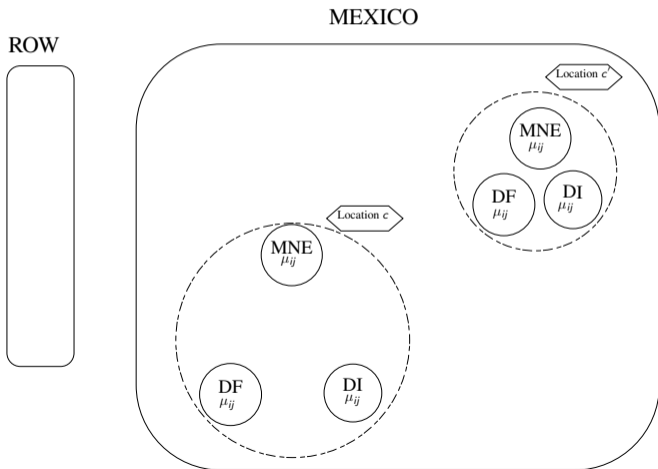
Framework sketch



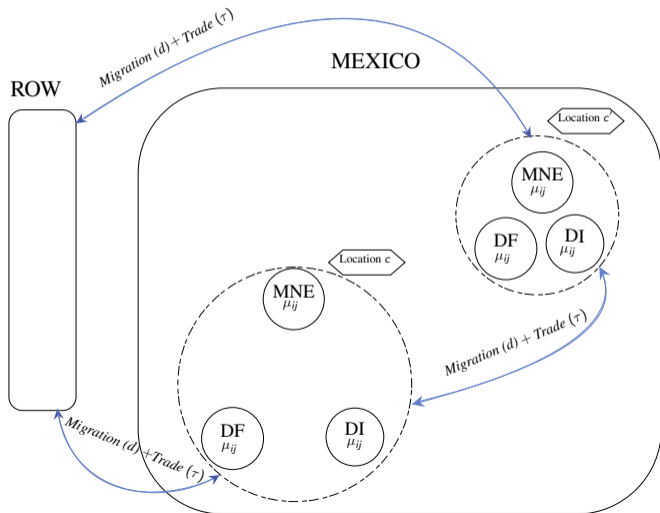
Framework sketch



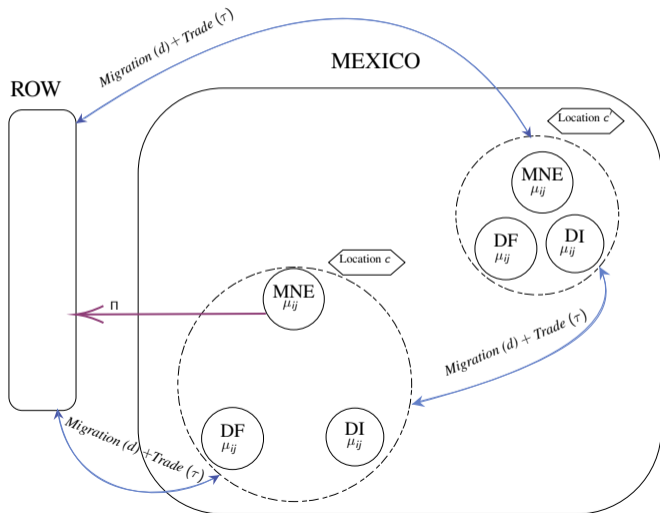
Framework sketch



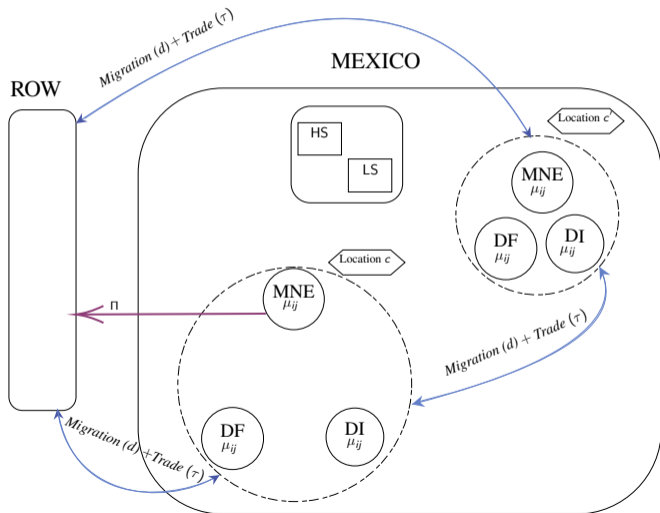
Framework sketch



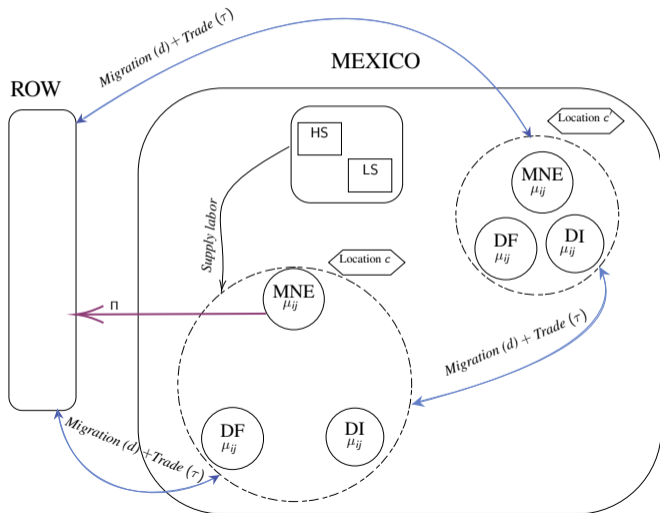
Framework sketch



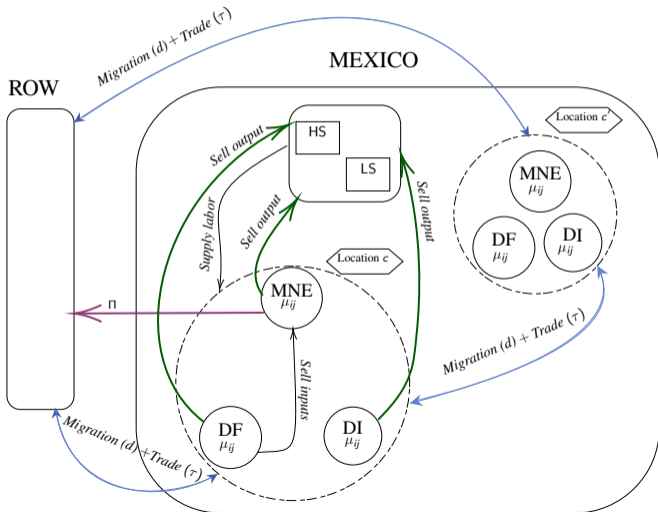
Framework sketch



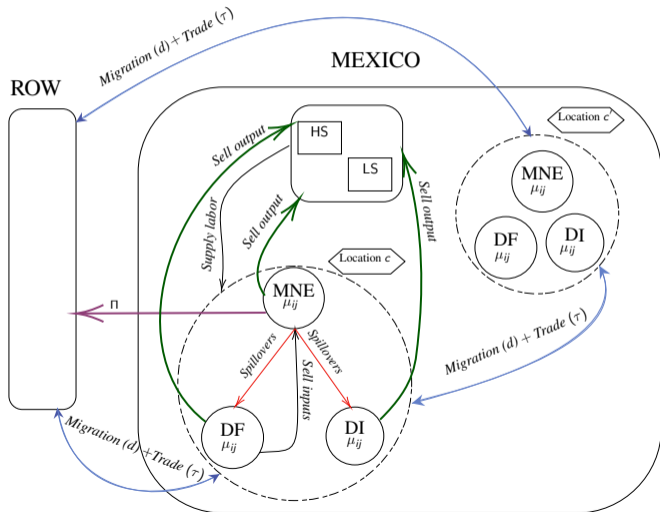
Framework sketch



Framework sketch



Framework sketch



Change in real income for CZ c

$$\begin{aligned}
 d \log W_c = & \underbrace{\sum_{ij} \tilde{\Psi}_{ij}^{W_c} d \log \tilde{A}_j}_{\text{Technological change}} + \underbrace{\sum_{ij} \tilde{\Psi}_{ij}^{W_c} \sum_{k \in \mathcal{N}_c} \gamma_{j,k} d \log L_k}_{\text{Spillovers}} \\
 & + \underbrace{\sum_{f \in \mathcal{F}_c, s \in \mathcal{N}_c} (\lambda_{fs}^c - \tilde{\Psi}_{fs}^{W_c}) d \log w_{fs} - \sum_{f \notin \mathcal{F}_c, s \notin \mathcal{N}_c} (\tilde{\Psi}_f^{W_c}) d \log w_{fs}}_{\text{Changes in (factoral) ToT}} \\
 & + \underbrace{\lambda_R^c [d \log R_c - d \log L_c]}_{\text{Revenue per capita from distortions, fixed wedges}} - \underbrace{\sum_{ij} \tilde{\Psi}_{ij}^{W_c} d \log \mu_{ij}}_{\text{Change in wedges}}
 \end{aligned}$$

- ▶ $\tilde{\Psi} = (I - \tilde{\Omega})^{-1}$: Leontief matrix (based on values paid by the buyer)
- ▶ $\gamma_{j,k}$: Spillover elasticity from producer k to j
- ▶ λ_{fs}^c : Income of factor f employed by producer s in c over total income of c
- ▶ λ_R^c : Distortion revenue over total income of c
- ▶ **Blue**: what we observe in the initial period. **Purple**: what we calibrate. **Green**: what we assume away. **Red**: the “reallocation effects” that we infer from model

Mapping the theory to the data. We need...

1. The distortions μ_{ij} (measured in the data)
2. The input-output share Ω_{ij} between all entities i and j
 - * Combination of data, gravity structure, and proportionality assumptions
3. Allen-Uzawa demand and supply elasticities
 - * We can write the Allen-Uzawa elasticities as a function of the CES EoS
 - * **We calibrate key EoS to match reduced form regression results**
4. The size of the prod shocks to MNEs, the prod spillover and migration elasticities
 - * Indirect inference: Use causally-identified coefficients as targets
 - * For a set of elasticities and productivity $\Delta\%$, model gives (i) $\Delta\%$ in foreign employment in CZs, (ii) $\Delta\%$ in formal emp, (iii) $\Delta\%$ informal emp, and (iv) $\Delta\%$ total pop across CZs
 - * We iterate over the elasticity values and productivity changes until the CZ-level effects across CZs match empirical evidence

Framework

Data and context

Effects of foreign MNEs on the domestic economy

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Establishment-level data

- ▶ Source: **Economic Census**. Collected by INEGI
- ▶ Time frame: **1994-2019**. Collected every 5 years
- ▶ Covers not only formal establishments but also the **informal** ones
 - * An informal establishment is one that does not comply with the legal requirement to pay social security contributions for its workers (as in [Ulyssea, 2020](#))
- ▶ (Unbalanced) **panel** tracking: location, total sales, assets, number of workers, wagebill, value added
- ▶ **Foreign ownership**
 - * Foreign MNEs \equiv ownership \geq 50% foreign ([Alfaro and Chen, 2018](#))
 - * Maquila (income from maquila activities $>$ 0) vs. non-maquila foreign MNEs

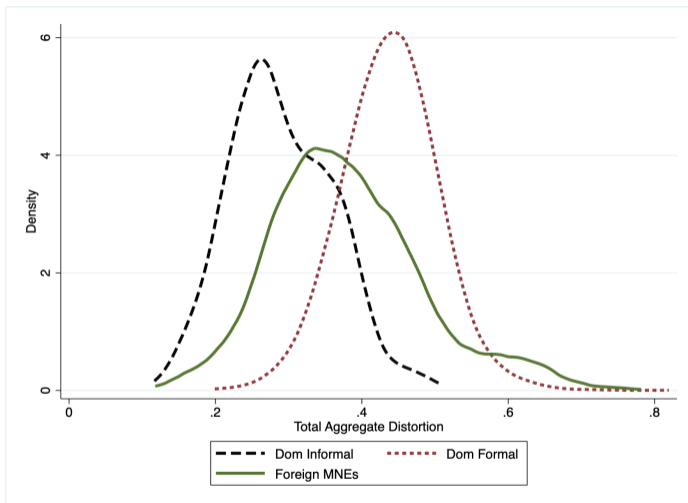
Distortions: two approaches to measurement

- ▶ **Indirect measurement** (Hsieh and Klenow, 2009): use dispersion in MRPK and MRPL to infer input and output distortions
 - * Pros: less data intensive, comparability
 - * Cons: more reliant on assumptions

- ▶ **Direct measurement:** gather data directly on each input and output distortion (by establishment-type and commuting zone)
 - * Pros: less reliant on assumptions, more informative for policy
 - * Cons: data intensive + “where do we stop?”

- ▶ We do the direct approach combining different surveys:
 - * Regulation and bureaucracy
 - * Crime and corruption
 - * Taxes, social contributions and subsidies

Informal establishments face the lowest distortions, then the foreign MNEs



Histogram of total (output and input) distortions

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CZ-level exposure to foreign MNEs

$$\widehat{X}_{cz,t}^F \equiv \frac{\overbrace{L_{cz,t}^F - L_{cz,t-5}^F}^{\Delta \text{ in foreign MNE employment in the CZ}}}{\underbrace{L_{cz,t-5}^F + L_{cz,t-5}^D}_{\text{Total employment in the CZ}}}$$

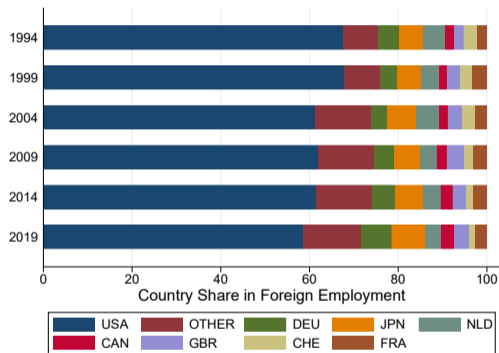
- ▶ *cz*: commuting zone in Mexico (781 CZs)
- ▶ $L_{cz,t-5}^F$ and $L_{cz,t-5}^D$: total employment in foreign MNEs (*F*) and domestic establishments (*D*) in CZ *cz* in year ($t - 5$)
- ▶ t : Economic Census year, i.e., 1994, 1999, 2004, 2009, 2014, 2019
- ▶ $t - 5$: the year of the previous Economic Census (5 years before)

CZ-level regression specification

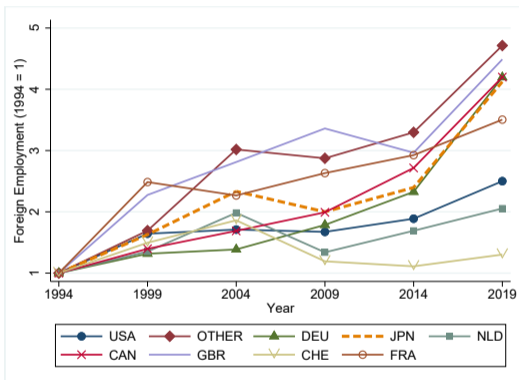
$$\log y_{cz,t} - \log y_{cz,t-5} = \beta \widehat{X}_{cz,t}^F + \theta' K_{cz,t} + \Delta \epsilon_{cz,t}$$

- ▶ cz : commuting zone (CZ) in Mexico. t : Economic Census years
- ▶ $y_{cz,t}$: outcome of domestic establishments in CZ cz in year t
- ▶ Outcomes: # domestic establishments in CZ cz + across all domestic establishments in CZ cz the total sales, # workers, wage bill, VA and assets
- ▶ $K_{cz,t}$ includes various time-variant CZ-level and regional controls [details](#)
- ▶ Obs. are weighted by the number of workers in domestic establishments in 1994
- ▶ SEs are clustered at the CZ-year level

Foreign MNE employment in Mexico has grown and diversified in its country of origin

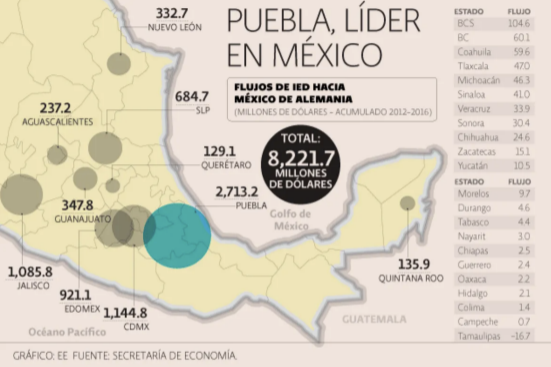


(a) Foreign MNE employment share by origin

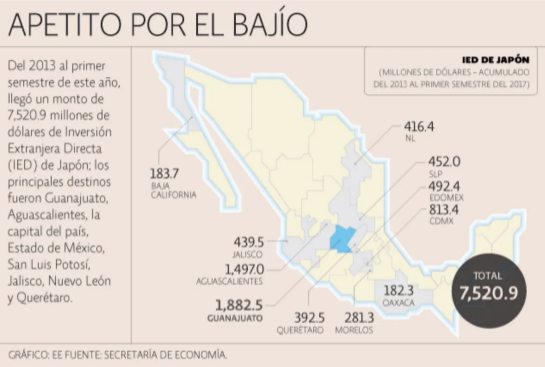


(b) Foreign MNE employment growth

Spatial concentration of MNEs from Germany and Japan into Mexico



(a) German MNEs cluster in Puebla



(b) Japanese MNEs cluster in Guanajuato

Source: *El Economista* articles [here](#) and [here](#)

CZ-level regression results: OLS and IV for all domestic establishments

$$\log y_{cz,t} - \log y_{cz,t-5} = \beta \widehat{X}_{cz,t}^F + \theta' K_{cz,t} + \Delta \epsilon_{cz,t}$$

	LFP (1)	Pop. (2)	Establ. (3)	Workers (4)	HS Workers (5)	LS Workers (6)	Sales (7)	VA (8)	Wage Bill (9)	HS Wage Bill (10)	LS Wage Bill (11)	Assets (12)
Panel A: OLS												
$\widehat{X}_{cz,t}^F$	-0.001 (0.011)	0.069 (0.072)	0.042 (0.022)	0.120*** (0.031)	0.214*** (0.076)	0.105 (0.057)	0.249*** (0.067)	0.314*** (0.083)	0.271*** (0.060)	0.425*** (0.097)	0.243*** (0.066)	0.093 (0.111)
Panel B: IV												
$\widehat{X}_{cz,t}^F$	0.034 (0.062)	0.620*** (0.156)	0.417** (0.177)	0.333** (0.144)	0.360 (0.281)	1.405** (0.597)	1.00*** (0.303)	1.475*** (0.409)	1.618*** (0.355)	0.974** (0.416)	1.800*** (0.565)	0.568 (0.714)
Observations	3,825	3,825	3,825	3,825	3,166	3,487	3,825	3,825	3,825	3,166	3,487	3,825
F-statistic	35.11	35.11	35.11	35.11	34.95	35.01	35.11	35.11	35.11	34.95	35.01	35.11

FE: Economic Region \times Year. Cluster: CZ-Year. Obs weighted by initial CZ dom employment

Controls: Trade exposure (x3) + various time-variant CZ-level controls

FS and RF

What segment of the local economy grows more after foreign MNE expansions?

Formal or informal?

Ex-ante not obvious whether foreign MNEs would benefit more the domestic formal or domestic informal sector. Two examples (captured in our framework):

- ▶ Domestic formal varieties are likely to be closer substitutes with those of foreign MNEs, having less to gain from their presence
- ▶ Domestic formal establishments are more likely to supply inputs to foreign MNEs, having more to gain from their presence

CZ-level IV estimates for the domestic formal vs. informal sectors

$$\log y_{i,cz,t} - \log y_{i,cz,t-5} = \beta_1 \widehat{X}_{cz,t}^F + \beta_2 \widehat{X}_{cz,t}^F \times \mathbb{1}\{i = D_I\} + \beta_3 \mathbb{1}\{i = D_I\} + \theta' K_{cz,t} + \Delta \epsilon_{i,cz,t}$$

	Establishments (1)	Workers (2)	Sales (3)	VA (4)	Wage Bill (5)	Assets (6)
$\widehat{X}_{cz,t}^F$	0.636*** (0.157)	0.662*** (0.185)	1.222*** (0.341)	1.436*** (0.419)	3.086*** (0.575)	0.166 (0.816)
$\widehat{X}_{cz,t}^F \times \mathbb{1}\{i = D_I\}$	-0.402 (0.261)	-0.938*** (0.310)	-0.688 (0.614)	-0.086 (0.534)	-4.002*** (0.899)	1.458 (1.189)
Observations	6,821	6,821	6,821	6,824	6,772	6,805
F-statistic	17.24	17.24	17.24	17.23	17.23	17.24

FE: Economic Region \times Year. Cluster: CZ-Year. Obs weighted by initial CZ dom i employment

Controls: Trade exposure (x3) + various time-variant CZ-level controls

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Calibration

Today: What would be the gains from foreign MNEs in Mexico if we were to ignore the distortions in the country?

- ▶ Assume 10% productivity shock in places with increases in MNE employment
- ▶ Calibrate spillovers from MNE (no separation of maquila vs non-maquila) on the domestic formal and informal sectors
- ▶ Take all EoS from the literature [details](#)

Future work:

- ▶ Calibration of the shock + estimation of most EoS [sketch](#)
- ▶ In a world with place-based policies, what would the welfare effects of foreign MNEs be if foreign MNEs were attracted to low/high-distortion locations?

Welfare effects: 10% productivity shock in places with + in foreign MNE employment

Table: Welfare effects: averages for three groups of CZs

	Scenario			
	Wedges-Spillovers (1)	No wedges-Spillovers (2)	Wedges-No spillovers (3)	No wedges-No spillovers (4)
All CZs	6.38% (0.024)	4.83% (0.020)	5.10% (0.023)	4.14% (0.018)
CZs without foreign MNEs	5.84% (0.016)	4.28% (0.013)	4.88% (0.020)	3.94% (0.016)
CZs with foreign MNEs	8.07% (0.034)	6.57% (0.027)	5.81% (0.029)	4.80% (0.023)

Parameters

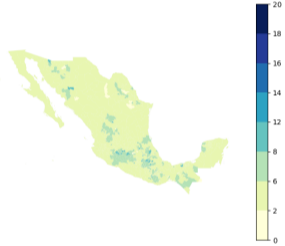
Conclusion

- ▶ Present a model to quantify the welfare effects of foreign MNEs' expansion in an economy with distortions
- ▶ Document the extent and heterogeneity of distortions in Mexico:
 - * Domestic informal estab. tend to be less distorted than domestic formal ones
 - * Foreign MNEs' distortions higher than dom informal but lower than dom formal
 - * Great heterogeneity within establishment-type and across space and distortion type
- ▶ Estimate that more foreign MNE employment growth in a CZ tends to:
 - * Increases the size of the domestic formal sector
 - * Leave the size of the domestic informal sector – on net – unaffected
 - * Maquila MNEs tend to have weaker positive effects than non-maquila
- ▶ Quantify (so far)
 - * Considering distortions amplifies the welfare gains of foreign MNEs
 - * Most CZs experience additional gains from these reallocation effects

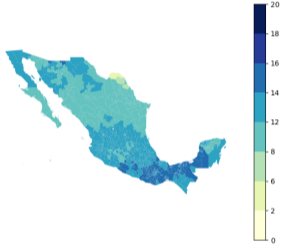
Thank you!

Appendix

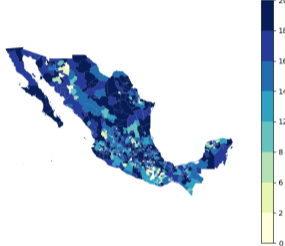
Spatial concentration of distortions in Mexico



(a) Crime distortions



(b) Capital distortions



(c) Labor taxes

Example: Cost of crime, security and bribes

- ▶ Source: ENVE (National Survey of Crime on Businesses or *Encuesta Nacional de Victimización de Empresas*). 2012, 2014, 2016, 2018. 34,443 establishments Strata: state, industry group, size bin
- ▶ The total cost of crime is the sum across the loss values declared in response to:
 - * What is the total cost incurred by your establishment on means of crime prevention?
 - * If your establishment has experienced any loss due to theft and vandalism, what was the total cost of the losses incurred?
 - * Did you have products shipped to supply domestic markets that were lost due to theft? If yes, what share of the value of your shipped products was lost due to theft?
 - * What was the total amount that the government employee(s) or public servant(s) appropriated during year X to expedite, approve or avoid any procedure?
 - * During year X, did a third person or “coyote” ask you to give a gift, favor or money, in the name of a government employee or public servant to expedite, approve or avoid any procedure? What was the total value of these gifts, favors or money?
- ▶ We merge ENVE with Economic Census via establishments ID and project on observables (e.g., location, industry, type, size). Assign value to all establishments based on their obs. Report as % of sales

Example cont'd: Crime as a major constraint on businesses of all sizes



ANALYSIS

Majority of Businesses Hurt by Crime in Mexico: Report

EXTORTION / 12 NOV 2018 BY PATRICK CORCORAN  EN  

A new report from Mexico's statistics institute provides fresh evidence that the country's ongoing security crisis has taken a toll on the local economy, particularly on large businesses.

Of more than 35,000 businesses surveyed in 2017, a third reported being victims of crimes, including robbery, shoplifting and extortion, according to the latest [National Survey of Business Victimization](#) (Encuesta Nacional de Victimización de Empresas - ENVE), by Mexico's National Institute of Statistics and Geography (Instituto Nacional de Estadística y Geografía - INEGI).

This is the fourth time the INEGI has released its report, which has now found that large businesses are particularly targeted by criminal groups, both big and small.

Yet nearly 32 percent of Mexico's [micro-businesses](#), which are defined as those that employ ten or fewer people and represent around 97 percent of the number of Mexican firms, reported suffering a crime in 2017.

In contrast, small, medium, and large firms reported higher rates of victimization: 59.3 percent, 61.5 percent, and 51.4 percent, respectively.

InSight Crime Analysis

The findings of the fourth ENVE survey paint a devastating picture of how Mexico's security crisis is affecting the nation's economy.

Nearly one-fifth of the businesses surveyed reported that they had reduced their hours of operation as a result of criminal threats. More than six percent said they had simply pulled out altogether, and 13 percent reported having reduced investments.

Whether directly or indirectly, all of these responses represent a reduction of Mexico's economic activity.

Tags

EXTORTION

MEXICO

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In the aggregate, both foreign MNEs and domestic informal establishments are growing in importance

	1994		2019	
	Domestic Informal	Foreign Multinationals	Domestic Informal	Foreign Multinationals
Workers	30.81	10.41	44.63	11.88
Sales	8.33	17.41	30.67	17.45
Wage bill	2.00	19.79	9.00	25.72
Assets	4.50	15.45	37.24	12.45

Note: The table contains the % of each row variable in the overall Mexican economy in establishments that are either domestic informal or foreign MNEs. Domestic formal establishments are the complement to 100%.

1. Changes in good and factor prices (as in BF)
2. Changes in distortion revenue (as in BF)
3. Changes in expenditure shares (as in BF)
4. Changes in factor income (as in BF)
5. Changes in capital allocations (as in BF)
6. Changes in productivity due to spillovers from MNEs (**new**)
7. Changes in labor allocations (**new: migration + Roy model**)

Solving the system requires a set of **Allen-Uzawa demand** (how entities substitute goods and inputs) and **supply** (how workers substitute the different type of producers) **elasticities**

- ▶ We assume a nested CES structure for consumers and producers

1. Final consumer demand

- * Utility in c is a CES of formal vs informal varieties, with EoS ξ
 - * The formal composite is a CES of foreign MNE vs domestic formal, with EoS $\epsilon \geq \xi$
 - * Consumption of each of the composite goods follows Armington, with EoS $\sigma > 1$

2. Production functions

- * The four producer types are linked by an input-output structure but informal producers do not sell to foreign MNEs ([Alfaro-Ureña et al., 2022a](#))
- * The production function of each producer type is a CES aggregator of intermediate inputs and VA, with EoS ζ
 - * Intermediate inputs are a CES of the different producer-types, with EoS ϵ
 - * Value-added is a CES of labor vs capital, with EoS ι
 - * Labor is a CES of low and high-skilled workers, with EoS σ_L

3. Labor supply decision to each producer type

- * Build on [Galle et al. \(2023\)](#). Workers draw idiosyncratic amenity shocks to work in each producer from a nested Fréchet
 - * First nest (parameter κ) captures how easy it is for workers to substitute jobs between informal and formal producers
 - * Second nest (parameter $\theta \geq \kappa$) captures how easy it is for workers to substitute jobs between foreign MNEs and domestic formal producers

4. Migration decision

- * Build on [Monte et al. \(2018\)](#). Assume that workers choose location based on amenities and real income, and draw idiosyncratic shocks from a Fréchet (para η)

5. Spillovers:

- * We assume TFP spillovers across firm types: $\log A_j = \log \tilde{A}_j + \sum_{k \in \mathcal{N}_c} \gamma_{j,k} \log L_k$
- * The productivity of domestic firms, formal and informal, increases as MNEs expand

Details for the system to solve to calculate the reallocation effects

back

- Changes in good and factor prices:** $d \log p_{ij} = d \log \tau_{ij} + d \log \mu_{ij} - d \log A_j + \sum_{k \in \mathcal{N} \cup \mathcal{F}_c} \tilde{\Omega}_{jk} d \log p_{jk}$
- Changes in distortion revenue:** $dR_c = \sum_{ij \in \mathcal{O}_c} (\mu_{ij} - 1) \tilde{\Omega}_{ij} \lambda_i (d \log \tilde{\Omega}_{ij} + d \log \lambda_i) + \mu_{ij} \lambda_i \tilde{\Omega}_{ij} d \log \mu_{ij}$
- Changes in expenditure shares:** $d \log \tilde{\Omega}_{ij} = \delta_i(j, j) d \log p_{ij} + \sum_k \tilde{\Omega}_{ik} \theta_i(j, k) d \log p_{ik}$
- Changes in factors' income:**
 $d \log \lambda_{f(c)s(c)} = d \log \tilde{\Omega}_{s(c)f(c)} + \sum_h \Omega_{hs(c)} d \log \lambda_h + \sum_{h,k} \Omega_{k(h)s(c)} d \log \lambda_{k(h)}$
- Changes in capital factor:** $d \log r = \sum_{s,c} \frac{\tilde{\Omega}_{s(c),K} \lambda_{s(c)}}{\lambda_K} (d \log \tilde{\Omega}_{s(c),K} + d \log \lambda_{s(c)})$
 $d \log K_{s(c)} = d \log \lambda_{s(c),K(c)} - d \log r$
- Changes in productivity:** $d \log A_k = d \log \tilde{A}_k + \sum_{j \in \mathcal{N}_c} \gamma_{kj} d \log L_j$
- Changes in labor factor:**

$$d \log L_{f(c)s(c)} = \phi_{f(c)}(c, c) \cdot d \log W_c + \sum_h \pi_{f(c)f(h)} \cdot \eta_{f(c)}(c, h) \cdot d \log W_h$$

$$+ \varphi_{f(c)}(s(c), s(c)) \cdot d \log w_{f(c),s(c)} + \sum_k \pi_{f(c)k(c)} \cdot \kappa_{f(c)}(s(c), k(c)) \cdot d \log w_{f(c),k(c)}$$

- ▶ We assume a nested CES demand:

$$U_c = \left(\alpha_{c,D_F \cup F} C_{D_F \cup F}^{\frac{\xi-1}{\xi}} + \alpha_{c,D_I} C_{D_I}^{\frac{\xi-1}{\xi}} \right)^{\frac{\xi}{\xi-1}}, \quad C_{D_F \cup F} = \left(\alpha_{c,D_F} C_{D_F}^{\frac{\epsilon-1}{\epsilon}} + \alpha_{c,F} C_F^{\frac{\epsilon-1}{\epsilon}} \right)^{\frac{\epsilon}{\epsilon-1}}$$

- * Nested CES across sectors $s \in \{D_I, D_F, F\}$
- * Armington model within each sector s
- * Domestic formal varieties (D_F) are closer substitutes to foreign MNE ones (F): $\sigma_s \geq \epsilon \geq \xi$

- ▶ We also assume a nested CES production function:

$$Y_{s(c)} = \left(\beta_{s(c),D_I} Q_{s(c),D_I}^{\frac{\zeta-1}{\zeta}} + \beta_{s(c),D_F \cup F} Q_{s(c),D_F \cup F}^{\frac{\zeta-1}{\zeta}} + \beta_{s(c),VA} VA_{s(c)}^{\frac{\zeta-1}{\zeta}} \right)^{\frac{\zeta}{\zeta-1}},$$

- * In each location c , we have one representative producer per sector $s \in \{D_I, D_F, F\}$
- * $s(c)$: producer-sector s in location c
- * $VA_{s(c)}$: composite input of labor and capital
- * If producer-sector s is F , it doesn't use inputs from the domestic informal sector D_I

- ▶ We then compute the Allen-Uzawa EoS given values of CES EoS

Roy model:

- ▶ The share of workers from group g in location c that decide to work in producer type $F \cup D_F$ and type I is:

$$\pi_{g(c), F \cup D_F} = \frac{B_{g(c), F \cup D_F} w_{g(c), F \cup D_F}^\kappa}{B_{g(c), F \cup D_F} w_{g(c), F \cup D_F}^\kappa + B_{g(c), D_I} w_{g(c), D_I}^\kappa}, \quad \pi_{g(c), D_I} = \frac{B_{g(c), D_I} w_{g(c), D_I}^\kappa}{B_{g(c), D_F} w_{g(c), D_F}^\kappa + B_{g(c), D_I} w_{g(c), D_I}^\kappa},$$

- ▶ The share of workers that decide to work in producer of type s within the formal sector is:

$$\pi_{g(c), s(c)} = \frac{B_{g(c), s(c)} w_{g(c), s(c)}^\theta}{\sum_{k \in \{D_F, F_M, F_N\}} B_{g(c), s(c)} w_{g(c), k(c)}^\theta},$$

Migration:

- ▶ The share of workers from group g that live in location c and migrate to location c' is:

$$\pi_{g(c), c'} = \frac{(B_{g(c')} U_{g(c')} d_{g(c), c'})^\eta}{\sum_\ell (B_{g(\ell)} U_{g(\ell)} d_{g(c), \ell})^\eta}$$

Connecting the model and the reduced form

- ▶ We calibrate the changes in foreign MNE productivity to match foreign MNE employment changes in c over the same time frame
 - * We use the IV-predicted change to isolate the exogenous part of the foreign MNE employment
- ▶ We plan to use inference matching to find the parameters that match our reduced-form estimates (overall and differentially for the formal vs. informal sector):
 - * Productivity spillovers from foreign firms to the local economy:
 - * $\gamma_{D_F, F_M}, \gamma_{D_F, F_N}, \gamma_{D_I, F_M}, \gamma_{D_I, F_N}$
 - * EoS in the production function:
 - * σ_L : low vs. high-skilled workers
 - * ι : labor vs. capital
 - * Labor supply elasticities:
 - * κ : domestic formal vs. foreign MNEs
 - * θ : formal vs. informal producers

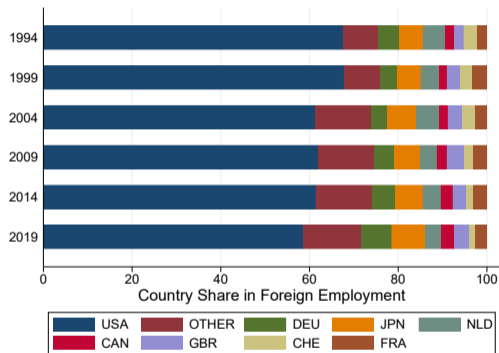
Maquila vs. non-maquila foreign MNEs

Any maquila income	Establishments share (1)	Workers share (2)	Sales (3)	Workers (4)	Sales/ worker (5)	Assets/ worker (6)	Exports share (7)
No	0.77	0.33	16,189.3	156.7	126.8	26.5	0.09
Yes	0.23	0.67	9,542.0	526.5	22.8	7.3	0.71

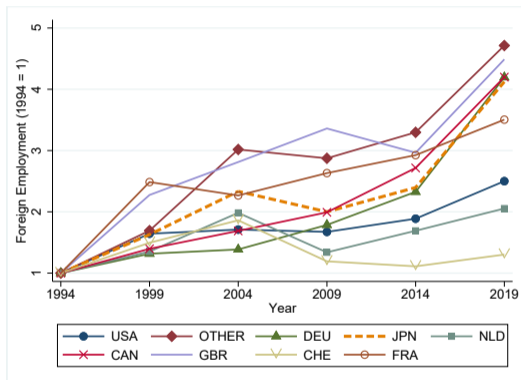
Foreign MNEs with any income from maquila activities are:

- ▶ Substantially larger employers
- ▶ More labor-intensive / less capital-intensive
- ▶ More export-oriented (and import-reliant)

Foreign MNE employment in Mexico has grown and diversified in its country of origin

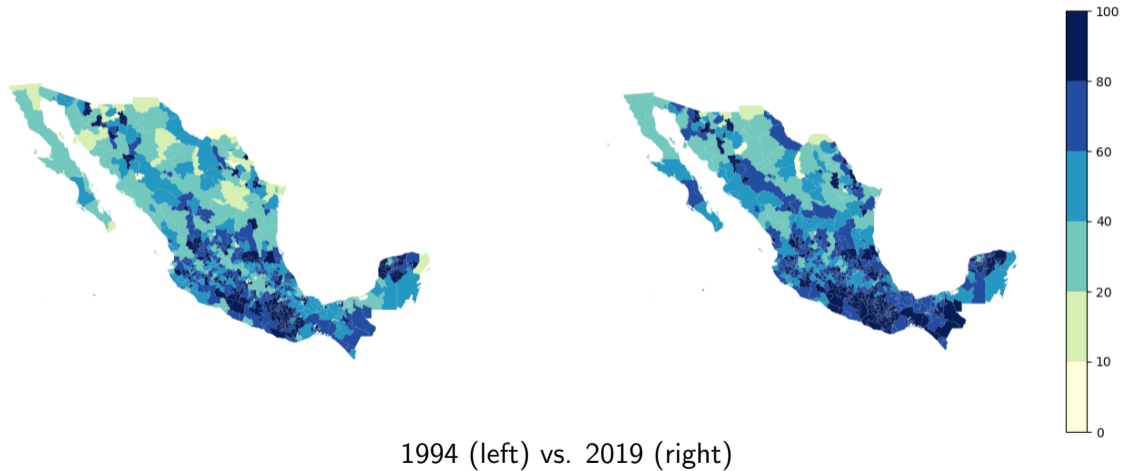


(a) Foreign MNE employment share by origin



(b) Foreign MNE employment growth

Domestic informal employment share across CZs



Output and input distortions in Mexico by establishment type

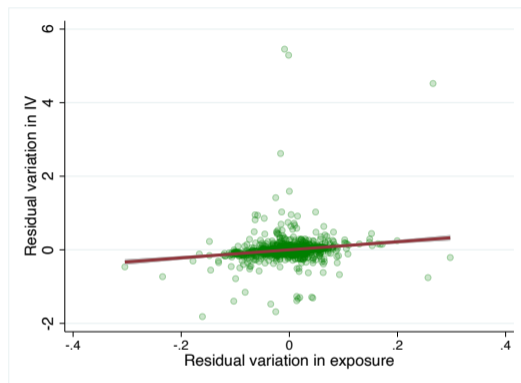
Mfg	Establishment Type	Output Distortions			Input Distortions	
		Bureaucracy & Regulation	Crime, Security & Bribes	VAT	Interest Rates	Labor Tax
No	Domestic Informal	4.76	7.67	5.16	11.91	0.00
	Domestic Formal	6.59	3.66	7.41	12.67	16.22
	Foreign MNEs	3.37	1.61	9.26	8.40	17.06
Yes	Domestic Informal	3.15	7.41	3.95	11.02	0.00
	Domestic Formal	4.49	2.50	5.13	13.05	17.85
	Foreign MNEs	4.16	0.95	3.38	4.37	20.55

$K_{CZ,t}$ – the vector of time-variant CZ-level and regional controls

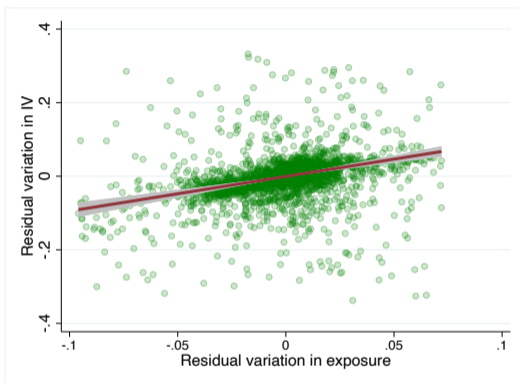
$$\log y_{CZ,t} - \log y_{CZ,t-5} = \beta \widehat{X}_{CZ,t}^F + \theta' K_{CZ,t} + \Delta \epsilon_{CZ,t}$$

- ▶ Economic-region (ER)-by-year FEs: controls for trends at the ER-level (8 ERs in Mexico)
- ▶ CZ FEs: controls for time-invariant differences in trends across CZs
- ▶ CZ-by-year level controls from IPUMS. All defined as shares of individuals in CZ:
 - * (i) living in an urban place; (ii) in manufacturing; (iii) with a secondary degree; (iv) employed; (v) in routine occupations; (vi) indigenous; and (v) foreign-born
- ▶ “China shock” controls
 - * CZ-by-year level import exposure measures from China [details](#)
 - * CZ-by-year level exposure to competit. w/ China in Mexico’s export markets [details](#)
- ▶ CZ-by-year level import exposure measures from the U.S. [details](#)
- ▶ Share of domestic employment in the CZ in year $(t - 5)$, $\frac{L_{CZ,t-5}^D}{L_{CZ,t-5}^F + L_{CZ,t-5}^D}$

Relevance of the instrument [Back](#)



(a) $\widehat{Z}_{CZ,t}^F$ vs. $\widehat{X}_{CZ,t}^F$. Full sample

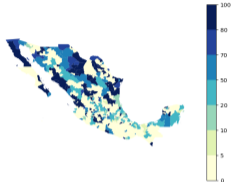


(b) $\widehat{Z}_{CZ,t}^F$ vs. $\widehat{X}_{CZ,t}^F$. Trimming top/bottom 1%

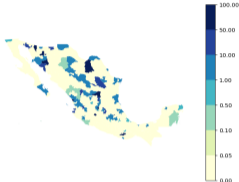
Notes: In both panels, the X-axis presents the residualized measure of exposure to foreign MNEs ($\widehat{X}_{CZ,t}^F$) and the Y-axis presents its residualized instrument ($\widehat{Z}_{CZ,t}^F$). Both variables are residualized by controlling for the vector of FE and other controls $K_{CZ,t}$. Clustering happens at the CZ-year level. The coefficients (standard errors) are 1.09 (0.13) for Panel (a) and 0.94 (0.10) for Panel (b).

Spatial concentration of foreign MNEs into Mexico by country (region) of origin (2019)

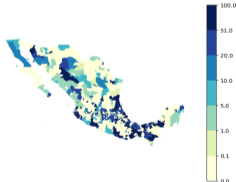
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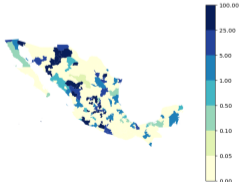
(a) United States



(b) Canada



(c) Western Europe



(d) Japan

CZ-level effects of exposure to foreign MNEs

First stage and reduced form for all domestic establishments

First Stage		Reduced Form									
$\widehat{X}_{cz,t}^F$		Establishments (1)	Workers (2)	HS Workers (3)	LS Workers (4)	Sales (5)	VA (6)	Wage Bill (7)	HS Wage Bill (8)	LS Wage Bill (9)	Assets (10)
$\widehat{Z}_{cz,t}^F$	1.073*** (0.162)	0.448** (0.177)	0.357** (0.149)	0.386 (0.314)	1.507*** (0.520)	1.075*** (0.341)	1.582*** (0.438)	1.735*** (0.311)	1.045* (0.516)	1.930*** (0.500)	0.609 (0.744)
Obs.	3,925	3,825	3,825	3,166	3,487	3,825	3,825	3,825	3,166	3,487	3,825

FE: Economic Region-Year. SE Cluster: CZ-Year. Obs weighted by initial CZ dom employment

Controls: Trade exposure (x3) + various time-variant CZ-level controls

CZ-level effects of exposure to foreign MNEs

Reduced form for domestic formal vs. domestic informal establishments

Table: Reduced Form

	Establishments (1)	Workers (2)	Sales (3)	VA (4)	Wage Bill (5)	Assets (6)
$\hat{Z}_{cz,t}^F$	0.668 (0.150)	0.669*** (0.176)	1.286*** (0.354)	1.548*** (0.441)	3.137*** (0.450)	0.253 (0.823)
$\hat{Z}_{cz,t}^F \times \mathbb{1}[i = D_I]$	-0.380 (0.247)	-0.867*** (0.273)	-0.653 (0.554)	-0.114 (0.486)	-3.703*** (0.750)	1.317 (1.034)
Observations	6,821	6,821	6,821	6,805	6,824	6,821

FE: Economic Region-Year. SE Cluster: CZ-Year. Obs weighted by initial CZ dom employment
Controls: Trade exposure (x3) + various time-variant CZ-level controls

Establishment-level specification: all domestic establishments

We follow an analogous specification to the one used in the CZ-level analysis

$$\log y_{i,cz,t} - \log y_{i,cz,t-5} = \beta \widehat{X}_{cz,t}^F + \theta' K_{cz,t} + \Delta \epsilon_{i,cz,t}$$

- ▶ Here $y_{i,cz,t}$: outcome of domestic establishment i in CZ cz in year t
- ▶ Observations are weighted by the initial establishment-level employment
- ▶ For comparability, the rest is kept the same as in the CZ-level analysis

Effects of maquila MNEs on the domestic formal vs. informal sectors (IV)

$$\log y_{i,cz,t} - \log y_{i,cz,t-5} = \beta_1 \widehat{X}_{cz,t}^F + \beta_2 \widehat{X}_{cz,t}^F \times \mathbb{1}\{i = D_I\} + \beta_3 \mathbb{1}\{i = D_I\} + \theta' K_{cz,t} + \Delta \epsilon_{i,cz,t}$$

	Establishments (1)	Workers (2)	Sales (3)	VA (4)	Wage bill (5)	Assets (6)
$\widehat{X}_{cz,t}^F$	0.543*** (0.147)	0.244 (0.160)	0.966*** (0.293)	1.099*** (0.350)	2.512*** (0.487)	1.321 (0.893)
$\widehat{X}_{cz,t}^F \times \mathbb{1}\{i = D_I\}$	-0.596** (0.253)	-0.867*** (0.298)	-0.756 (0.496)	-0.125 (0.413)	-3.548*** (0.658)	-0.126 (1.369)
Observations	6,821	6,821	6,821	6,821	6,772	6,805
F-statistic	22.01	22.01	22.01	22.01	22.00	22.00

FE: Economic Region \times Year. Cluster: CZ-Year. Obs weighted by initial CZ dom i employment
 Controls: Trade exposure (x3) + various time-variant CZ-level controls

Effects of non-maquila MNEs on the domestic formal vs. informal sectors (IV)

$$\log y_{i,cz,t} - \log y_{i,cz,t-5} = \beta_1 \widehat{X}_{cz,t}^F + \beta_2 \widehat{X}_{cz,t}^F \times \mathbb{1}\{i = D_I\} + \beta_3 \mathbb{1}\{i = D_I\} + \theta' K_{cz,t} + \Delta \epsilon_{i,cz,t}$$

	Establishments (1)	Workers (2)	Sales (3)	VA (4)	Wage bill (5)	Assets (6)
$\widehat{X}_{cz,t}^F$	1.503* (0.892)	2.973** (1.282)	3.372* (1.961)	4.646* (2.576)	4.287** (2.146)	-2.097 (3.990)
$\widehat{X}_{cz,t}^F \times \mathbb{1}\{i = D_I\}$	-0.020 (0.742)	-0.895 (0.797)	1.157 (1.913)	1.027 (1.656)	-1.994 (2.342)	9.646 (8.179)
Observations	6,821	6,821	6,821	6,821	6,772	6,805
F-statistic	3.89	3.89	3.89	3.89	3.87	3.89

FE: Economic Region \times Year. Cluster: CZ-Year. Obs weighted by initial CZ dom i employment
 Controls: Trade exposure (x3) + various time-variant CZ-level controls

Establishment-level effects: OLS and IV for all domestic establishments

	Employment	Sales	Assets	Wagebill	VA
Panel A: OLS					
$\widehat{X}_{cz,t}^F$	0.033 (0.026)	0.180*** (0.053)	0.139** (0.069)	0.078** (0.037)	0.185*** (0.065)
Panel B: IV					
$\widehat{X}_{cz,t}^F$	0.304*** (0.088)	1.070*** (0.177)	0.195 (0.317)	0.523*** (0.120)	1.353*** (0.268)
Observations	7,812,210	7,792,650	6,748,400	7,812,118	7,377,846
F-stat	53.29	51.90	52.92	53.28	53.49

FE: Economic Region \times Year. SE Cluster: CZ-Year. Obs weighted by initial estab employment
 Controls: Trade exposure (x3) + various time-variant CZ-level controls

Establishment-level effects of exposure to foreign MNEs

First stage and reduced form for all domestic establishments

Panel A: First Stage	$\widehat{X}_{CZ,t}^F$	$\widehat{X}_{CZ,t}^F$	$\widehat{X}_{CZ,t}^F$	$\widehat{X}_{CZ,t}^F$	$\widehat{X}_{CZ,t}^F$
$\widehat{Z}_{CZ,t}^F$	1.127*** (0.154)	1.123*** (0.156)	1.127*** (0.155)	1.126*** (0.154)	1.127*** (0.154)

Panel B: Reduced Form	Employment	Sales	Assets	VA	Wagebill
$\widehat{Z}_{CZ,t}^F$	0.343*** (0.097)	1.201*** (0.201)	0.219 (0.366)	1.523*** (0.266)	0.589*** (0.141)
Observations	7,812,210	7,792,650	6,748,400	7,377,846	7,812,118

FE: Economic Region-Year. SE Cluster: CZ-Year. Obs weighted by initial estab employment
Controls: Trade exposure (x3) + various time-variant CZ-level controls

Establishment-level effects: IV for domestic formal vs. informal estab

$$\log y_{i,cz,t} - \log y_{i,cz,t-5} = \beta_1 \widehat{X}_{cz,t}^F + \beta_2 \widehat{X}_{cz,t}^F \times \text{Inf}_{i,cz,t-5} + \beta_3 \text{Inf}_{i,cz,t-5} + \theta' K_{cz,t} + \Delta \epsilon_{i,cz,t}$$

	Employment	Sales	Assets	Wagebill	VA
$\widehat{X}_{cz,t}^F$	0.384*** (0.107)	0.868*** (0.207)	-0.159 (0.388)	0.644*** (0.139)	1.179*** (0.295)
$\widehat{X}_{cz,t}^F \times \text{Inf}_{i,cz,t-5}$	-0.244 (0.167)	0.612** (0.285)	1.093 (0.677)	-0.368* (0.205)	0.541* (0.317)
Observations	7,812,210	7,792,650	6,748,400	7,812,118	7,377,846
F-stat	25.85	25.28	25.41	25.85	26.09

FE: Economic Region \times Year. Cluster: CZ-Year. Obs weighted by initial estab employment

Controls: Trade exposure (x3) + various time-variant CZ-level controls

FS and RF

Establishment-level effects of exposure to foreign MNEs

Reduced form for domestic formal vs. informal establishments

Table: Reduced Form

	Employment	Sales	Assets	VA	Wagebill
$\hat{Z}_{cz,t}^F$	0.408*** (0.110)	1.033*** (0.225)	-0.068 (0.396)	1.376*** (0.291)	0.688*** (0.162)
$\hat{Z}_{cz,t}^F \times Inf_{i,cz,t-5}$	-0.218 (0.151)	0.552*** (0.240)	0.988* (0.583)	0.494* (0.275)	-0.330* (0.188)
Observations	7,812,210	7,792,650	6,748,400	7,377,846	7,812,118

FE: Economic Region-Year. SE Cluster: CZ-Year. Obs weighted by initial estab employment

Controls: Trade exposure (x3) + various time-variant CZ-level controls

CZ-level import and exposure measures

CZ-level changes in imports from the U.S. and China to other countries:

$$\Delta IPW_{o,cz,t} = \sum_j \frac{L_{cz,jt}}{L_{jt}^{MX}} \frac{\Delta M_{jt}^{H \rightarrow RoW}}{L_{cz,t}}$$

cz are the CZs in Mexico, j the 2-digit INEGI sector, $H \in \{U.S., China\}$, t is the start-of-period year, and L is employment. $\Delta M_{jt}^{H \rightarrow RoW}$ represents the import changes from the U.S. and China to the RoW.

The trade competition measure between China and Mexico is given below, where $k \in \{Japan, Spain, France, USA, Canada\}$. We follow [Blyde et al. \(2020b\)](#) equation (4) for the increased competition between Mexico and China in the U.S. market. In our case, we aggregated trade changes between Mexico and China to country k , weighted by the importance of Mexican imports for country k

$$Exp_{cz,t}^{MX} = \frac{1}{L_{cz,t}^{MX}} \sum_j \frac{L_{cz,jt}^{MX}}{L_{jt}^{MX}} \left[\sum_k \frac{M_{jt}^{MX \rightarrow k}}{M_{jt}^k} \Delta M_{jt}^{China \rightarrow k} \right]$$

cz are CZs, L is employment, $\frac{M_{jt}^{MX \rightarrow k}}{M_{jt}^k}$ is the share of Mexican imports out of country k 's total imports, while $\Delta M_{jt}^{China \rightarrow k}$ is the import changes from China to country k

Consumption and inputs expenditure shares: AU elasticities

- ▶ The Allen-Uzawa (AU) elasticities for final consumers are:

- * The AU elasticity in the substitution of F varieties i for I varieties j is:

$$\theta_c(i, j) = \xi$$

- * The AU elasticity in the substitution of FD varieties i for FM varieties j is:

$$\theta_c(i, j) = \frac{\iota}{\tilde{\Omega}_F^c} + \xi \left(1 - \frac{1}{\tilde{\Omega}_F^c} \right)$$

- * ι determines the competition between FD and FM varieties

- ▶ The Allen-Uzawa (AU) elasticities for producers are:

- * AU elasticity in the substitution of domestic formal inputs i from CZ c' for labor f is:

$$\theta_{kc}(ic', f) = \frac{\eta}{\sum_{v \in C} \Omega_{iv}} + \varphi \left(1 - \frac{1}{\sum_{v \in C} \Omega_{iv}} \right)$$

- * γ : determines how easy it is to substitute domestic factors for intermediate inputs

Trade flow matrix and baseline equilibrium

- ▶ We construct a trade flows' share matrix Ω_{ij} across entities:
 - * We use a standard gravity model
 - * We use proportionality assumptions
 - * We assume foreign MNEs do not use informal varieties
 - * We assume informal firms do not trade outside of their location

- ▶ From this data and the calibrated distortions:
 - * We build the matrices Ω , $\tilde{\Omega}$, Ψ and $\tilde{\Psi}$
 - * We assume a nested structure for both the final demand and production functions to compute reallocation effects
 - * Then, in an algorithm for different values of the elasticities and changes in productivity:
 - * We compute the Allen-Uzawa elasticities (measuring how entity i substitutes goods/inputs k for goods/inputs j)
 - * We solve for the change in prices and reallocation effects
 - * We match the change in foreign MNE employment and run the reduced form regression using the simulated data

Table: Model parameters

Empirical moment	Outcome	Parameter identified	Parameter description
(1) β CZ specification	Δ log population	η	Migration elasticity
(2) β_M Maquila-no maquila specification	Δ log domestic formal employment	γ_{D_F, F_M}	Spillovers from foreign-maquila to formal domestic firms
(3) β_N Maquila-no maquila specification	Δ log domestic formal employment	γ_{D_F, F_N}	Spillovers from foreign-no maquila to formal domestic firms
(4) β_M Maquila-no maquila specification	Δ log domestic informal employment	γ_{D_I, F_M}	Spillovers from foreign-maquila to informal domestic firms
(5) β_N Maquila-no maquila specification	Δ log domestic informal employment	γ_{D_I, F_N}	Spillovers from foreign-no maquila to informal domestic firms
(6) β CZ specification	Relative Δ b/n high and low-skilled workers	σ_L	EoS between high and low-skilled labor
(7) β CZ specification	Relative Δ b/n employment and capital	ι	EoS between capital and labor
(8) β_F Formal-informal specification	Δ log wage bill	θ	EoS between domestic formal and foreign jobs
(9) β_I Formal-informal specification	Δ log wage bill	κ	EoS between formal and informal jobs

Notes: Table 4 reports the empirical moments and the associated reduced-form coefficients that we use to estimate the main parameters of the model.

Table: Model parameters

<u>Parameter</u>	<u>Description</u>	<u>Value</u>	<u>Source</u>
ξ	EoS between informal and formal varieties	1.5	Edmond et al. (2015)
ϵ	EoS between formal domestic and foreign goods	4	Zárate (2022)
θ	EoS between formal domestic and foreign jobs	3	Zárate (2022)
κ	EoS between formal and informal jobs	2	Zárate (2022)
$\sigma_s = \sigma; \forall s$	Trade elasticity	6	Rodriguez-Clare et al. (2022)
ζ	EoS between VA and inputs	0.5	Baqee and Farhi (2023a)
γ_{D_F, F_N}	Spillover effects to formal domestic firms	0.15	Calibration
γ_{D_I, F_N}	Spillover effects to informal firms	0.105	Calibration

Notes: Table 4 reports the empirical moments and the associated reduced-form coefficients that we use to estimate the main parameters of the model.

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