The Gains from Foreign Multinationals in an Economy with Distortions*

Isabela Manelici[†], Jose P. Vasquez[‡] and Román D. Zárate[§]

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We study the local labor market and welfare effects of the expansion of foreign multinationals enterprises (MNEs) in an economy with distortions. Our empirical context is Mexico. We proceed in four steps. First, we present our framework. We build on Baqaee and Farhi (2022) and use a first-order approximation to calculate the aggregate effects of foreign MNEs. We decompose the impact between technological changes and reallocation effects. We emphasize the necessary distortion measures and elasticities to take the theory to the data. Second, we build a rich establishment-level panel tracking between 1994 and 2019, the near-universe of four types of establishments in Mexico: domestically-owned establishments (labeled domestic) separated into formal or informal, and foreign MNEs separated into maquila and non-maquila. We also put together a comprehensive database with measures of distortions varying across establishment types and space. We measure distortions such as crime, labor taxes, subsidies, and credit constraints. We show that the Mexican economy faces significant distortions that can generate resource misallocation within and across space. Third, we study the reallocation effects within a local labor market of employment growth in foreign MNEs. Following the migration literature, we use the spatial clustering of foreign MNEs by origin country to build an instrument for the endogenous component of their expansion. We find that increases in foreign MNE employment in a labor market lead to increases in the size of the local domestic sector. This effect comes from a larger size of the formal sector in the domestic economy, with the net effect on the size of the informal sector being not statistically different from zero. We also find that foreign MNEs in the maquila program increase the size of the domestic economy less than those MNEs not in the program. Fourth and lastly, we simulate productivity shocks matching the evolution of foreign MNE employment and use an inference-matching procedure to estimate the key elasticities of the model. Armed with these elasticities, we study the impact of foreign MNEs on Mexico's welfare at the aggregate level and across commuting zones.

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[†]London School of Economics. Email: i.manelici@lse.ac.uk.

[‡]London School of Economics. Email: j.p.vasquez@lse.ac.uk.

[§]World Bank, Development Research Group. Email: rzaratevasquez@worldbank.org.

1 Introduction

Low and middle-income countries (LMICs) are often characterized by market imperfections or distortions that can misallocate resources and hinder economic development. At the same time, most of these countries have pursued a development strategy that incentivizes foreign multinational enterprises (foreign MNEs henceforth) to settle in and expand – with the expectation they bring technology and know-how in addition to the capital often scarce in LMICs. Against this backdrop, we know relatively little about whether foreign MNEs amplify or attenuate the (mis)allocative consequences of domestic distortions and, therefore, whether attracting foreign MNEs as a development strategy is more or less desirable in contexts with severe distortions. In this paper, we aim to fill this gap by estimating both the average effects of foreign MNEs on the domestic economy and its reallocative effects across differently distorted segments of the domestic economy. We also quantify the impacts of foreign MNEs on welfare in an economy with extensive distortions. Our empirical context is Mexico.

Mexico lends itself particularly well to this research. In 1994, after the North American Free Trade Agreement (NAFTA) came into force, Mexico started liberalizing foreign direct investment and trade. In the following twenty-five years, Mexico became the tenth-largest recipient of foreign direct investment and the twelfth world exporter. However, over the same period, the growth in the aggregate productivity of Mexico has been disappointingly low (Iacovone et al., 2022). We inquire whether the many distortions prevalent in the Mexican economy (Hsieh and Klenow, 2014; Levy, 2018; Bloom et al., 2022) have hampered or amplified the gains from opening to foreign MNEs.[1] In addition, Mexico is a prominent example of an economy that banked on the *maquiladora* model of foreign direct investment as an early-days development strategy and stepping-stone towards higher value-added investment.[2] The typical foreign MNE plant in the *"maquiladoras de exportación"* program (maquiladoras for exports, or maquila for short) imported duty-free most of its inputs, which then underwent labor-intensive processing before being exported. Given the notable differences between maquila and non-maquila foreign MNEs, we distinguish between them both in our theory and empirics.[3]

Mexico also presented us with the opportunity to put together a set of rich microdata necessary to study the effects of foreign MNEs in a setting with distortions. One of the two data pillars is the establishment-level Economic Census, which tracks over a long period of interest (1994 to 2019) the outcomes of four types of establishments: domestically-owned establishments (labeled domestic henceforth) separated into formal or informal, and foreign MNEs

[1] This conjecture was also put forward in a *Journal of Economic Literature* article by Gordon Hanson ("Why Isn't Mexico Rich?," Hanson, 2010): "Over the last three decades, Mexico has aggressively reformed its economy, opening to foreign trade and investment, achieving fiscal discipline, and privatizing state-owned enterprises. Despite these efforts, the country's economic growth has been lackluster, trailing that of many other developing nations. [...] The most prominent [arguments] suggest that some combination of poorly functioning credit markets, distortions in the supply of nontraded inputs, and perverse incentives for informality creates a drag on productivity growth. [...] Even a cursory examination of Mexico's economic structure suggests the country is deep in the world of the second best, meaning that models based on a single distortion may be a poor guide to how future reform would change economic outcomes in the country."

[2] Even if they are referred to by different names (e.g., export processing zones), incentives to attract foreign MNEs under the assembly-for-export model are widespread across LMICs.

[3] The recent rise in nearshoring to Mexico and the continued importance of the maquila model further supports the policy relevance of this distinction (see recent articles here and here).

separated into maquila and non-maquila. We define an establishment as informal if it does not comply with the legal requirement of paying Social Security contributions for its workers. Moreover, in the Economic Census, we observe whether establishments have foreign ownership and the country of foreign ownership (which is crucial for our instrumental variable strategy). Foreign MNEs are those establishments with at least 50% foreign ownership in one Census year. Maquila foreign MNEs are those foreign MNEs with positive income from maquila activities. When we study the reallocative effects of foreign MNEs within the local domestic sector, we separate between the formal and the informal sector for two reasons. First, the informal sector tends to face lower distortions on average.[4] Second, the unique features of foreign MNEs (their skill intensity, the product type and quality, and the responsible sourcing standards they impose in their supply chain) suggest that MNEs may impact differently the formal vs. informal sector. Splitting foreign MNEs and non-maquila bring further richness on mechanisms. The second data pillar is a database that we build and that measures distortions salient not only in Mexico but across LMICs (such as crime, corruption, subsidies, and credit constraints). This allows us to acknowledge other distortions (beyond no or partial compliance with labor regulations) affecting the four types of establishments we study.

The analysis proceeds in four steps. In the first step, we introduce the theoretical framework for our general equilibrium analysis. We build on the models from Baqaee and Farhi (2022) (BF henceforth) and Atkin and Donaldson (2022) (AD henceforth) to understand the effects of the foreign MNE shocks in the aggregate and across commuting zones (our definition of a labor market, abbreviated CZ henceforth). We model the shock as an increase in productivity for foreign MNEs in Mexico. The model allows the foreign MNE shock to affect welfare through three channels: technological changes, reallocation effects, and changes in distortion revenue.[5] The model features multiple locations (CZs in Mexico and the rest of the world, as an aggregate), four producer types (foreign maquila, foreign non-maquila, domestic formal and domestic informal), and three factors of production (two types of workers: low- and high-skill, and capital). Since we are interested in aggregate effects, we assume a representative firm for each type of producer, and as a result, we do not model the decision of a producer to be formal or informal.

The BF framework is relatively general – in the sense that it does not impose strict parametric assumptions about the primitives of the model. For instance, the utility and production functions only need to be homogeneous of degree one. However, to compute the reallocation effects due to distortions, we need the Allen-Uzawa elasticities that measure how producers and final consumers (entities) substitute goods and inputs. To quantify the model, we assume a nested CES structure for consumers and producers and write the Allen-Uzawa elasticities as a function of the CES elasticities of substitution (EoS henceforth), which are more amenable to a transparent calibration procedure.[6]

[4] Overall, the literature has found that the informal sector faces lower distortions than the formal sector. For example, Atkin and Khandelwal (2020) calibrate distortions for the entire world, finding larger distortions in the formal sector, and Levy (2008); Busso et al. (2013) show that the formal sector is more distorted in Mexico.

[5] For now, we do not allow foreign MNEs to also change the magnitude of the distortions themselves (e.g., we do not allow for foreign MNEs to change markups or institutions). We are considering relaxing this assumption.

[6] BF also assume a nested structure but do not include different types of producers. In our case, the reallocation effects across the different types of producers are captured by these CES elasticities.

For the case of the representative consumer in each location, we assume they have preferences for formal vs. informal varieties. Then, within the formal sector, the consumer chooses from a lower nest that includes foreign MNE and formal domestic varieties. We assume that it is easier to substitute varieties in the formal sector than between formal and informal varieties. This assumption captures the intuitive notion that domestic formal producers compete more directly with foreign MNEs than domestic informal producers.

Furthermore, we assume that the production functions also have a nested structure. Informal producers only use the three domestic factors of production (two types of labor and capital). Meanwhile, formal producers (including all foreign MNE and domestic formal producers) use intermediate inputs from several locations that they combine with the three factors of production. In particular, foreign MNEs source some of their inputs from domestic formal producers but not from informal ones. These assumptions imply that changes in the labor demand of foreign MNEs can generate a positive or a negative reallocation effect toward domestic formal producers. On the one hand, if there is more competition between foreign MNE and domestic formal producers (since their products are easier to substitute), domestic formal producers are hurt by the growth in foreign MNE employment. On the other hand, if domestic formal producers supply more inputs to foreign MNEs, domestic formal producers benefit from the increase in foreign MNE employment. The sign of this effect comes directly from our reduced-form estimates.

We add four additional features to the BF framework that become necessary when studying the impact of foreign MNEs. First, empirical evidence suggests that foreign MNEs generate positive spillovers on the total factor productivity (TFP) of local domestic producers. We incorporate these spillovers as external economies of scale in which, as the foreign MNE sector expands, the TFP of domestic producers may increase. These spillovers add a new term in the welfare change that captures the role of external economies of scale in the domestic economy (given that the price index changes due to shifts in TFP). Second, we include two types of foreign MNEs, as foreign MNEs not in the maquila program interact more with the local economy and can generate different spillovers than those in the maquila program. Third, we allow for the reallocation of workers across regions (migration). Classic trade models (Armington, 1969; Eaton and Kortum, 2002) assume that workers do not move out of their country/region. Since we are studying the effects of the foreign MNE shock within a country over twenty-five years, we allow workers to move across space using the framework from Monte et al. (2018). Worker movement can impact misallocation by reallocating employment toward more or less distorted locations. Fourth and last, we include and calibrate a Roy model where workers face frictions to reallocate across sectors or producer types.[7] Recent evidence suggests that workers face frictions when moving across sectors (Caliendo et al., 2019; Galle et al., 2023) and that these frictions impact how the gains from trade are distributed across the economy. The extended model captures that in the same way that certain product varieties are closer substitutes for final consumers, some jobs are closer substitutes for workers. Specifically, we assume a nested structure in which workers are more likely to substitute jobs within the formal sector (foreign MNE vs. domestic formal) than between the formal and informal sectors.

[7] BF include a Roy model extension in their appendix but do not calibrate it.

To bring the model to the data and analyze the welfare effects of foreign MNEs in the Mexican economy, we require various data sources and parameters. First, we need an input-output matrix tracking expenditures across CZs and the RoW, different types of producers, and production factors. This matrix serves as a foundation for computing the Leontief matrix. We use the Leontief matrix to compute exposure measures for each entity to technological shocks experienced by other entities within the economy.[8] Second, we need to measure output and input distortions capturing the wedges between producers' marginal cost and prices (wedges which affect resource allocations). Third, we need to infer the productivity shocks for foreign MNEs that drive their expansion in the Mexican economy since 1994. Last, we need the EoS in consumption, production, labor supply and workers' mobility to solve the reallocation effects.

In the second step, we produce a set of facts about foreign MNEs and distortions in Mexico with the data we assembled. We first show that relative to 1994, foreign MNEs have become more important in Mexico, accounting for 12% of employment, 17% of sales, 26% of the wage bill and 12% of assets in 2019. There is notable spatial variation in foreign MNE employment growth, with states such as Nuevo León and Quintana Roo experiencing larger increases. We also show that the composition of employment in foreign MNEs by country of origin has diversified away from the initial dominance of the United States. We then divide foreign MNEs into maquila and non-maquila. Relative to non-maquila foreign MNEs, we find that maquila foreign MNEs are, on average, substantially larger employers, less capital-intensive and less productive (measured as sales per worker). Maquila MNEs are also more import-reliant and export-oriented.

Second, we look into both the average level of distortions in Mexico and their distribution across establishment types and CZs. While distortions in Mexico are severe overall, we also find a large variation in how taxing distortions are. For instance, we find that domestic formal establishments face a disproportionately higher cost (as a share of sales) of dealing with bureaucracy and regulations compared to domestic informal establishments and foreign MNEs. We also find that while domestic informal establishments face lower tax and regulatory burdens, they incur higher costs due to other distortions, such as crime. This highlights the value of not only considering the labor tax compliance when characterizing the distortions of the informal sector. Overall, domestic informal establishments experience lower total output and input distortions than domestic formal establishments and foreign MNEs.

In the third step, we study the reallocation effects of foreign MNEs in Mexico by exploiting variation in foreign MNE employment growth across time and space. We are interested in both the overall size of the domestic economy but also how resources shift within this sector between differently-distorted segments of the domestic economy. Namely, we study the reallocation of economic activity between the formal and the informal sectors of the local domestic economy. The explanatory variable of interest measures the change in the employment in foreign MNEs in a CZ between two consecutive Economic Censuses (i.e., between $t-5$ and t, as Economic Censuses occur every five years), normalized by the overall employment in that CZ in the earlier Census year ($t-5$).

We want to estimate the effect of the foreign MNE employment growth on the local do-

[8] Appendix D provides the specific details on how we build this matrix for the Mexican economy

mestic economy (measured as the difference in log outcomes for the domestic economy between the two consecutive Economic Censuses, e.g., the difference in log employment between $t - 5$ and t). An OLS estimation poses two main concerns: that there might be (i) omitted variables correlated with both the future performance of the domestic economy in a CZ and foreign MNE employment growth in that CZ (e.g., a new government commitment to invest in productive infrastructure); or (ii) measurement error in the explanatory variable.

To address these concerns, we use an instrumental variable (IV) approach. Namely, to build an IV for the growth in foreign MNE employment from a given country of origin in a given CZ, we leverage (i) the past spatial clustering of foreign MNE employment from that country of origin and (ii) the growth of foreign MNE employment from that country of origin in all Mexican CZs *except* the CZ of interest.[9] The final formula for the IV sums across countries of origin to capture the supply-push component of the foreign MNE employment growth in a CZ. This IV was recently used by Setzler and Tintelnot (2021) to study the effects of foreign MNEs in the United States. As the first-stage F-statistics tend to be above 35, this IV is a statistically significant predictor for foreign MNE employment growth. The IV satisfies the exclusion restriction if it does not affect the outcomes of a specific CZ other than through its effect on the change in the employment in foreign MNEs in that CZ. To help in this direction, the IV does not use CZ-level specific information on the change in market conditions in that CZ. Moreover, to address remaining threats to identification, we also use a rich set of CZ-level controls.[10]

Using the IV strategy just described, we estimate that a 1 percentage point increase in the share of foreign MNE employment in a CZ increases the number of domestic establishments by 0.42%, workers by 0.33% (particularly low-skill workers), sales by 1%, value added by 1.48%, and the wage bill by 1.62% (particularly the wage bill of the low-skill workers). The effect on domestic assets is not statistically significant. When we split foreign MNEs into maquila and non-maquila, we find evidence that the effects of maquila MNEs are more muted than those of non-maquila MNEs, which is consistent with their less productive and less integrated into the local economy nature.

Next, we explore the differential effects of foreign MNE employment growth on the formal and informal segments of the local domestic economy. We learn that the formal sector is the primary beneficiary of the positive effect of foreign MNEs on the domestic economy. In contrast, the informal sector seems to be on-net unaffected by the changing exposure to foreign MNEs (though we need to caution that the negative coefficients on the differential effects on the informal sector are noisier). We again separate foreign MNEs into maquila and non-maquila. The current results suggest that most of the offsetting negative effect of foreign MNEs on the domestic informal sector comes from its exposure to maquila foreign MNEs. In other

[9] The rationale of this IV is analogous to that of a classic IV from the migration literature, which instruments the immigrant inflows from a given source country to a location by using the historical settlement patterns of immigrants from that source country and the total number of newly-arriving immigrants from that country (Card, 2001).

[10] We include (i) economic region-year indicators (controlling for shocks common across CZs in an economic region); (ii) time-varying CZ-specific controls (such as urban concentration rates, employment rates, the importance of manufacturing in employment, the prevalence of a secondary education or routine occupations, in addition to demographic characteristics such as the share of indigenous or foreign-born individuals); (iii) controls for changes in CZ-level exposure to the "China shock" (both via import competition and competition in Mexico's historical export markets) and to rising imports from the United States into Mexico (following Autor et al., 2013; Blyde et al., 2020); (iv) a control for the "missing share" (Borusyak et al., 2022b); and (v) measures of indirect exposure to the growth in foreign MNE employment in other CZs (Adao et al., 2019; Borusyak et al., 2022a).

words, the size of the informal sector tends to be on-net unaffected by increased exposure to the maquila foreign MNEs. In contrast, the exposure to non-maquila foreign MNEs tends to also increase the size of the domestic informal sector alongside the domestic formal sector.

In the fourth and last step, we need to calibrate the model described in the first step. We plan to use an inference-matching procedure. First, following the logic in Rodriguez-Clare et al. (2022), we model the "shock" to foreign MNE employment as coming from changes in the TFP of foreign MNEs in each location (since this replicates a change in local labor demand from foreign MNEs). Second, we plan to simulate the model for different values of our key elasticities and spillover parameters and match our reduced-form regressions. For example, by matching the effect of foreign MNEs on local employment, we can recover the spillovers to domestic formal and informal firms; or by analyzing the impact between low- and high-skill workers, we can recover the elasticity of substitution between the two types of workers in the production function.

In the current draft, to shed light on the impact of foreign MNEs, we simulate a productivity shock that expands foreign MNEs in Mexico. In particular, following AD, we simulate a 10% productivity shock in the locations that experienced an increase in foreign employment between 1994 and 2019. Approximately 25% of commuting zones in Mexico experienced the shock. Overall, the results suggest the shock increased average welfare in Mexico by around 6%. However, without distortions or spillovers, this effect is only 4%, implying that market failures explain one third of the effect. We also find that distortions explain a slightly larger fraction than spillovers. This finding is mostly driven by the effect in the locations that do not experience the shock directly since distortions play a more prominent role for these CZs. In particular, consistent with the trade literature, workers reallocate to the formal sector due to trade linkages, which amplifies the gains from foreign MNEs. On the other hand, in the CZs that experience the shock directly, the spillovers play a bigger role than distortions.

Related literature This article relates and contributes to two main literatures. First, the accumulation of capital and its relationship to workers' welfare (particularly those in the informal subsistence sector) have been at the core of established theories of economic development of classics such as Adam Smith, David Ricardo, and Joan Robinson. Lewis (1954) noted that most countries start growing a capitalist class (necessary for economic development) by "importing their capitalists from abroad." However, Lewis (1954) pointed out that labor in capital-importing countries may not see real wage increases (if foreign capital only increases productivity in export-oriented industries); adding to his stylized model the many distortions prevalent in LMICs may further nuance the impact of foreign capital on welfare.[11]

The longstanding interest in the development potential of foreign direct investment has spurred a large empirical literature estimating the effects of foreign MNE entry and expansion on receiving economies.[12] Most of this literature has focused on knowledge spillovers from foreign MNEs to domestic firms as the market failure of interest.[13] More recent exceptions

[11] Banerjee and Duflo (2005) argue that market imperfections (such as government failures, credit constraints, externalities) can explain why capital may be misallocated within poor countries.

[12] There is a smaller but complementary literature interested in the welfare gains from multinational production, in which Northern MNEs with superior technologies benefit the Southern countries that receive their affiliates and their accompanying technologies (Ramondo and Rodríguez-Clare, 2013; Tintelnot, 2017; Arkolakis et al., 2018).

[13] Prior research has either produced evidence in favor of knowledge spillovers (Javorcik, 2004; Poole, 2013; Alfaro-

study the effects of foreign MNEs in contexts with product (Asturias et al., 2022) or labor market power (Alfaro-Ureña et al., 2021; Setzler and Tintelnot, 2021; Méndez and Van Patten, 2022) or distorted access to capital (Bau and Matray, 2022).

We contribute to this literature by exploring the interaction – both in reduced form and in general equilibrium – between foreign MNEs and a wide set of distortions prominent in LMICs. For now, we assume that as foreign MNEs become more important in local economies in Mexico, distortions remain fixed. We focus on estimating how the growing importance of foreign MNEs affects the allocative efficiency of the economy via reallocations in the local activity towards more or less distorted segments of the economy.[14] We also study explicitly the impact of foreign MNEs on domestic informal establishments (which, we find, tend to face lower distortions). To our knowledge, almost all research on foreign MNEs uses data that excludes the informal sector, even in contexts plagued with informality.[15] Moreover, Mexico is a particularly valuable case to study given the puzzle of its history of plausibly growth-enhancing policies (e.g., massive liberalization of trade and foreign direct investment), yet disappointing subsequent productivity growth.[16]

Second, a vast literature has studied the prevalence of distortions in LMICs and their implications for both firm-level and aggregate TFP (Hsieh and Klenow, 2009; Hopenhayn, 2014; Restuccia and Rogerson, 2017; Baqaee and Farhi, 2020). In particular, Mexico has already been documented as a country with high distortions, which have been presented as the plausible culprit behind the low firm-level and aggregate TFP of the country (Hanson, 2010; Kehoe and Ruhl, 2010; Hsieh and Klenow, 2014; Hsieh and Olken, 2014; Levy, 2018; Bloom et al., 2022).

Related to this literature is a recent work studying the effects of international trade in countries characterized by weak institutions, market failures and firm distortions (for recent summaries, see Atkin and Khandelwal, 2020; Atkin et al., 2022). The distortions most studied have been those associated with informality – with informal firms paying little or no taxes and not complying with regulations (particularly those applying to labor).[17] On the one hand, papers such as Dix-Carneiro and Kovak (2019); Blyde et al. (2020); Ulyssea and Ponczek (2022); Cisneros-Acevedo (2022) show that exposure to foreign competition has increased informality among low-skill workers in Brazil, Mexico and Peru, with informality acting as a buffer against unemployment. On the other hand, Aleman-Castilla (2006) and McCaig and Pavcnik (2018) show that greater access to foreign markets in Mexico and Vietnam has led to the reallocation of workers away from informal firms to more productive formal firms. We study the effect of a different form of globalization (the entry and expansion of foreign MNEs) on informality.

More broadly, AD develop a framework that draws on BF to study how international trade interacts with economic development, acknowledging the prevalence in LMICs of not

Ureña et al., 2022b; Abebe et al., 2022) or has assumed them as the reason behind productivity growth among domestic firms in proximity to foreign MNEs (Setzler and Tintelnot, 2021).

[14] Alfaro and Chen (2018) provide cross-country evidence that foreign direct investment leads to the reallocation of workers and revenues away from the less productive establishments.

[15] Sharma and Cardenas (2018) and Cao (2020) are notable exceptions, studying the cases of Mexico and Vietnam.

[16] Prior research on foreign MNEs in Mexico has focused on the link between the maquila sector (which concentrates about two thirds of the foreign MNE employment), the skill-premium and incentives to acquire education (Feenstra and Hanson, 1997; Verhoogen, 2008; Atkin, 2016). Atkin et al. (2018) find gains from foreign MNEs in retail, mainly driven by a lower cost of living.

[17] Exceptions include Asturias et al. (2019); Arkolakis et al. (2019); Bai et al. (2021); Lanteri et al. (2022); Berthouy et al. (2021).

only informality but also a plethora of other distortions. In the same spirit, we build a database that measures the size of several distortions on both the output and input side across establishment types (including foreign MNEs) and locations within Mexico. On the theory side, we build on these frameworks, adjusting them to our shock of interest (the foreign MNE shock, which we model as a productivity shock instead of a trade cost shock) and the within-country analysis in this paper. We have also implemented several extensions, such as incorporating external increasing returns to scale, two worker types, frictions when moving across firm types, and internal migration which are particularly relevant when wanting to study the effects of foreign MNEs over a longer time horizon.

The remainder of the paper proceeds as follows. Section 2 presents the theoretical framework we use to study the welfare implications of foreign MNEs in an economy with distortions and the steps we take to map the theory to the data. Section 3 describes the data and provides context on foreign MNEs and distortions in Mexico. Section 4 presents the empirical evidence on the effects of the higher exposure to foreign MNEs in a commuting zone on the domestic economy. Section 5 presents the model estimation and calibration procedure. Section 6 presents our counterfactual exercises. Most importantly, we study what would have happened to Mexico in the absence of foreign MNEs and the effect of foreign MNEs in the absence of distortions. Section 7 concludes.

2 Model

We now describe the theoretical framework for our analysis. The main goal is to understand the welfare and output implications of foreign MNEs in an economy where market failures distort the allocation of resources. We build on the model from BF and AD to understand the effects of foreign MNE shocks at the commuting zone level and for the Mexican economy in the aggregate. We model the foreign MNE shock as a productivity increase in foreign-owned producers that changes their labor demand. The shock affects the economy depending on its potential spillovers from foreign MNE producers to domestic ones and its effect on the relative supply and demand of factors and producers.

We consider an economy with multiple regions (CZs in Mexico and an aggregate rest of the world or RoW). There is a representative producer for each of the four producer types in each region: a foreign MNE producer not in the maquila program (F_N), a foreign MNE producer in the maquila program (F_M), a domestic formal producer (D_F), and a domestic informal producer (D_I).[18] Trade takes place between producer-region pairs, and workers can move across CZs in Mexico. We make an explicit distinction between maquilas and non-maquilas since the economic effect due to an expansion of these producers can be different. For instance,

[18] We assume a representative firm for each type, which implies that there is no firm heterogeneity within each type and location and firms do not switch types. On the latter assumption, we build on prior evidence that formalization among informal businesses is rare. For example, McCaig and Pavcnik (2021) find that in Vietnam, only 1.5 to 2% of informal businesses formalized in the period 2006-08 to 2016-18 conditional on survival between successive surveys (two years apart). Using the same dataset, formalization among manufacturing businesses varied between 0.8 and 1.5%. Additionally, Malesky and Taussig (2009) show that most newly registered private enterprises in Vietnam spent very little time in the informal sector. In particular, firms established in 2000 spend on average 3 months in informality between establishment and registration, while the firms established in 2001 through 2006, spend 1 month or less. We will explore further the issue of transitions in our empirical context.

maquila foreign MNEs tend to interact less with the local economy than non-maquila foreign MNEs. On the consumer side, we assume a representative consumer in each region. Workers draw idiosyncratic shocks to the utility of working in each producer-region. Based on these draws and real income, workers decide their labor supply to each producer-region.

We start presenting a general framework using the same notation as in BF and we then describe our specific application. As in BF, the model decomposes the effect on welfare of a given commuting zone, into changes due to the technological environment, for a given resource allocation and changes in allocation for a given technology. The changes in allocation are themselves split into different mechanisms that are detailed below. We present an abridged description of the model, focusing on the new elements we introduce, such as productivity spillovers and migration decisions. We relegate the remaining details to Appendix A.

2.1 General model environment

Consider a set of locations $\mathcal{C}$, a set of producers $\mathcal{N}$ producing different goods that operate in the formal or informal sector, and a set of factors of production $\mathcal{F}$. The set of producers in each location is denoted by $\mathcal{N}_c$ and the set of factors by $\mathcal{F}_c$. Since we include multiple types of producers the notation $s(c)$ corresponds to the type of producer s in location c, and similarly, $f(c)$ corresponds to the factor of production f in location c. As in BF, we interchangeably refer to factor prices as p_f or w_f. We assume that there is a representative consumer in each location c that consumes the different goods and is the owner of the production factors.

Producers Each producer $i \in \mathcal{N}_c$ produces using a constant returns to scale (CRS) technology. The production function is:

$$y_i = A_i f_i \left(\{x_{ik}\}_{k \in N}, \{l_{fi}\}_{f \in \mathcal{F}_c} \right),$$

where y_i is the total quantity that is produced of good i, x_{ik} is the quantity of intermediate input $k \in \mathcal{N}$ used by producer i, and l_{fi} is the quantity of production factor $f \in \mathcal{F}_c$ used by i. The parameter A_i is a Hicks neutral exogenous productivity shifter.

Distortions As in BF, we assume that there is an arbitrary set of distortions that impact the allocation of resources. The parameter $\mu_{ij} \geq 0$ denotes the distortion in the exchange from j to i. This distortion creates a gap between the price paid by the buyer i and the marginal cost of the seller j. If $\mu_{ij} > 1$, the distortion is a tax or a markup, while if $\mu_{ij} < 1$, the distortion is a subsidy or a markdown.

Define X_{ij} as the value i spends on entity j.[19] Define the matrix $\tilde{\Omega}$ as a global input-output share across all entities in the world in which the entry $\tilde{\Omega}_{ij} = \frac{X_{ij}}{\sum_r X_{ir}}$ corresponds to the expenditure share of i that devotes to direct purchases from j. Let the element $\Omega_{ij} = \frac{\tilde{\Omega}_{ij}}{\mu_{ij}}$ correspond to the expenditure share exchanged between i and j valued at the seller's marginal cost instead than the price paid by the buyer. The main distinction between these two matrices implies that the allocation of resources is distorted in the economy since the price paid by the buyer is different than the producer's marginal cost. In the case in which $\mu_{ij} = 1$ the market

[19] For example, in the case in which i is a producer, and j is labor, X_{ij} corresponds to the total wage bill; or in the case in which i is a final consumer and j a producer in another country, it corresponds to imports for final consumption.

allocation coincides with the first-best.

Households The representative consumer in each location c owns the different production factors with an ownership matrix $\Phi_{f(c)}$, and obtains income from the primary factors and the revenue from the distortions.[20]

We assume a utility function homogeneous of degree one. This implies that the representative consumer in location c maximizes real income, which is given by:

$$W_c = \frac{I_c}{P_c}, \quad I_c = \sum_{f \in \mathcal{F}_c} \Phi_{f(c)} \sum_s w_{f(c)s(c)} L_{f(c)s(c)} + R_c + D_c$$

where I_c corresponds to the income of location c, P_c denotes the ideal price index, $w_{f(c)s(c)} L_{f(c)s(c)}$ is the total income of factor f in producer type s in location c, R_c is the revenue from the distortions, and D_c corresponds to the initial trade deficits that we assume that are exogenous.

Prices of goods Since the technology has CRS, we can denotes the price that producer j charges to entity i as $p_{ij} = \mu_{ij} \frac{c_j \tau_{ij}}{A_j}$, where $\mu_{ij} \geq 0$ denotes the distortion on j to i exchange, c_j corresponds to the cost aggregator of the different inputs and production factors, τ_{ij} to the iceberg trade cost of shipping a unit of producer j to entity i, and A_j to the total factor productivity of producer j.

Input-output exposure Denote $\tilde{\Psi}$ as the Leontief matrix, where $\tilde{\Psi} = (I - \tilde{\Omega})^{-1}$. The element $\tilde{\Omega}_{ij}$ measures the direct impact of entity j in $i's$ expenditure, while the Leontief matrix $\tilde{\Psi}_{ij}$ captures both the direct and indirect effects through input-output linkages. We also refer to $\tilde{\Psi}_{ij}^{W_c}$ as the exposure of final consumers in location c to the j-to-i trade. To connect the model with the data, we would also need data on the Domar weights that correspond to the share of the total income of each entity in global GDP. We define $\lambda_i \equiv \sum_c Y_c \Psi_{ci}$ as the share of sales of entity i in global GDP. Since we normalize global GDP, this corresponds to the total sales of entity i. We use a similar notation to define total factor $f's$ income in location c, for instance, $\lambda_{f(c)}$ represents the total income obtained by factor f in location c.[21]

Labor shares and migration shares We extend the BF framework by including the possibility of imperfect worker mobility between producer-region pairs. To do so, we assume that there are frictions for workers to move across different types of producers, and that workers can also migrate across regions. Define $\pi_{f(c)s(c)} \equiv \frac{L_{f(c)s(c)}}{\sum_k L_{f(c)k(c)}}$ as the share of workers in location c working in producer type s. Similarly, we define $\pi_{f(c)f(h)}$ as the share of workers of type f migrating from region c to h.

2.2 Changes in real income

Suppose we are interested in understanding the effect on real income in each location due to a productivity shock in the economy. The total change in real income for the representative

[20] We are assuming that the representative consumer is the owner of the production factor in that particular location, but we can assume that owners can vary by location. For example, the owners of capital can be a consumer in another location.

[21] We also refer to $\lambda_{f(c),s(c)}$ as the share of revenue in global GDP obtained by factor f in firm type $s(c)$.

consumer in c due to a perturbation is given by:

$$d\log W_c = \underbrace{\sum_{ij\in B_c} \tilde{\Psi}^{W_c}_{ij} d\log A_j}_{\text{Technological change}} \tag{1a}$$

$$+ \underbrace{\sum_{f\in\mathcal{F}_c, i\in\mathcal{N}_c} \left(\lambda_{f(c)i} - \tilde{\Psi}^{W_c}_{fi}\right) [d\log w_{fi} + d\log L_{fi}]}_{\text{Change in local factor income}} \tag{1b}$$

$$- \underbrace{\sum_{f\notin\mathcal{F}_c, i\notin\mathcal{N}_c} \left(\tilde{\Psi}^{W_c}_{fi}\right) d\log w_{fi}}_{\text{Changes in factor income abroad}} \tag{1c}$$

$$+ \underbrace{\lambda^c_{R(c)} d\log R_c}_{\text{Revenue from distortions}} \tag{1d}$$

$$- \underbrace{\sum_{ij\in B_c} \tilde{\Psi}^{W_c}_{ij} d\log \mu_{ij}}_{\text{Change in the distortions}} , \tag{1e}$$

where B_c denotes the set of transactions that are imported into location c, λ_c is the share of factor's f income in total expenditure from location c $\left(\lambda_c = \left(\Phi_{f(c)} \sum_s w_{f(c)s(c)} L_{f(c)s(c)}\right) / X_c\right)$, and $\Lambda^c_R = R_c / X_c$ is the share of the revenue from distortions in total expenditure. As in BF and AD, we can decompose the effect of a perturbation in the productivity into four different components: a technological change, a change in the factoral terms of trade, which corresponds to the difference between the local income and the effect on local prices due to changes in factor prices, the change in the total revenue from distortions, and the change in the wedges.[22]

The first term in equation (1) captures technological changes, showing how much final consumers in location c would benefit from changes in prices of producer j. It corresponds to the classical Hulten result in macroeconomics since the term $\tilde{\Psi}^{W_c}_{ij}$ captures the direct and indirect exposure of households in c to the j-to-i trade through direct effects and input-output linkages. The second and third terms capture changes in the factorial trade of terms. This change corresponds to an income effect and the change in the ideal price index due to changes in goods and factor prices. The exposure to the change is weighted by the initial income and expenditure shares. The fourth term captures changes in the revenue from the distortions, which depend on the importance of the initial revenue in the income level of location c. The final term represents the change in the price index due to changes in the wedges (e.g., markups). These effects also depend on the Leontief matrix, capturing the direct effects and the indirect effects.[23]

2.3 Reallocation effects

Equation (1) allows to quantify the real income effects of a shock. To implement the decomposition described in this equation, let us split the equation elements into three categories. The first category is the change in productivity. We model the foreign MNE shock as an increase in productivity of foreign MNE producers ($d\log A_j$, with j being foreign) and calibrate

[22] We assume that transfers D_c are exogenous and constant.
[23] The reader can refer to AD to get a more complete explanation of these terms.

the size of the shock to match the increase in the share of foreign employment across CZs in Mexico. The shock can also affect the productivity of other producers as we will describe below. The second category corresponds to the elements that we need to measure directly in the data. These are the input-output exposures $\tilde{\Psi}^{W_c}_{ij}$, the factor shares in income $\lambda_{f(c)i}$, the level of the distortions (which are important to compute the share of revenue from distortions in total expenditure Λ^c_R), and the changes in distortions $d\log\mu_{ij}$. We discuss in Section 3 the measurement of these objects. The third category corresponds to the elements that we can infer from the model structure. These are called the reallocation effects, and include the change in factor prices $d\log w_{fi}$, the change in revenue from distortions $d\log R_c$, and the change in employment $d\log L_{fi}$. Let us focus now on the reallocation effects.

We extend the results from theorem 3 of BF to our setting and log-linearize the system to solve for the reallocation effects in our context. We include the following new elements into the model: (i) a Roy model in which there are frictions to move across firm types as in Galle et al. (2023); (ii) the possibility for workers to move across locations as in Monte et al. (2018), and (iii) spillover effects across sectors as in Faber and Gaubert (2019) to capture that the expansion of foreign MNEs can have productivity spillovers on domestic producers. The implication of these new elements is that factor prices vary across producers, factors of production are not fixed in each firm type and location, and changes in factor revenue do not only capture changes in factor prices. Throughout the subsection, we discuss the different parts of the linear system necessary to compute the reallocation effects.

Change in prices From the problem of the firm, the change in the price charged by producer j to entity i is:

$$d\log p_{ij} = d\log\tau_{ij} + d\log\mu_{ij} - d\log A_j + \sum_{k\in\mathcal{N}\cup\mathcal{F}_c} \tilde{\Omega}_{jk} d\log p_{jk}. \tag{2}$$

This equation shows that the change in the price depends on changes in the iceberg trade costs, wedges, productivity levels and how much the prices of other producers and production factors change. The exposure to these changes depends on the initial expenditure levels $\tilde{\Omega}_{jk}$. For example, a producer j is more exposed to changes in k if the initial expenditure share is higher.

Productivity spillovers To capture the potential spillovers, we assume that the productivity change of a producer k is:

$$d\log A_k = d\log\tilde{A}_k + \sum_{j\in\mathcal{N}_c} \gamma_{kj} d\log L_j, \tag{3}$$

where $d\log\tilde{A}_k$ correspond to changes in the exogenous component and γ_{kj} represent the spillovers of producer type j to producer type k. We plan to recover these parameters when j corresponds to a foreign MNE producer.

Change in distortion revenue Recall that $\lambda_i \equiv \frac{I_i}{GDP}$ corresponds to the income share of entity i in global GDP. Then, changes in income shares capture changes in each entity's income. The change in total revenue of location c is:

$$dR_c = \sum_{ij \in \mathcal{O}_c} (\mu_{ij} - 1)\tilde{\Omega}_{ij}\lambda_i \left(d\log\tilde{\Omega}_{ij} + d\log\lambda_i\right) + \mu_{ij}\lambda_i\tilde{\Omega}_{ij} d\log\mu_{ij}, \tag{4}$$

where O_c denote the set of transactions from which region c obtains distortion revenues. It depends on the income change in each entity and the change in the distortions weighted by how important the initial income levels were in global GDP.

Changes in factors' income From the market clearing conditions (factor's demand), the change in the factor's income share is:

$$d\log\lambda_{f(c)s(c)} = d\log\tilde{\Omega}_{s(c)f(c)} + \sum_h \Omega_{hs(c)} d\log\lambda_h + \sum_{h,k} \Omega_{k(h)s(c)} d\log\lambda_{k(h)}, \tag{5}$$

where $\lambda_{f(c),s(c)}$ corresponds to factor $f's$ income that work in producer type s in location c and $\lambda_h = \sum_{g,k} \Phi_{g(h)}\lambda_{g(h),k(h)} + R_h + D_h$ corresponds to the total income of the representative consumer in location h.[24]

Changes in expenditure shares The change in the expenditure share between entity i and j depends on how easy it is for entity i to substitute other producers and factors for entity j. Since the expenditure function is homogeneous of degree 1, the change in the expenditure shares is:

$$d\log\tilde{\Omega}_{ij} = \delta_i(j,j) d\log p_{ij} + \sum_k \tilde{\Omega}_{ik}\theta_i(j,k) d\log p_{ik}, \tag{6}$$

where the parameter $\delta_i(j,j)$ captures how entity i change its demand for entity j due to changes in prices, and $\theta_i(j,k)$ corresponds to the Allen-Uzawa elasticity. This elasticity of substitution captures how entity i substitutes input k for input j due to changes in the price of input k.

Changes in labor factor The last part to solve the reallocation effects is to understand how workers reallocate across producer-regions due to a perturbation in the economy based on their labor supply decisions. The change in the number of workers in producer type $s(c)$ is:

$$d\log L_{f(c)s(c)} = \underbrace{\phi_{f(c)}(c,c) \cdot d\log W_c + \sum_h \pi_{f(c)f(h)} \cdot \eta_{f(c)}(c,h) \cdot d\log W_h}_{\text{Migration decisions}} \tag{7a}$$

$$+ \underbrace{\varphi_{f(c)}(s(c),s(c)) \cdot d\log w_{f(c),s(c)} + \sum_k \pi_{f(c)k(c)} \cdot \kappa_{f(c)}(s(c),k(c)) \cdot d\log w_{f(c),k(c)}}_{\text{Labor supply to each producer type}}, \tag{7b}$$

where the parameter $\phi_{f(c)}(c,c)$ corresponds to the migration elasticity of location c, $\eta_{f(c)}(c,h)$ to the Allen-Uzawa supply elasticity between locations, $\varphi_{f(c)}(s(c),s(c))$ to the labor supply elasticity of producer type s in location c, and $\kappa_{f(c)}(s(c),k(c))$ to the Allen-Uzawa supply elasticity between producer s and k. The parameters $\pi_{f(c),h}$ correspond to the initial migration flows of factor f from c to h, and $\pi_{f(c)s(c)}$ to the initial share of workers f in $s(c)$.[25]

[24] Notice that we can also solve for the change in producers' income: $d\log\lambda_{s(c)} = d\log\lambda_{f(c),s(c)} - d\log\tilde{\Omega}_{s(c),f(c)}$.

[25] We then can solve for the change in the price of factor f: $d\log w_{f(c)s(c)} = d\log\lambda_{f(c)s(c)} - d\log L_{f(c)s(c)}$.

Changes in capital factor We assume that capital is a factor of production that is freely mobile across locations. This implies that the price is the same for all producers in the world. The change in the price and quantity of capital in each location is:

$$d \log r = \sum_{s,c} \frac{\tilde{\Omega}_{s(c),K} \lambda_{s(c)}}{\lambda_K} \left(d \log \tilde{\Omega}_{s(c),K} + d \log \lambda_{s(c)} \right), \tag{8a}$$

$$d \log K_{s(c)} = d \log \lambda_{s(c),K(c)} - d \log r. \tag{8b}$$

Solving for the reallocation effects Based on equations (2) to (8), we can solve for the vector of endogenous elements $(d \log \vec{p}, d \log \vec{R}, d \log \vec{\tilde{\Omega}}, d \log \vec{w}, d \log \vec{L})$. We describe the exact system of linear equations and the solution algorithm in Appendix A.1.

2.4 Parametric assumptions to map the model to the data

As it is clear from the previous equations, the Allen-Uzawa supply and demand elasticities are key objects to solve for the reallocation effects of the shock. To compute these Allen-Uzawa elasticities, we assume a nested CES structure for both the demand and production functions. The main advantage of the CES structure is that it allows us to write the Allen-Uzawa elasticities as a function of the CES EoS. We present here a summary of the production and preferences assumptions and dive into the details in Appendix A.2.

Final consumer demand Following BF and AD, we assume that the demand of final consumers for different varieties takes a nested CES structure. The utility of each region c is a CES aggregate of a composite good for formal varieties and a composite good for informal varieties, with an elasticity of substitution between formal and informal varieties equal to ξ. The formal composite good is itself a CES aggregate of varieties from foreign MNE and domestic formal producers with an elasticity of substitution $\epsilon \geq \xi$. This assumption implies that foreign MNE varieties are closer substitutes to domestic formal varieties than to informal ones. As in a multi-sector Armington (1969) trade model, consumption of each of the composite goods (s) in each region is a CES aggregator of varieties across locations, with an elasticity of substitution $\sigma_s > 1$. Finally, we assume that the good of the domestic informal producer is not tradable.

Production functions We assume that the four producer types are linked by an input-output structure. In line with responsible sourcing standards that foreign MNEs tend to impose (Alfaro-Ureña et al., 2022a), we assume that while formal producers (domestic and foreign) use inputs from other formal producers, domestic informal producers do not sell to foreign MNEs. The production function of each producer type $s(c)$ is a CES aggregator of intermediate inputs and value-added with an elasticity of substitution ζ. Similar to the case of consumers, intermediate inputs are a CES composite of formal varieties and informal ones (except for foreign MNEs, who do not source from informal ones) with an elasticity of substitution ϵ. Value-added is a CES composite between labor and capital with an elasticity of substitution ι. Finally, the labor composite input is also a CES aggregator composed by low- and high-skill workers with an elasticity of substitution σ_L.

Labor supply decision to each producer type To capture potential labor market frictions to move across producers, we assume that workers draw idiosyncratic amenity shocks to work for each producer, which implies that the wages vary by producer. To capture stronger labor market competition between domestic formal producers and foreign MNE producers than between informal and foreign MNE producers, we assume that there is higher labor sustitutability between domestic formal and foreign MNE producers than between informal and formal producers. We build on Galle et al. (2023) and assume that workers draw idiosyncratic amenity shocks to work in each type of from a nested Fréchet distribution with a shape parameter κ capturing how easy is for workers to substitute jobs between informal and formal producers, and a shape parameter θ capturing how easy is for workers to substitute jobs between foreign MNEs and domestic formal producers. We assume that $\theta \geq \kappa$ implying that foreign MNE and domestic formal jobs are easier to substitute than formal and informal jobs.

Migration decisions Finally, we build on Monte et al. (2018) and incorporate to our analysis that workers can decide the location where to live. We assume that workers make the decision based on amenities and real income, and draw idiosyncratic shocks from a Fréchet distribution with a parameter η that directly maps to the migration elasticity.

2.5 Mapping the theory to the data

In order to bring the theory described above to the data, we need five sets of inputs: (a) the measures of distortions μ_{ij}; and (b) the global input-output share Ω_{ij} between all entities i and j located in Mexican CZs or the RoW; (c) the Allen-Uzawa demand and supply elasticities; (d) the productivity shocks to foreign MNEs and (e) the foreign productivity spillover and migration elasticities.

We postpone to Sections 3.2.1 and 3.3 the discussion on (a) and (b), namely how we build the output and input distortions that we consider for the Mexican context and the global input-output matrix. For (c), Appendix A.2 shows how the parametric assumptions described above allow us to write the Allen-Uzawa elasticities as a function of the CES elasticities of substitution σ_s, ξ, ϵ, ι, and ζ. We calibrate these elasticities of substitution from the literature.

Armed with (a)-(c), we obtain the elements in (d) and (e) jointly. For any set of elasticity values and productivity changes, we use the model structure to compute the implied change in the share of foreign employment in Mexico, as well as the changes in domestic formal employment, domestic informal employment, and total population across CZs in Mexico. We then iterate over the elasticity values and productivity changes until the CZ-level changes in Mexico match those predicted by the reduced form evidence that we present in Section 4. Therefore, we follow the approach suggested by Redding (2022), by using causally-identified reduced form coefficients to calibrate our general equilibrium model. We come back to these steps and provide more details in Section 5.

3 Data and context

3.1 Establishments in Mexico

3.1.1 Data on establishments in Mexico

The primary data source on establishments is the Economic Census collected by the "National Institute of Statistics and Geography" (INEGI in Spanish) every five years since 1994. The Economic Census is an almost complete enumeration of fixed establishments in Mexico.[26]

Critically for our analysis, the Economic Census includes establishments that are not registered or, even if registered, are not compliant with government regulation. Our baseline definition of an informal establishment labels as informal any establishment that does not comply with the legal requirement of paying social security contributions for its workers (as in Levy, 2008; Ulyssea, 2020), irrespective of whether the establishment is registered or not.

The Economic Census microdata allows us to build an unbalanced panel of all establishments in Mexico between 1994 and 2019.[27] This panel tracks typical balance sheet variables such as total sales, number of workers, wage bill, value added, and assets (our proxy for capital). The Economic Census also tracks the establishment-level employment and wage bill by worker type. In particular, salaried workers are split into administrative workers (who we label high-skill) and operative workers (who we label low-skill).[28] We also observe the municipality of each establishment, which we then map to a commuting zone – abbreviated CZ hereafter. Mexico will therefore be divided into 781 CZs.[29]

Last and crucially for this paper, we also observe the establishments with foreign ownership. We refer to an establishment as a foreign MNE if it is at least 50% foreign-owned in a Census year. Additionally, we track the country of origin of an establishment's foreign capital (which is a key input for our leading instrumental variable). In the rare instances where we observe more than one country of origin, we keep the country with the largest share of ownership. Appendix B describes in detail the Economic Census data construction.

3.1.2 Facts on foreign MNEs and domestic establishments in Mexico

Differences between foreign MNEs and domestic establishments Table B1 (Appendix B) presents summary statistics on the sample of establishments in our analysis, separated into three groups: foreign MNEs, domestic formal establishments, and domestic informal establishments.[30] Table B1 shows the average establishment characteristics by establishment type at

[26] For manufacturing, commerce and non-financial services, the Economic Census has a reduced coverage in more isolated rural locations. Businesses that do not have a permanent location and without fixed installations – such as street vendors – are not covered by the Economic Census (irrespective of their industry).

[27] The Economic Census gathers data about the previous calendar year. We refer to years by the Economic Census year (e.g., 1994) but note that the data corresponds to the prior calendar year (e.g., 1993). The Economic Census also records the industry classification of each establishment. So far, our analysis abstracts from industry classifications.

[28] Workers are classified as either salaried or non-salaried. The salaried group is further divided into operative workers, who operate machinery for manufacturing goods, and administrative workers, who perform general office tasks, accounting functions, and executive roles. Non-salaried workers include owners, relatives, active partners, and workers who do not receive a fixed salary. In addition, this group also includes interns, individuals working for tips, those engaged in social service, participating in training and development programs, and volunteers.

[29] We define CZs as in Blyde et al. (2023). We thank Matias Busso for sharing their municipality-CZ crosswalk.

[30] The further separation of foreign MNEs into maquila and non-maquila is done in Table B3 (Appendix B).

the beginning and end of our sample period (1994 and 2019). Specifically, we look into the total number of workers, wage bill per worker, sales, and capital. Across all characteristics, domestic informal establishments perform about an order of magnitude more poorly than domestic formal establishments, which in turn perform about an order of magnitude more poorly than foreign MNEs. For instance, in 2019, domestic informal establishments employed, on average, 2.7 workers, domestic formal establishments employed 20.8 workers, while foreign MNEs employed 291.6 workers.

Table B2 (Appendix B) shows the importance of each establishment type as a share of the economy-wide totals, again in 1994 and 2019. While in 2019, foreign MNEs represent only 0.2% of the number of establishments, they account for 11.88% of employment, 17.45% of sales, 25.72% of the wage bill, and 12.45% of assets. Meanwhile, in 2019, domestic informal establishments account for a sizable share of employment (44.63%), sales (30.67%), wage bill (9%), and assets (37.24%). Moreover, we learn that both domestic informal establishments and foreign MNEs have grown in importance at the national level between 1994 and 2019. Appendix B includes further details on the data, sample build, and summary statistics.

Figure B1 (Appendix B) presents the percentage of CZ-level employment in foreign MNEs in 1994 and 2019. While distance to the United States border remains a good predictor of the importance of foreign MNEs in CZ-level employment, between 1994 and 2019, foreign MNEs have also expanded into Central and Southern Mexico. By contrast, domestic informal establishments employ a higher percentage of CZ-level workers in the Southern half of Mexico (see Figure B2 in Appendix B). Similar to foreign MNEs, domestic informal establishments have grown in importance between 1994 and 2019 across Mexico.

Spatial clustering of foreign MNEs by country of origin We now turn our interest to the country of origin of foreign MNEs in Mexico. Panel (a) in Figure B3 (Appendix B) shows the changing composition of foreign MNE employment by the country of origin of the foreign capital. We focus on Mexico's eight largest investor countries: the United States, Japan, Germany, Netherlands, Great Britain, Canada, France, and Switzerland (plus the rest of the world labelled "other"). While MNEs from the United States remain dominant, Mexico has also been able to increasingly diversify the origin countries of its foreign MNEs. In panel (b) of the same figure, we normalize to 1 the nation-wide employment in 1994 in establishments owned by Mexico's eight largest investor countries. Each line reveals the change since 1994 of foreign MNE employment from these largest investor countries. Most of the growth in employment in foreign MNEs since 1994 has occurred in establishments owned by British, German, Canadian, Japanese, and French investors.

Figure B4 (Appendix B) showcases the spatial clustering by country of origin of foreign MNEs, measured as the employment in foreign MNEs from a given origin country in a given CZ as a share of the total employment in foreign MNEs in that CZ. MNEs from Canada are more likely to favor Northern Mexico, with particular preferences for Baja California Sur and Coahuila. While MNEs from Japan rarely targets East, Southeast and Southwest Mexico, MNEs from Western Europe are particularly well represented in those regions. While MNEs from the United States are prevalent across Mexico, it is particularly dominant in areas such as the Yucatán Peninsula and Chiapas. We will leverage this spatial clustering by country of origin in our identification strategy for the effects of foreign MNEs on the domestic economy.

Maquila vs. non-maquila foreign MNEs The maquila status of a foreign MNE is associated with duty-free and tariff-free operations. Maquila MNEs tend to take raw materials and assemble, manufacture, or process them and export the finished products. The separation between maquila and non-maquila MNEs is meant to acknowledge both the different tax distortions that these MNEs face and the plausibly different effects they might bring about on the domestic economy.

Table B3 (Appendix B) presents summary statistics separately for foreign MNEs in Mexico with or without income from maquila activities.[31] We learn that while non-maquila MNEs are 77% of the number of foreign MNE establishments, they only employ a third of all workers in foreign MNEs. Relative to non-maquila foreign MNEs, we find that maquila foreign MNEs are, on average, substantially larger employers (employing, on average, 527 workers compared to 157 in non-maquilas). Maquila MNEs are also significantly less capital-intensive and productive (measured as sales per worker) than non-maquila MNEs. Maquila MNEs are also more import-reliant and export-oriented.[32]

3.2 Distortions in Mexico

3.2.1 Data on distortions in Mexico

One of our key contributions is to build a comprehensive dataset that estimates the level of a broad set of output and input distortions for the initial year (1994) across establishment types and CZs. The source data for all these distortions is Mexico-specific and draws either from the Economic Census directly or from national surveys.

An alternative approach to building these various measures of distortions ourselves would be to use indirectly-inferred measures of distortions à la Hsieh and Klenow (2009). This indirect approach infers misallocation from measured gaps in average products. This approach has obvious benefits, including the parsimonious set of variables needed to implement it (i.e., typical balance sheet variables) and the comparability of such distortion measures with existing research. There are drawbacks to this approach as well. Bils et al. (2021) acknowledge that "differences in measured average products need not imply differences in true marginal products. First, marginal products are proportional to average products only under Cobb-Douglas production. Second, measured differences in revenue over inputs could simply reflect poor measurement. [...] Moreover, there could be transitory mismeasurement from classifying some revenue or inputs in an adjacent year to when it actually occurred."

An important appeal of our direct measurement approach is that it allows us to unpack the relative importance of a large set of output and input distortions. This means that our measures can be traced back to specific government policies or market failures, which is what Bils et al. (2021) call for in their conclusion.[33] One caveat to our direct measurement approach is

[31] Our definition of maquila vs. non-maquila foreign MNEs needs to be further refined as not all establishments with income from maquila activities were actually part of the official maquila program.

[32] Verhoogen (2013) includes a more detailed comparison between maquila and non-maquila (foreign-owned) establishments and a history of the maquila program.

[33] This also relates to Rodrik (1987), who argues that "a policy broadly aimed towards addressing observed market wedges will not work because different mechanisms — even if they lead to similar divergence between social and

that it is exceptionally data-intensive. Moreover, one can always argue that there is an additional distortion that we should have incorporated in our list, despite our intention to be as exhaustive as the Mexican data allows. With these caveats in mind, we move forward with our direct measurement approach.

For those distortions measured directly in the Economic Census, we observe a value for each establishment in the Census in each Economic Census year when that establishment is in operation. For those distortions measured via national surveys covering a sample of establishments, we project survey responses on establishment-level observables and use those projections to generate values for all establishments in the Census based on their observables. We assume that the projection coefficients are time-invariant (e.g., that the predictive role of establishment size for a given distortion is the same in 2018 and 1994).[34]

Note that as of now, we treat distortions as time-invariant and use their 1994 value – either the direct 1994 measure for those distortions measured in the Economic Census or the 1994 projection for those whose measurement relies on national surveys. We are investigating whether we can find alternative panel data for the distortions currently measured based on surveys. If we find such data, we can then allow the distortions themselves to be affected by the increasing importance of foreign MNEs in Mexico (which affects the welfare effects of foreign MNEs, as shown in the last term of equation (1)).[35]

Sales distortions We first summarize the distortions that apply on the sales of producers in Mexico and for which we bring direct measures by establishment-type and CZ.

- *Regulation:* The data source for the distortion associated with the excessive burden of regulation is the "National Survey on Productivity and Competitiveness of Micro, Small and Medium Enterprises" (ENAPROCE in Spanish, collected in 2015 and 2018). ENAPROCE allows us to estimate (i) the value of time spent by senior employees to address government requirements and (ii) any additional payments to the government due to regulation (other than taxes).
- *Crime and corruption:* We use the National Survey of Business Victimization (ENVE in Spanish, collected in 2012, 2014, 2016, 2018, 2020) to obtain estimates for the cost of crime and corruption to establishments in Mexico. For crime, we measure both the cost of prevention measures and those of actual damages cause by crimes. For corruption, we look into the bribes paid by establishments to public servants or third parties.[36]
- *Taxes and subsidies:* The Economic Census tracks establishment-specific (i) taxes paid for supplying goods and services to producers and final consumers and (ii) subsidies granted by the government to establishments associated with their programs. We are in the process of collecting data on the special tax treatment of foreign MNEs (maquila or not).
- *Export tariffs:* We use the World Integrated Trade Solution (WITS) data on product-level import tariffs for Mexico for the years 1995, 1998, 2003, 2008, 2013, and 2018. We then build industry-level average tariffs (based on the weighted importance of products for each in-

private costs — could behave differently to policies."

[34] Appendix C provides a detailed account of these data sources, variables used and the imputation procedure.

[35] Dell et al. (2019) show that Mexican labor markets with more trade-induced job loss see a rise in violence. One could hypothesize that an increased presence of foreign MNEs can also affect crime (in addition to other distortions.)

[36] Olken and Pande (2012) review literature pointing to the prevalence and distortive effect of corruption on firm behavior in the developing world (e.g., Sequeira and Djankov, 2014).

dustry) for each Economic Census year. We are in the process of updating the establishment-specific tariffs for foreign MNEs under the maquila program.

– *Markups:* While this is a distortion of interest, for now we have not found a direct measure. There is the option of estimating markups using methods such as De Loecker and Warzynski (2012), but so far this is not our preferred approach.

Input distortions Input distortions create a wedge between the price paid by an input user and the marginal cost to the input provider of supplying that input. We consider the following input distortions for measurement in our empirical setting:

– *Capital input distortions:* To build our measure of capital input distortions, we draw on a rich set of questions from the "National Business Financing Survey" (ENAFIN in Spanish, collected in 2015 and 2018). We use the predicted base rate for loans evaluated at the mean percentage of collateral required (115%) and loan duration (1.85 years).

– *Labor input distortions:* We use the Economic Census to calculate the contributions to social security on behalf of workers and other labor-related contributions that each establishment made in a given year as a share of its wage bill.

– *Import tariffs:* We use the World Integrated Trade Solution (WITS) data on product-level import tariffs for Mexico for the years 1995, 1998, 2003, 2008, 2013, and 2018. We then build industry-level average tariffs (based on the weighted importance of products for each industry) for each Economic Census year. We are in the process of updating the establishment-specific tariffs for foreign MNEs under the maquila program.

3.2.2 Facts on distortions in Mexico

Table 1 reports weighted averages of distortion values by establishment type (domestic informal, domestic formal, foreign MNE) and whether establishments are in a manufacturing industry.[37] First, we learn that distortions vary substantially across establishment types. For instance, domestic informal establishments do not pay labor taxes (by construction), whereas foreign MNEs pay 17.1% of their wage bill (a slightly higher percentage than domestic formal establishments). Second, we notice that other distortion types also vary significantly across the three types of establishments, reinforcing the importance of keeping track of as many empirically-relevant distortions as the data allows. Third and last, we note that the ranking of the distortion values across establishment types depends on the distortion. For instance, crime is most costly for domestic informal establishments.[38]

Figure 1 includes three histograms of an "index" of the value of total distortions in 1994, one histogram for each establishment type (domestic formal, domestic informal, and foreign MNEs). Each histogram plots the value of the average total distortion for an establishment type across all 781 CZs in Mexico. We build the index of total distortions by summing across all the output and input distortions as shares of sales.[39] There are two main takeaways from this figure. First, there is substantial heterogeneity across CZs in how distorted a given establishment

[37]The further reporting of the distortion measures separately for maquila and non-maquila foreign MNEs is work-in-progress.

[38]This supports the view that property rights are protected for formal firms but not for informal ones (De Soto, 1989).

[39]Future versions of this index should weigh output and input distortions appropriately (as opposed to adding them indiscriminately).

type is. Second, domestic informal establishments tend to be less distorted than foreign MNEs, which in turn tend to be less distorted than domestic formal establishments. The comparison between the distortions of foreign MNEs relative to the domestic sector (formal and informal) highlights that the mere expansion of foreign MNEs in the Mexican economy has reallocative implications (even without distinguishing between the relative effects of this expansion on the domestic formal vs. informal sectors).

Appendix C.2 provides additional summary statistics on the magnitude of distortions in Mexico in 1994 across two-digit industries, distortion types and space. The maps in Figures C1 and C2 plot the values of the average output and input distortions in 1994 by commuting zone (averaging across establishment types and industries).

3.3 Other data

Trade flows data Appendix D provides details on how we construct the global input-output matrix between all entities located in Mexican CZs and the rest-of-the-world. In short, we build this matrix by combining multiple data sources, a set of proportionality assumptions, and implications from a gravity model.

Migration flows Appendix E describes the construction of the migration flow matrix in 1990. We use the 1990 "Integrated Public Use Microdata Series" (IPUMS) Census data for Mexico, the ACS 1990 United States Census and the 1993 "Survey about Migration at the Northern Border" ("Encuesta sobre Migración en la Frontera Norte" in Spanish) from Mexico.

Population and the labor market We use the publicly available Census microdata by location from INEGI to build 1995-2020 panel data for the population of each municipality. We divided the population proportionally into five categories: in the labor force, not in the labor force, informal workers, employed, and unemployed using shares from the National Survey of Occupation and Employment (ENOE) and the National Survey of Employment (ENE).

Other CZ-level controls Appendix E describes the construction of our CZ-level controls based on data from the "Integrated Public Use Microdata Series" (IPUMS) and Comtrade.[40]

4 The local effects of changes in exposure to foreign MNEs

In this section, we implement the empirical exercises suggested by the framework described in Section 2, providing plausibly-causal reduced-form estimates that inform the calibration of the key model parameters. To that end, we want to estimate the effect of changes in the importance of foreign MNEs in a commuting zone (CZ) on the domestic economy. We study these effects in the aggregate across all domestic establishments and separately by subgroups of domestic establishments (namely, between formal and informal establishments). We also study the differential effects of the growth in employment in maquila vs. non-maquila

[40] We also describe our concordance tables for changing commuting zones and industry classifications across time. Between 1994 and 2019, Mexico both created new municipalities and merged some municipalities, making it necessary to create time-consistent CZs. Moreover, the 1994 Economic Census industry classification differs from the NAICS classification used in the subsequent Censuses.

foreign MNEs on the local domestic economy. We use the simpler case of the average effects on all domestic establishments to motivate our empirical strategy.

4.1 Intuition on channels

We start by discussing the channels by which an increased presence of foreign MNEs (maquila or not) in a CZ can affect (formal and informal) domestic establishments. We also link this discussion with how we build these channels into our framework from Section 2.

First, the growth of the foreign MNE sector in a CZ can affect local input markets. The effects are a priori ambiguous. On the one hand, foreign MNEs increase demand for non- or less-tradable inputs such as labor, raising their prices and hurting domestic establishments. On the other hand, foreign MNEs can increase the set of input varieties available to domestic buyers (Rodriguez-Clare, 1996) or improve the quality of existing inputs (e.g., by transferring knowledge to workers and workers moving to domestic firms, as in Poole, 2013). Among foreign MNEs, those focused on maquila activities tend to import most of their inputs and are less likely to trigger the positive effects just mentioned. For informal establishments, an increase in foreign MNE employment will likely toughen the competition for domestic factors (particularly low-skill workers). In the model, we capture these effects by including input-output linkages between the local domestic economy and foreign MNEs and adding different EoS in the labor supply that capture the competition between foreign and domestic producers for the local factors.

Second, foreign MNEs can also affect domestic establishments via interactions in the output market. Again, the sign of this effect is ambiguous. On the one hand, foreign MNEs tend to be more productive and their expansion can make domestic establishments shrink or even exit (e.g., as was the case with retail foreign MNEs in Mexico, see Atkin et al., 2018). On the other hand, the increased competition from foreign MNEs incentivizes domestic establishments to innovate or imitate (Brambilla et al., 2009). Maquila foreign MNEs are less likely to affect domestic establishments through these channels as maquilas export most of their output. Domestic informal establishments are less likely to both be hurt and benefit from this channel as informal varieties are less substitutable with foreign MNE varieties. In our model, the utility function of final consumers is a nested CES, in which we allow for stronger competition between formal producers but also allow for some competition between foreign MNEs and domestic informal producers.

Third, foreign MNEs can also impact the performance of domestic establishments whenever they enter supply-chain linkages (as either buyers or suppliers). There is consistent evidence that suppliers to foreign MNEs experience gains in productivity (Javorcik, 2004; Alfaro-Ureña et al., 2022b). Again, foreign maquilas are less likely to improve the performance of domestic establishments through this channel as they tend to import most of their inputs and export most of their output. Domestic informal establishments are less likely to benefit from foreign MNEs through this channel, as foreign MNEs are less likely to source from them and themselves are less likely to source from foreign MNEs. To capture these potential mechanisms, we include input-output linkages between domestic formal producers and foreign MNEs. In particular, the exposure of domestic producers to foreign MNEs is captured directly by the

Leontief matrix. Moreover, we allow for spillovers of foreign MNEs to the local domestic economy.

Fourth and last, an increase in foreign MNE employment can lead to positive demand effects on domestic establishments in the non-tradables sector (Moretti, 2010). This channel is plausibly relevant for both formal and informal establishments. In the model, we capture this channel by allowing the growth in employment in foreign MNEs to increase the relative income of locations experiencing this growth (which, in turn, increases the demand for other products and services, including those in the non-tradable sector).

4.2 Empirical strategy

Measure of exposure to foreign MNEs We define $\widehat{X}^F_{cz,t}$ as the change in the importance of foreign MNEs in a commuting zone cz between two Economic Census years $(t-5)$ and t as the change between those years in the number of workers employed by foreign MNEs divided by all employment in that CZ in $(t-5)$:

$$\widehat{X}^F_{cz,t} \equiv \frac{L^F_{cz,t} - L^F_{cz,t-5}}{L^F_{cz,t-5} + L^D_{cz,t-5}} \tag{9}$$

where $L^F_{cz,t-5}$ and $L^D_{cz,t}$ are the total number of workers employed at foreign MNEs and domestic establishments, respectively, in CZ cz in year $(t-5)$.

OLS specification We start with the following regression equation:

$$\log y_{cz,t} - \log y_{cz,t-5} = \beta \widehat{X}^F_{cz,t} + \theta' K_{cz,t} + \Delta\epsilon_{cz,t}, \tag{10}$$

where cz indexes commuting zones in Mexico and t indexes Economic Census years (i.e., 1994, 1999, 2004, 2009, 2014, 2019). $y_{cz,t}$ is the outcome associated to domestic establishments in CZ cz in Economic Census year t; our main outcomes are the total sales, number of workers, wage bill, and capital of all domestic establishments in CZ cz. All observations are weighted by the number of workers in domestic establishments in 1994. We cluster standard errors at the CZ-year level.

Potential endogeneity concerns We want a consistent estimate of β measuring the effect of employment growth at foreign MNEs on the CZ-level outcomes of domestic establishments. However, the OLS estimate presents two main potential concerns. First, there is the classic omitted variables concern. The OLS estimate might overestimate the effects of foreign MNE employment growth if foreign MNEs tend to flow into CZs set to grow (e.g., because foreign MNE parents learn about a new government commitment to invest in productive infrastructure). Conversely, the OLS estimate might underestimate the effects of foreign MNEs if they tend to enter and grow in CZs experiencing a decline (e.g., in reaction to falling wages or local government incentives). Second, there might be measurement error in the growth of the employment share of foreign MNEs in a CZ (for instance, if an establishment misreports its foreign ownership).

Instrumental variable (IV) approach Before introducing the instrument, it is first helpful to denote $L^{F,o}_{cz,t}$ as the employment of foreign MNEs from origin country o in CZ cz in year t and rewrite the expression of $\widehat{X}^F_{cz,t}$ as follows:

$$\widehat{X}^F_{cz,t} \equiv \frac{L^F_{cz,t} - L^F_{cz,t-5}}{L^F_{cz,t-5}} \times \frac{L^F_{cz,t-5}}{L^F_{cz,t-5} + L^D_{cz,t-5}} = \left(\sum_o \frac{L^{F,o}_{cz,t} - L^{F,o}_{cz,t-5}}{L^{F,o}_{cz,t-5}} \times \frac{L^{F,o}_{cz,t-5}}{L^F_{cz,t-5}} \right) \times \frac{L^F_{cz,t-5}}{L^F_{cz,t-5} + L^D_{cz,t-5}}.$$

The expression above spells out the fact that the overall growth in foreign MNE employment in a CZ cz between $(t-5)$ and t is a weighted sum across origin countries o of the growth experienced by foreign MNEs from each origin country (where the weights are the $(t-5)$ share of employment from that origin in all foreign MNE employment in that CZ and year). Consider two hypothetical CZs with the same share of foreign MNE employment in overall employment in $(t-5)$, $\left(L^F_{cz,t-5}/(L^F_{cz,t-5} + L^D_{cz,t-5})\right)$ but with different compositions of that foreign MNE employment across countries of origin $\left(L^{F,o}_{cz,t-5}/L^F_{cz,t-5}\right)$. Whenever Mexico experiences an increase in foreign MNE employment from origin o (for reasons unrelated to cz-specific shocks), cz would benefit from that foreign MNE employment growth from o proportional to the original importance of origin country o for that CZ. The instrument takes advantage of this past composition of foreign MNE employment in a CZ to predict its growth.

Below is an alternative rewriting of $\widehat{X}^F_{cz,t}$ also useful to understand the IV:

$$\widehat{X}^F_{cz,t} \equiv \frac{L^F_{cz,t} - L^F_{cz,t-5}}{L^F_{cz,t-5} + L^D_{cz,t-5}} = \sum_o \frac{L^{F,o}_{cz,t} - L^{F,o}_{cz,t-5}}{L^{F,o}_{cz,t-5}} \times S^o_{cz,t-5} = \frac{1}{L^F_{cz,t-5} + L^D_{cz,t-5}} \sum_o \left(L^{F,o}_{cz,t} - L^{F,o}_{cz,t-5} \right).$$

The instrument will predict the increase in foreign MNE employment from origin country o in cz $\left(L^{F,o}_{cz,t} - L^{F,o}_{cz,t-5}\right)$ by leveraging the insight that new foreign MNE employment in Mexico from origin country o will disproportionately be created in CZs where that country of origin clustered in the past. Let's construct the instrument $\widehat{Z}^F_{cz,t}$ as follows:

$$\begin{aligned}
\widehat{Z}^F_{cz,t} \equiv & \sum_o \frac{\sum_{cz' \neq cz} \left(L^{F,o}_{cz',t} - L^{F,o}_{cz',t-5} \right)}{\sum_{cz'} L^{F,o}_{cz',t-5}} \times \frac{L^{F,o}_{cz,t-5}}{L^F_{cz,t-5} + L^D_{cz,t-5}} = \sum_o \frac{\sum_{cz' \neq cz} \left(L^{F,o}_{cz',t} - L^{F,o}_{cz',t-5} \right)}{\sum_{cz'} L^{F,o}_{cz',t-5}} \times S^o_{cz,t-5} \\
= & \frac{1}{L^F_{cz,t-5} + L^D_{cz,t-5}} \sum_o \left(\sum_{cz' \neq cz} L^{F,o}_{cz',t} - L^{F,o}_{cz',t-5} \right) \times \frac{L^{F,o}_{cz,t-5}}{\sum_{cz'} L^{F,o}_{cz',t-5}}. \qquad (11)
\end{aligned}$$

Each term in the last summation is the prediction for $\left(L^{F,o}_{cz,t} - L^{F,o}_{cz,t-5}\right)$, which uses the prediction for the overall change in employment in Mexico in foreign MNEs from origin o (i.e., the overall change in foreign MNE employment in Mexico from that origin *excluding* the change in the CZ of interest) and apportions it to cz based on the previous clustering of foreign MNEs from o in cz. For instance, if 30% of the employment in Mexico of foreign MNEs from Germany was clustered in $(t-5)$ in a CZ in Puebla, that CZ is predicted to receive 30% of any new increase between $(t-5)$ and t of employment in Mexico in foreign MNEs from Germany.

The rationale of this IV is analogous to that of a classic IV from the migration literature, which instruments the immigrant inflows from a given source country to a particular location by using the historical settlement patterns of immigrants from that source country and the total number of newly-arriving immigrants from that country (Card, 2001). Several studies have documented herding patterns in MNC entry decisions for parent firms from the same origin country. For example, Head et al. (1995) find that Japanese firms tend to locate affiliates in states across the United States that already host many other Japanese-owned firms, Barry et al. (2003) find co-localization patterns for United States-owned affiliates in Ireland, while Bernard and Thomas (2019) bring similar evidence for MNC entry in Eastern Europe. A variant of this instrument was recently used by Setzler and Tintelnot (2021) to study the effects of foreign MNEs in the United States.

Panels B5a and B5b from Figure B5 (Appendix B.3) present two examples from Mexican newspaper articles that discuss the pattern of spatial clustering for German and Japanese MNEs in Mexico. In those articles, the state of Puebla is heralded as the leader in attracting MNEs from Germany, whereas MNEs from Japan have an "appetite" for Guanajuato. Panels B5c and B5b exemplify that the geographic clusters for MNEs from a given origin country are also clusters for amenities relevant to expatriates from that country. In this example, German schools (relevant to German expatriates) also cluster in Puebla. The intuition of our IV relies on the predictive power of factors such as the presence of German schools to predict where German MNEs will expand in Mexico.

The relevance of this IV requires that the growth of foreign MNE employment from an origin country o in a CZ and its growth in all other CZs in Mexico are correlated. This is the case whenever both growth rates are affected by improvements in the overall appeal of Mexico as an investment destination for parent firms from origin country o[41] or exogenous shocks to the performance of these parent firms that lead to increased investments worldwide. Moreover, the relevance of the instrument requires that the past clustering patterns of foreign MNE employment by country of origin is indeed a good predictor of the spatial split of future foreign MNE employment growth from that country.

In both panels of Figure B6 (Appendix B.3), the X-axis presents the residualized measure of exposure to foreign MNEs ($\widehat{X}^F_{cz,t}$) and the Y-axis presents its residualized instrument ($\widehat{Z}^F_{cz,t}$). Both variables are residualized by controlling for the vector of fixed effects and other controls $K_{cz,t}$. The difference between the plots in Panels B6a and B6b is that in Panel B6b, we trim the top and bottom 1% of both the X and Y axes. The slope coefficients (standard errors) are 1.09 (0.13) for Panel B6a and 0.94 (0.10) for Panel B6b. This figure is a graphical check on the first stage of our instrument and the importance of outliers for the first stage coefficient.

The exclusion restriction requires that the unexplained determinant of growth of the domestic economy in cz and the instrument are orthogonal (conditional on the potential determinants of growth already controlled for through $K_{cz,t}$). Formally, the exclusion restriction is:

$$E(\Delta\epsilon_{cz,t}\widehat{Z}^F_{cz,t}|K_{cz,t}) = 0$$

While the exclusion restriction is not testable, it is not unreasonable to expect it to be satisfied. First, $\widehat{Z}^F_{cz,t}$ is not a function of cz-specific changes in input or output market between $(t-5)$ and t. Moreover, prior papers on the spatial clustering of foreign MNEs by origin country argue that differences across locations in endowments of natural resources, labor and in-

[41] For instance, after each revision of the "Global Agreement" between Mexico and the European Union (which first came into force in 2000), Mexico became a more attractive destination for MNEs from the European Union.

frastructure do not seem to explain this pattern of localization choice (Head et al., 1995; Barry et al., 2003; Bernard and Thomas, 2019). Instead, this pattern suggests stronger agglomeration and demonstration effects among firms from the same origin country.

The third way of writing the IV in equation (11) highlights that this IV has a shift-share or "Bartik" structure. Identification in our shift-share IV regressions follows from the assumption that the assignment of the shocks $\left(\Delta L^{F,o}_{-cz,t}\right)$ is quasi-random, whereas the exposure shares $\left(S^{o}_{cz,t-5}\right)$ are allowed to be endogenous (as in Borusyak et al., 2022b). In the same paper, Borusyak et al. (2022b) recommend to control for the "missing share", which in our case is $\frac{L^{D}_{cz,t-5}}{L^{F}_{cz,t-5}+L^{D}_{cz,t-5}}$. We add this control to all our regressions so as to avoid comparing CZs with too different levels of importance of foreign MNEs in their overall employment.

To address remaining threats to identification, we include in the control vector $K_{cz,t}$ a conservative set of CZ-level controls. First, we include economic region-year indicators to control for shocks common across commuting zones in an economic region.[42] Second, we include time-varying controls for CZ-specific urban concentration rates, employment rates, the importance of manufacturing in employment, the prevalence of secondary education or routine occupations, and demographic characteristics such as the share of indigenous or foreign-born individuals. Third and last, we include controls for CZ-level shocks in import and export markets. Namely, we control for the "China shock" using two variables: one capturing the rising importance of imports from China into Mexico and another capturing the increasing competition from China in the main export markets of Mexico in 1994 (in the spirit of Autor et al., 2013; Blyde et al., 2020). We also include a control for the rising importance of imports from the United States into Mexico. Appendix E provides additional details on these controls.

4.3 Effects of exposure to foreign MNEs on the local domestic economy

Table 2 reports the OLS and IV estimates coming from running the regression in equation (10) for twelve outcome variables. In order of the columns, these measures of size are the labor force participation rate (as a share of the working-age population), the working-age population, the number of domestic establishments, the total number of workers in the domestic economy, the number of high-skill workers, the number of low-skill workers, total sales, total value added, total wage bill, wage bill for the high-skill workers, wage bill for the low-skill workers, and total assets.

Panel A in Table 2 presents the OLS estimates, whereas Panel B shows the IV estimates and corresponding F-statistics. A first takeaway is that while both OLS and IV estimates are positive and mostly significant, the IV estimates are larger in magnitude. As discussed in Section 4.2, one reason behind this pattern could be measurement error in the exposure to foreign MNEs. Alternatively, this pattern could reflect the selection of foreign MNEs into CZs with declining conditions (e.g., falling wages and/or being attracted by local government incentives).

The *F*-statistic is 35, and the first-stage coefficient is 1.07 (see Table 3). Hence, the IV defined in equation (11) is a strong predictor of foreign MNE employment growth. In the right-hand side panel of Table 3, we also show the reduced-form regression of our outcomes

[42] Mexico is split into 8 economic regions: East, North, Northeast, Northwest, South, Southeast, Southwest, and West.

of interest on the instrument. These regressions serve to convince the reader that the IV actually affects the outcome variables. According to Angrist and Pischke (2009), the reduced-form regressions act as a weak-instruments test. It is reassuring that we find effects in the reduced form as well, and the estimates do not vary substantially between the reduced form and the IV.

Now focusing on the IV estimates, we find that while the labor force participation rate is unaffected, increasing exposure to foreign MNEs leads to an expansion of the domestic economy across most size measures. We estimate that a 1 percentage point increase in the share of employment at foreign MNEs in a CZ increases population by 0.62%, the number of domestic establishments by 0.42%, workers by 0.33% (particularly low-skill workers), sales by 1%, value added by 1.48%, and the wage bill by 1.62% (particularly the wage bill of the low-skill workers). The effect on assets is not statistically significant.[43]

4.4 Effects of exposure to maquila vs. non-maquila foreign MNEs

We now modify the specification in equation (10) by separating the change in foreign MNE employment in a CZ between that occurring in maquila (F_M) vs. non-maquila (F_N) foreign MNEs:

$$\log y_{cz,t} - \log y_{cz,t-5} = \beta_M \widehat{X}^{F_M}_{cz,t} + \beta_N \widehat{X}^{F_N}_{cz,t} + \theta' K_{cz,t} + \Delta\epsilon_{cz,t}, \tag{12}$$

where $\widehat{X}^{F_m}_{cz,t} \equiv \frac{L^{F_M}_{cz,t} - L^{F_M}_{cz,t-5}}{L^F_{cz,t-5} + L^D_{cz,t-5}}$ and $\widehat{X}^{F_N}_{cz,t} \equiv \frac{L^{F_N}_{cz,t} - L^{F_N}_{cz,t-5}}{L^F_{cz,t-5} + L^D_{cz,t-5}}$, and $L^{F_M}_{cz,t}$ and $L^{F_N}_{cz,t}$ denote the employment in a commuting zone cz in year t in maquila (F_M) and non-maquila (F_N) foreign MNEs. All other features of this regression remain the same as those in equation (10).

We perform two IV exercises starting from equation (12). First, we instrument one type of foreign MNE employment change at a time while controlling for the other. For instance, we instrument the maquila foreign MNE employment change $\left(\widehat{X}^{F_M}_{cz,t}\right)$ while controlling for the non-maquila foreign MNE employment change in the same CZ over the same period $\left(\widehat{X}^{F_N}_{cz,t}\right)$. Second, we instrument both types of foreign MNE exposure at once. Each time we instrument one type of foreign MNE exposure (F_M or F_N), we use as an instrument an adaptation of the one described in equation (11), where we replace the overall change in foreign MNE employment with that occurring for the specific type of foreign MNE employment we want to instrument for (F_M or F_N).

The magnitude of the IV estimates for β_M and β_N is not sensitive to whether we instrument both exposures simultaneously or only one at a time (while controlling for the other). The (conventional) F-statistic is substantially lower when instrumenting for both maquila and non-maquila foreign MNE exposure in one go (mostly because the instrument is weak for non-maquila foreign MNEs). Given the stability of the IV estimates, we use as our baseline IV specification the one where we instrument for each foreign exposure at a time. In future work, we need to calculate the appropriate F-statistics for settings with multiple endogenous variables and revisit the regressions where both exposure measures are instrumented at once.

Table 4 presents the IV estimates of the regression described in equation (12). The three

[43] The effects of exposure to foreign MNEs on the substitution between labor and capital (empirical moment (7) in Table 8) is work in progress.

panels differ in the set of foreign MNEs whose effects we estimate (and the subsequent controls used). In the upper panel, we keep the baseline sample of all foreign MNEs, which corresponds to the regression in equation (10) and the results presented in Tables 2 and 3. In the middle panel, we focus only on the exposure to maquila foreign MNEs. In these regressions, we control for the change in exposure to non-maquila foreign MNEs. In the lower panel, we focus only on the exposure to non-maquila foreign MNEs. In these regressions, we control for the change in exposure to maquila foreign MNEs.

There are two main takeaways from this exercise. First, the instrument is substantially weaker for the non-maquila foreign MNEs (the F-statistic is 7.7 for non-maquilas compared to the 42 for maquilas). We conjecture that this is owed to (i) the more recent entry of non-maquila relative to maquila MNEs (which makes the past spatial clustering of non-maquilas less informative) and (ii) the measure of exposure based on employment might be less relevant for non-maquilas (which tend to be more capital-intensive). In work in progress, we aim to disentangle these factors, propose a stronger IV for the non-maquilas or conduct an inference analysis appropriate for weak instruments.

Second, by contrasting the estimates in the three panels, one can notice that, on average, maquila foreign MNEs have weaker positive effects on the size of the local domestic economies than the non-maquila foreign MNEs. When focusing on high- vs. low-skill workers, we learn that maquilas tend to favor the expansion of the low-skill workforce, whereas non-maquilas favor the expansion of the high-skill workforce. This pattern aligns with maquilas' more low-skill intensive nature and lower integration in the local economy (given their heavy reliance on imports and assembly-for-export business model).

4.5 Effects of exposure to foreign MNEs on the domestic formal vs. informal sector

To study the reallocation effects between the formal and informal segments of the domestic economy, we use the following augmented specification:

$$\log y_{i,cz,t} - \log y_{i,cz,t-5} = \beta_1 \widehat{X}^F_{cz,t} + \beta_2 \widehat{X}^F_{cz,t} \times \mathbb{1}[i = D_I] + \beta_3 \mathbb{1}[i = D_I] + \theta' K_{cz,t} + \Delta\epsilon_{i,cz,t} \quad (13)$$

where i stands for either the formal or informal segment of the domestic economy in CZ cz. For example, assume that i, cz refers to the domestic informal segment in cz, for which $\mathbb{1}[i = D_I] = 1$. Then, the value of an outcome (e.g., number of workers) for i in CZ cz and year t is the summation of that variable across all domestic informal establishments in that CZ cz and year t. For each measure of size, CZ and year, there are two stacked observations: one capturing the size of the domestic formal economy ($\mathbb{1}[i = D_I] = 0$) and another capturing the size of the domestic informal economy ($\mathbb{1}[i = D_I] = 1$). The interpretation of the coefficient β_1 is that the average effect of exposure to foreign MNEs on the local domestic formal sector, whereas coefficient β_2 captures the average *differential* effect of exposure to foreign MNEs on the local domestic informal sector.

Table 5 reports the IV estimates from the regressions described in equation (13).[44] We learn that the formal sector is the primary beneficiary of the positive effect of foreign MNEs on

[44] In future work, we need to calculate the appropriate F-statistics for settings with multiple endogenous variables.

the domestic economy. In contrast, the informal sector seems to be on-net unaffected by the changing exposure to foreign MNEs (though we need to caution that the negative coefficients on the differential effects on the informal sector are noisier). Table 6 includes the reduced form regressions (outcomes regressed on the instrument).

We also adjust the specification in equation (13) to study the differential effects on the formal and domestic informal sectors of either changes in maquila or non-maquila foreign MNE employment. The three panels in Table 7 (with a similar structure of those in Table 4) summarize these differential effects. The current results suggest that most of the offsetting negative effect of foreign MNEs on the domestic informal sector comes from its exposure to maquila foreign MNEs. In other words, the size of the informal sector tends to be on-net unaffected by increased exposure to the maquila foreign MNEs. In contrast, the exposure to non-maquila foreign MNEs tends to also increase the size of the domestic informal sector alongside the domestic formal sector. These results are preliminary. In future work, we need to calculate the appropriate F-statistics for settings with multiple endogenous variables and apply tests for weak instruments in the case of exposure to non-maquila foreign MNEs.

5 Model estimation

Disclaimer: This section discusses what we aim to do for estimation. The next section discusses what we are currently doing, which is a subset of what we aim to do.

To solve for the reallocation effects and quantitatively assess the decomposition in equation (1) we need to calibrate the size of the foreign MNE productivity shock ($d\log\tilde{A}_j$ for foreign MNEs), the EoS between formal and informal varieties (ξ), the EoS between formal domestic and foreign varieties (ϵ), the trade elasticity for each producer type s (σ_s), the EoS between intermediate inputs and value added in production (ζ), the EoS between labor and capital (ι), the EoS between high- and low-skill workers (σ_L), the EoS between formal and informal jobs for workers (κ), the EoS between formal domestic and foreign MNE jobs (θ), the migration elasticity (η), and the productivity spillover elasticities from maquila and non-maquila foreign MNEs to domestic formal and informal producers $\{\gamma_{kj}\}$.

In our current version, we take the parameters $\{\xi,\epsilon,\sigma_s,\zeta\}$ from the literature and present their values in Table 9.[45] We discuss in this section how we can calibrate $\{d\log\tilde{A}_{F_M}, d\log\tilde{A}_{F_N}, \gamma_{D_F,F_M}, \gamma_{D_I,F_M}, \eta, \iota, \sigma_L, \kappa, \theta\}$ using our reduced-form evidence.

Each of the parameters has a mapping to the reduced-form evidence. The foreign productivity shocks ($d\log\tilde{A}_{F_M}, d\log\tilde{A}_{F_N}$) map to the increased presence of foreign producers in each CZ in Mexico. The spillover elasticities $(\gamma_{D_F,F_M}, \gamma_{D_I,F_M})$ map to how formal or informal employment react when foreign MNEs expand. The migration elasticity η could be obtained from the population responses to the foreign productivity shock. The EoS ι maps to the relative effect of the shock on capital vs. labor. The EoS σ_L maps to the relative effect of the shock on low- vs. high-skill workers. The shape parameter θ maps to the effect of the shock on domestic wages. The shape parameter κ maps to the relative effect of the shock on domestic informal

[45]Future versions of the paper aim to estimate some of these elasticities to match reduced-form causal moments presented in Section 4.

wages relative to domestic formal wages.

We take the values of the parameters such that the effect of the shock in the model simulations gets as close as possible to the reduced form empirical effects. In other words, we estimate the model parameters using an indirect inference matching approach using causally estimated reduced-form moments as targets.[46] Table 8 summarizes the mapping between moments and parameters. We describe this relationship in more detail below.

TFP shocks to the foreign MNE producers We model the foreign MNE shock as a productivity shock that expands labor demand for foreign MNEs conditional on potentially-changing distortions (since foreign MNEs may be expanding as a result of receiving subsidies and tax deals). To calibrate the shock, we invert the model and recover changes in productivity $d \log \tilde{A}_j$ for foreign MNEs to match the expansion of foreign employment in each CZ, given a change in the distortions for foreign MNEs. For instance, instead of solving the change in employment in equation A1, we solve for the change in productivity for foreign MNEs given the elasticities and the expansion of foreign MNEs we observe in the data. We use the predicted foreign MNE employment growth from our IV specification instead of the one we directly observe (as we want to use the exogenous variation for the shock).

Other parameters In the same iteration and given a productivity shock, we could estimate the effect of the shock using the simulated data and recover the main model parameters. Table 8 describes the different moments and the parameters we plan to match by running our main specification with the simulated data.

The migration elasticity, η, captures how sensitive migration flows are to changes in real income; we identify this parameter by looking at the increase in population in areas that experience the foreign employment shock, as this corresponds to a productivity shock that has a direct impact on the real income of these locations. In the reduced-form, we find a positive impact on the total population of around 0.6%.[47] So far we use a value of $\eta = 2$ from the literature (Monte et al., 2018).

Conditional on the demand, input elasticities, and migration elasticity, the relative change between domestic formal and informal employment is determined by the spillovers from foreign MNEs to the local domestic economy. We identify these spillover elasticities $(\gamma_{D_F,F_M}, \gamma_{D_I,F_M}, \gamma_{D_F,F_N}, \gamma_{D_I,F_N})$ by looking at the reduced-form coefficient on the relative effect of the maquila and non-maquila expansion on the domestic economy as a whole and their relative effect on domestic formal vs. domestic informal employment. On the one hand, higher spillovers increase total employment for both types of producers. On the other hand, the relative change in employment between the two types of domestic producers determines which type of domestic producers benefit more from the spillovers. In a basic calibration, in which we group maquila and no-maquila foreign firms, we found positive effects for both types of domestic producers, implying positive spillovers. We also found a higher increase in employment for domestic formal relative to informal producers, suggesting higher spillovers

[46] We use the algorithm proposed by Gourieroux et al. (1993) that finds the combination of parameters such that $\hat{\delta} = argmin \beta(\delta)' W \beta(\delta)$, where δ corresponds to the estimates to find, β to the reduced-form coefficients from the model simulations that depend on these parameters, and W is a weighting matrix. We plan to use the inverse of the standard errors as weights as Faber and Gaubert (2019).

[47] This result controls for the indirect exposure (via migration) that each CZ experiences from other CZs. The omission of this control misleads the interpretation of commonly used population regressions (Borusyak et al., 2022a).

from foreign MNEs to the formal sector.

We can also identify the EoS between the factors of production by looking at the relative effect of the shock across factors. In particular, we can identify the EoS between the two types of labor, high- and low-skill, and between labor and capital by looking at the relative effects of the foreign TFP shocks on input demand. These parameters informs us how both domestic producers and foreign MNEs substitute inputs in the production function.

Most of parameters described capture the effects on the relative demand for factors. We then use moments that affect wages to identify the supply parameters. In particular, by looking at the effect on the wage bill for domestic producers, we can identify the labor supply elasticities that measure how easy it is for workers to substitute jobs. For instance, conditional on the spillovers and demand elasticities, the foreign shock changes the labor demand of domestic producers, allowing us to identify the labor supply moments. For instance, we can identify how workers substitute jobs at domestic producers for foreign ones by matching the impact on the wage bill. Then, we can recover both elasticities κ and θ by matching these coefficients.

6 Counterfactuals

Disclaimer: We are still working on the parameter estimation and simulation of the shocks.

To shed light on the impact of foreign MNEs on real income and the misallocation channel, we currently run a simulation similar to the one from AD. In particular, for all the places that experience a positive increase in foreign employment, we simulate a 10% productivity increase for foreign MNEs. Around 25% commuting zones in Mexico are affected by the shock.[48] For now, we combine in a single category the foreign MNEs that are maquila or not. Table 9 reports the parameters for this simulation, and Figure F1 (Appendix F) plots the spillover calibration.

Table 10 reports the average effect on real income across commuting zones. Column (1) shows the results for the case in which there are distortions and spillovers, column (2) removes the distortions, column (3) the spillovers, and column (4) both market failures. Similarly, Figure 2 plots the percentage change of real income across commuting zones for the four scenarios.

We find that the productivity shock increases real income by 6.4% on average. This effect is 5% for the CZs that did not directly experience the increase in productivity of foreign MNEs and 8% for CZs that experienced the increase directly. We find that in a world without pre-existing distortions and spillovers, the real income gains would be around 4%, suggesting that distortions and externalities amplify the gains from foreign MNEs by 55%. On the distortions side, the gains come from reallocating economic activity from the informal (less distorted) to the formal (more distorted) segment of the economy.

Column (2) in Table 10 shows that the distortions explain 30 percentage points of the increase due to market failures, and the spillovers drive the remaining 25 percentage points. The distortions' effect is larger for locations that do not directly experience the shock, suggesting that trade linkages across commuting zones can drive the reallocation from low-distorted to

[48] Future versions of the draft will have the full calibration of the shock instead of assuming it to be a 10% productivity increase.

high-distorted establishments, even in areas without foreign MNEs. This finding is consistent with the literature showing that trade openness can reduce informality (McCaig and Pavcnik, 2018) since formal establishments in non-treated locations can sell to MNEs in treated locations. For instance, Figure 2 shows that most locations obtain larger gains when the distortions are acknowledged, even when muting the potential for spillovers. For the locations that experience the shock directly, the spillovers explain most of the gains, as they drive two thirds of the gains explained by market failures. Panel (b) in Figure 2 also shows that the spillovers are more localized as they only directly affect the locations that experience the shock.

Overall, this current simulation suggests that distortions and spillovers can amplify the gains from foreign MNEs by a significant amount in low and middle-income countries – even in locations in those countries without foreign MNEs (due to trade and labor linkages).

7 Conclusion

Work in progress.

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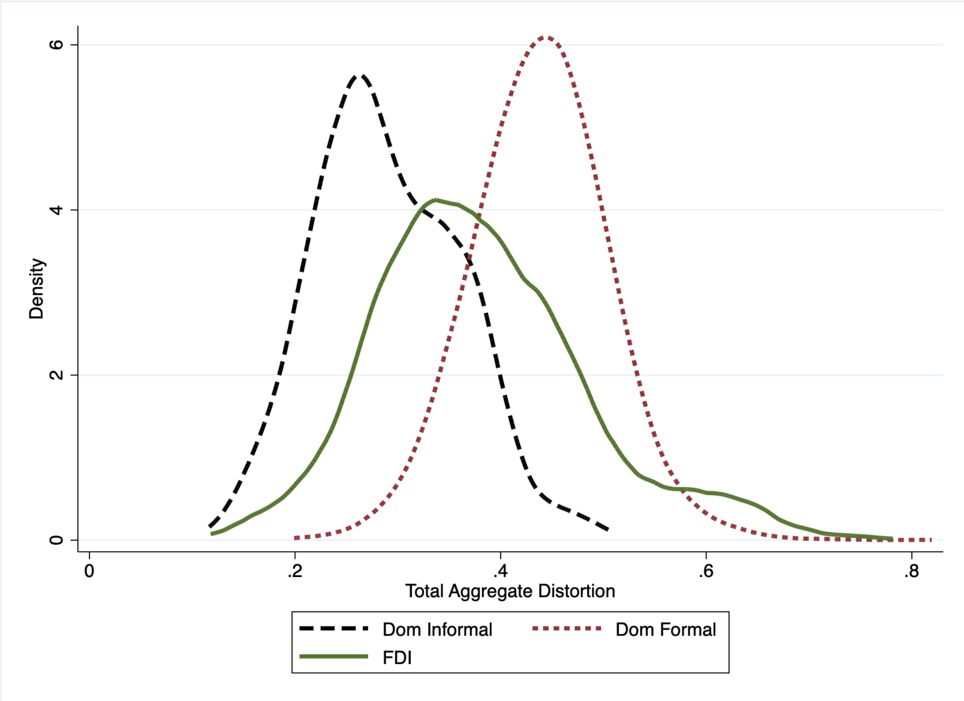
Figures

Figure 1: Histogram of an "index" of total distortions by establishment-type and CZs



Notes: Figure 1 includes three histograms of an "index" of the value of total distortions in 1994, one histogram for each establishment type (domestic formal, domestic informal, and foreign MNEs). Each histogram plots the value of the average total distortion for an establishment type across all 781 CZs in Mexico. We build the index of total distortions by summing across all the output and input distortions as shares of sales. Future versions of this index should weigh output and input distortions appropriately (as opposed to adding them indiscriminately). Section 3.2.2 provides more details.

Figure 2: Percentage changes in welfare across CZs due to the foreign MNE productivity shocks

(a) Gains with distortions and spillovers (b) Gains with no distortions and spillovers

(c) Gains with distortions and no spillovers (d) Gains with no distortions and no spillovers

Notes: Figure 2 plots the changes in welfare for each CZ in Mexico as a result of the local foreign MNE productivity shocks. Panel (a) reports the results when we simulate the economy with distortions and spillover effects from increases in foreign MNE employment. Panel (b) reports the results in the economy without distortions. Panel (c) with distortions but no spillovers, and panel (d) without distortions and without spillovers. Section 6 provides more details.

Tables

Table 1: Output and input distortions (%) by establishment type and broad economic activity

		Output Distortions			Input Distortions	
Mfg	Establishment Type	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 Multinational	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 Multinational	4.16	0.95	3.38	4.37	20.55

Notes: Table 1 reports weighted averages of distortion values by establishment type (domestic informal, domestic formal, foreign MNE) and by whether establishments are in a manufacturing industry or not. The weights in the averages are the number of workers in each CZ. Crime, security, bribes, bureaucracy time, regulation costs, and VAT distortions are reported as shares of total annual sales. Labor taxes are reported as a share of the total annual wage bill. The capital distortion is reported as interest rates. All values are presented as percentages. Section 3.2.2 provides more details.

Table 2: OLS and IV estimates of the effects of foreign MNE exposure on the local domestic economy

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

Notes: Table 2 presents the OLS and IV estimates of the regression described in equation (10). Observations are weighted by the initial CZ domestic employment. We cluster the standard errors at the CZ-year level. We use as controls economic region-year, measures of import and export exposure, and various time-variant CZ-level controls. Sections 4.2 and 4.3 provide more details.

Table 3: First stage and reduced form estimates of the effects of foreign MNE exposure on the local domestic economy

	First Stage	Reduced Form									
	$\widehat{X}^F_{cz,t}$	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)
$\widehat{Z}^F_{cz,t}$	1.073***	0.448**	0.357**	0.386	1.507***	1.075***	1.582***	1.735***	1.045*	1.930***	0.609
	(0.162)	(0.177)	(0.149)	(0.314)	(0.520)	(0.341)	(0.438)	(0.311)	(0.516)	(0.500)	(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

Notes: Table 3 presents the first stage and reduced form estimates of the regression described in equation (10). Observations are weighted by the initial CZ domestic employment. We cluster the standard errors at the CZ-year level. We use as controls economic region-year, measures of import and export exposure, and various time-variant CZ-level controls. Sections 4.2 and 4.3 provide more details.

Table 4: IV estimates of the effects of foreign MNE exposure on the local domestic economy. By foreign MNE type: all, only maquila or only non-maquila

	Establishments	Workers	HS Workers	LS Workers	Sales	VA	Wage Bill	HS Wage Bill	LS Wage Bill	Assets
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
All foreign										
$\widehat{X}^F_{cz,t}$	0.417**	0.333**	0.360	1.405**	1.00***	1.475***	1.618***	0.974**	1.800***	0.568
	(0.177)	(0.144)	(0.281)	(0.597)	(0.303)	(0.409)	(0.355)	(0.416)	(0.565)	(0.714)
Observations	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	34.95	35.01	35.11	35.11	35.11	34.95	35.01	35.11
Maquila foreign										
$\widehat{X}^F_{cz,t}$	0.313*	0.021	-0.226	1.304**	0.903***	1.131***	1.196***	0.813*	1.995***	1.087
	(0.162)	(0.141)	(0.322)	(0.654)	(0.281)	(0.352)	(0.301)	(0.439)	(0.590)	(0.782)
Observations	3,825	3,825	3,166	3,487	3,825	3,825	3,825	3,166	3,487	3,825
F-statistic	42.19	42.19	42.03	42.10	42.19	42.19	42.19	42.03	42.10	42.19
Non-maquila foreign										
$\widehat{X}^F_{cz,t}$	1.104	2.174**	3.219*	1.817	2.932	5.124*	3.485**	1.899	0.977	0.773
	(0.824)	(1.011)	(1.686)	(1.768)	(1.786)	(2.647)	(1.671)	(1.985)	(2.165)	(2.909)
Observations	3,825	3,825	3,166	3,487	3,825	3,825	3,825	3,166	3,487	3,825
F-statistic	7.7	7.7	7.53	7.61	7.7	7.7	7.7	7.53	7.61	7.7

Notes: Table 4 presents the IV estimates of the regression described in equation (12). The three panels differ in the set of foreign MNEs whose effects we estimate (and the subsequent controls used). In the upper panel, we keep the baseline sample of all foreign MNEs, which corresponds to the regression in equation (10) and the results presented in Tables 2 and 3. In the middle panel, we focus only on the exposure to maquila foreign MNEs. In these regressions, we control for the change in exposure to non-maquila foreign MNEs. In the lower panel, we focus only on the exposure to non-maquila foreign MNEs. In these regressions, we control for the change in exposure to maquila foreign MNEs. Observations are weighted by the initial CZ domestic employment. We cluster the standard errors at the CZ-year level. We use as controls economic region-year indicators, measures of import and export exposure, and various time-variant CZ-level controls. Section 4.4 provides more details.

Table 5: IV estimates of the effects of foreign MNE exposure on the local domestic formal vs. informal sectors

	Establishments (1)	Workers (2)	Sales (3)	VA (4)	Wage Bill (5)	Assets (6)
$\widehat{X}^F_{cz,t}$	0.636***	0.662***	1.222***	1.436***	3.086***	0.166
	(0.157)	(0.185)	(0.341)	(0.419)	(0.575)	(0.816)
$\widehat{X}^F_{cz,t} \times \mathbb{1}[i = D_I]$	-0.402	-0.938***	-0.688	-0.086	-4.002***	1.458
	(0.261)	(0.310)	(0.614)	(0.534)	(0.899)	(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

Notes: Table 5 presents the IV estimates of the regression described in equation (13). Observations are weighted by the initial CZ domestic formal or informal employment. We cluster the standard errors at the CZ-year level. We use as controls economic region-year indicators, an informal sector indicator, measures of import and export exposure, and various time-variant CZ-level controls. Section 4.5 provides more details.

Table 6: Reduced form estimates of the effects of foreign MNE exposure on the local domestic formal vs. informal sectors

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

Notes: Table 6 presents the reduced form estimates of the regression described in equation (13). Observations are weighted by the initial CZ domestic formal or informal employment. We cluster the standard errors at the CZ-year level. We use as controls economic region-year indicators, an informal sector indicator, measures of import and export exposure, and various time-variant CZ-level controls. Section 4.5 provides more details.

Table 7: IV estimates of the effects of foreign MNE exposure on the local domestic formal vs. informal sectors. By foreign MNE type: all, only maquila or only non-maquila

	Establishments (1)	Workers (2)	Sales (3)	VA (4)	Wage bill (5)	Assets (6)
All foreign						
$\widehat{X}^F_{cz,t}$	0.636***	0.662***	1.222***	1.436***	3.086***	0.166
	(0.157)	(0.185)	(0.341)	(0.419)	(0.575)	(0.816)
$\widehat{X}^F_{cz,t} \times \mathbb{1}[i = D_I]$	-0.402	-0.938***	-0.688	-0.086	-4.002***	1.458
	(0.261)	(0.310)	(0.614)	(0.534)	(0.899)	(1.189)
Observations	6,821	6,821	6,821	6,821	6,772	6,805
F-statistic	17.24	17.24	17.24	17.23	17.23	17.24
Maquila foreign						
$\widehat{X}^F_{cz,t}$	0.543***	0.244	0.966***	1.099***	2.512***	1.321
	(0.147)	(0.160)	(0.293)	(0.350)	(0.487)	(0.893)
$\widehat{X}^F_{cz,t} \times \mathbb{1}[i = D_I]$	-0.596**	-0.867***	-0.756	-0.125	-3.548***	-0.126
	(0.253)	(0.298)	(0.496)	(0.413)	(0.658)	(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
Non-maquila foreign						
$\widehat{X}^F_{cz,t}$	1.503*	2.973**	3.372*	4.646*	4.287**	-2.097
	(0.892)	(1.282)	(1.961)	(2.576)	(2.146)	(3.990)
$\widehat{X}^F_{cz,t} \times \mathbb{1}[i = D_I]$	-0.020	-0.895	1.157	1.027	-1.994	9.646
	(0.742)	(0.797)	(1.913)	(1.656)	(2.342)	(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

Notes: Table 7 presents the IV estimates of the regression described in equation (13). The three panels differ in the set of foreign MNEs whose effects we estimate (and the subsequent controls used). In the upper panel, we keep the baseline sample of all foreign MNEs, which corresponds to the regression in equation (13) and the results presented in Tables 5 and 6. In the middle panel, we focus only on the exposure to maquila foreign MNEs. In these regressions, we control for the change in exposure to non-maquila foreign MNEs. In the lower panel, we focus only on the exposure to non-maquila foreign MNEs. In these regressions, we control for the change in exposure to maquila foreign MNEs. Observations are weighted by the initial CZ domestic formal or informal employment. We cluster the standard errors at the CZ-year level. We use as controls economic region-year indicators, an informal sector indicator, measures of import and export exposure, and various time-variant CZ-level controls. Section 4.5 provides more details.

Table 8: Model parameters

	Empirical moment	Outcome	Parameter identified	Parameter description
(1)	β in eq. (10)	Δ log population	η	Migration elasticity
(2)	β_M in eq. (12)	Δ log domestic formal employment	γ_{D_F,F_M}	Spillovers from foreign-maquila to formal domestic firms
(3)	β_N in eq. (12)	Δ log domestic formal employment	γ_{D_F,F_N}	Spillovers from foreign-no maquila to formal domestic firms
(4)	β_M in eq. (12)	Δ log domestic informal employment	γ_{D_I,F_M}	Spillovers from foreign-maquila to informal domestic firms
(5)	β_N in eq. (12)	Δ log domestic informal employment	γ_{D_I,F_N}	Spillovers from foreign-no maquila to informal domestic firms
(6)	β in eq. (10)	Relative Δ b/n high and low-skilled workers	σ_L	EoS between high and low-skilled labor
(7)	β in eq. (10)	Relative Δ b/n employment and capital	ι	EoS between capital and labor
(8)	β_1 in eq. (13)	Δ log wage bill	θ	EoS between domestic formal and foreign jobs
(9)	β_2 in eq. (13)	Δ log wage bill	κ	EoS between formal and informal jobs

Notes: Table 8 reports the empirical moments and the associated reduced-form coefficients that we use to estimate the main parameters of the model. Section 5 provides more details.

Table 9: Model parameters for the simulations

Parameter	Description	Value	Source
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	Baqaee and Farhi (2022)
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 9 reports the main parameters we use for our simulation. The "Parameter" column introduces our parameter notation. The "Description" column describes the economic interpretation of the parameter. The "Value" column the value that we use, and the "Source" column the source of that value. We take most of the elasticities from the literature, and calibrate the spillovers to match our reduced-form coefficients. For now, we are combining foreign maquila and non-maquila firms in a single category. Section 6 provides more details.

Table 10: 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 mult.	5.84% (0.016)	4.28% (0.013)	4.88% (0.020)	3.94% (0.016)
CZs with foreign mult.	8.07% (0.034)	6.57% (0.027)	5.81% (0.029)	4.80% (0.023)

Notes: Table 10 reports the results of our main counterfactual, which consists of a 10% productivity increase for foreign MNEs in the locations that experience a positive increase of foreign employment between 1994 and 2019. The first column reports the results for the counterfactual that includes wedges and spillovers, column 2 removes the wedges, column 3 the spillovers, and column 4 both sources of market failures. The first row reports the simple average across all the commuting zones, while the second and third rows report the results for the locations that did not experience the productivity shock directly and those that did respectively. The standard deviation is reported in parentheses. Section 6 provides more details.

The Gains from Foreign Multinationals in an Economy with Distortions

Isabela Manelici, Jose P. Vasquez, and Román D. Zárate

Appendices for online publication

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These appendices supplement the paper "The Gains from Foreign Multinationals in an Economy with Distortions" with the following material:

- Appendix A presents more detailed derivations of our model.
- Appendix B provides details on the build of the establishment-level data from the Economic Census and summary statistics.
- Appendix C describes the construction of the distortions data and summary statistics.
- Appendix D presents the steps undertaken to build the input-output matrix between all entity types in CZs in Mexico and the rest-of-the world (RoW).
- Appendix E discusses additional data used in the project (e.g., for the CZ-level controls).
- Appendix F includes additional quantitative results.

Appendix A Additional model derivations

Appendix A.1 Solving for the reallocation effects

In section 2.3, we used the different equilibrium conditions to derive the change in the different endogenous variables. Based on those equation, we can solve the following system of linear equations to solve for the reallocation effects:

$$\begin{pmatrix} d\log\vec{p} \\ d\log\vec{R} \\ d\log\vec{\tilde{\Omega}} \\ d\log\vec{w} \\ d\log\vec{L} \end{pmatrix} = \Gamma \begin{pmatrix} d\log\vec{p} \\ d\log\vec{R} \\ d\log\vec{\tilde{\Omega}} \\ d\log\vec{w} \\ d\log\vec{L} \end{pmatrix} + \Delta, \tag{A1}$$

where Γ corresponds to a matrix that captures how the different endogenous variables are exposed to each other and Δ corresponds to the perturbation of the economy that can be productivity changes, iceberg trade costs changes, or changes in the distortions, such as, tariffs, markups, etc:

$$\Delta = \begin{pmatrix} d\log\vec{\tau} - d\log\vec{\tilde{A}} + d\log\vec{\mu} \\ 1\{ij \in O_c\}\vec{\mu}\vec{\lambda}\vec{\tilde{\Omega}}d\log\vec{\mu} \\ 0 \\ 0 \\ 0 \end{pmatrix}$$

Let's denote the matrix Γ as:

$$\Gamma = \begin{pmatrix} A_1 & A_2 & A_3 & A_4 & A_5 \\ B_1 & B_2 & B_3 & B_4 & B_5 \\ C_1 & C_2 & C_3 & C_4 & C_5 \\ D_1 & D_2 & D_3 & D_4 & D_5 \\ E_1 & E_2 & E_3 & E_4 & E_5 \end{pmatrix}$$

[*in progress*]

Appendix A.2 Nested structure of demand and production

We parametrize the demand and supply functions with a nested structure to compute the key EoS that are required to solve the system.

To compute the Allen-Uzawa elasticities, we assume a nested CES structure for both the demand and production functions. Recall that we are using the following notation, F_N corresponds to the foreign MNE producers that are not in the maquila program, F_M to the foreign MNE producers that are in the maquila program, D_F to domestic formal producers, $F \cup D_F$ to the formal sector, and $\mathrm{D_I}$ to the informal sector that only includes the domestic informal producers.[49]

Final consumer demand Following Baqaee and Farhi (2022) and Atkin and Donaldson (2022), we assume that the demand of final consumers for different varieties take a CES form. The utility of each commuting zone or country c is:

$$U_c = \left(\alpha_{c,D_F\cup F} C_{c,F\cup D_F}^{\frac{\xi-1}{\xi}} + \alpha_{c,\mathrm{D_I}} C_{c,\mathrm{D_I}}^{\frac{\xi-1}{\xi}}\right)^{\frac{\xi}{\xi-1}}, \tag{A2}$$

[49] For the case of domestic producers that are in the maquila program, we assume that they are either in D_F or $\mathrm{D_I}$. The reason is that there is not a particular distinction in the model that makes them different from other producers within these two groups.

where $\alpha_{c,D_F\cup F}$ and $\alpha_{c,\mathrm{D_I}}$ are taste-shifters for formal and informal varieties, $C_{c,D_F\cup F}$ is a composite good of formal varieties, $C_{c,\mathrm{I}}$ is a composite good for informal varieties, and ξ is the elasticity of substitution between formal and informal varieties. The formal composite good is composed by varieties from foreign and domestic formal producers:

$$C_{c,D_F\cup F} = \left(\alpha_{c,F_N} C_{c,F_N}^{\frac{\epsilon-1}{\epsilon}} + \alpha_{c,F_M} C_{c,F_M}^{\frac{\epsilon-1}{\epsilon}} + \alpha_{c,D_F} C_{c,D_F}^{\frac{\epsilon-1}{\epsilon}}\right)^{\frac{\epsilon}{\epsilon-1}}, \tag{A3}$$

where α_{c,F_N}, α_{c,F_M} and α_{c,D_F} also represent taste-shifters for foreign and domestic formal producers, and ϵ is the elasticity of substitution between foreign and domestic formal varieties. To capture that there is more competition between domestic formal producers and foreign MNE producers for final consumers we assume that $\epsilon \geq \xi$. This assumption implies that an increase in foreign employment due to productivity shocks have a bigger impact on the domestic formal producers than on the informal ones due to higher competition in the consumer markets.

Finally, we assume that each one of the composite good is composed by varieties from each one of the commuting zones and the rest of the world with an EoS σ_s. In particular,

$$C_{c,s} = \left(\sum_{c'\in C} \alpha_{c,s(c')} c_{c,s(c')}^{\frac{\sigma_s-1}{\sigma_s}}\right)^{\frac{\sigma_s}{\sigma_s-1}}, \tag{A4}$$

where $1-\sigma_s$ corresponds to the trade elasticity of producer types s, and $c_{c,s(c)}$ is the total amount of consumption of location c from location c' of producers type s. We assume that for the informal sector, the good is only consumed locally, then $\alpha_{c,D_I(c')} = 0$ for all $c \neq c'$.

Production functions Following the assumptions that we use to construct the matrix X_{ij}, we assume that formal producers use inputs from other producers and that informal producers only consume locally.

Without loss of generality, the production function of producer type $s(c)$ is:

$$Y_{s(c)} = \left(\beta_{s(c),D_I} Q_{s(c),D_I}^{\frac{\zeta-1}{\zeta}} + \beta_{s(c),F\cup D_F} Q_{s(c),F\cup D_F}^{\frac{\zeta-1}{\zeta}} + \beta_{s(c),VA} VA_{s(c)}^{\frac{\zeta-1}{\zeta}}\right)^{\frac{\zeta}{\zeta-1}}, \tag{A5}$$

where ζ is the elasticity of substitution between intermediate inputs and value-added, which measures how easy is to substitute intermediate inputs with value-added, and the parameters $\beta's$ represent the relative efficiency terms of the different inputs. Since these terms are fixed, we do not need to know their exact value, since we will solve the model in changes. Similar to the case of consumers, $Q_{s(c),F\cup D_F}$ is a composite input of formal varieties that is composed by foreign and domestic formal varieties, and $Q_{s(c),D_I}$ is a composite input of informal varieties. In the cases in which producer type s is formal we would assume that $\beta_{s(c),D_I} = 0$, meaning that formal producers do not use informal varieties as inputs. The formal composite input is:

$$Q_{s(c),F\cup D_F} = \left(\beta_{s(c),F_N} Q_{s(c),F_N}^{\frac{\epsilon-1}{\epsilon}} + \beta_{s(c),F_M} Q_{s(c),F_M}^{\frac{\epsilon-1}{\epsilon}} + \beta_{s(c),D_F} Q_{s(c),D_F}^{\frac{\epsilon-1}{\epsilon}}\right)^{\frac{\epsilon}{\epsilon-1}},$$

where ϵ corresponds to the same elasticity of substitution within the formal sector that captures the competition between domestic formal and foreign varieties. Each composite input is composed by varieties from the different locations with the same trade elasticity that in the consumer case. On the other hand, the value-added input is composed by two factors of production: labor and capital

$$VA_{s(c)} = \left(\beta_{s(c),L} L_{s(c)}^{\frac{\iota-1}{\iota}} + \beta_{s(c),K} K_{s(c)}^{\frac{\iota-1}{\iota}}\right)^{\frac{\iota}{\iota-1}},$$

where $L_{s(c)}$ represents the labor composite input, $K_{s(c)}$ corresponds to the capital stock, and ι is the EoS between labor and capital. The labor composite input is also a CES aggregator composed by low- and high-skill workers:

$$L_{s(c)} = \left(\beta_{s(c),L_L} L_{L,s(c)}^{\frac{\sigma_L - 1}{\sigma_L}} + \beta_{s(c),L_H} L_{H,s(c)}^{\frac{\sigma_L - 1}{\sigma_L}}\right)^{\frac{\sigma_L - 1}{\sigma_L}},$$

where $L_{L,s(c)}$ and $L_{H,s(c)}$ correspond to the efficiency units of low- and high-skill workers, and σ_L to the elasticity of substitution between groups of workers.

Based on these production functions, we solve the reallocation effect after computing the Allen-Uzawa elasticities. In the case of production factors, we need to compute three sets of EoS: (i) how producers substitute intermediate inputs for other intermediates; (ii) how they substitute inputs for production factors and viceversa; and (iii) how they substitute factors for other factors. Details on the derivations of these elasticities are in Appendix A.

Roy model In a similar fashion that there is higher competition in the final consumption market, we also assume that there are frictions in the labor market to move across producers. Workers draw idiosyncratic amenity shocks to work in each producer, which implies that the wages vary by producer. We assume that there is higher substitutability between the varieties of domestic formal producers and foreign MNE producers than between those of informal and formal producers.[50] Following Galle et al. (2023) workers draw idiosyncratic amenity shocks to work in each type of producer from a nested Fréchet distribution.[51] Then, the share of workers from group g in location c that decide to work in producer type $F \cup D_F$ and type D_I is:

$$\pi_{g(c),F\cup D_F} = \frac{B_{g(c),F\cup D_F} w^{\kappa}_{g(c),F\cup D_F}}{B_{g(c),F\cup D_F} w^{\kappa}_{g(c),F\cup D_F} + B_{g(c),D_I} w^{\kappa}_{g(c),D_I}}, \quad \pi_{g(c),D_I} = \frac{B_{g(c),D_I} w^{\kappa}_{g(c),D_I}}{B_{g(c),D_F} w^{\kappa}_{g(c),D_F} + B_{g(c),D_I} w^{\kappa}_{g(c),D_I}}, \tag{A6}$$

where κ corresponds to the dispersion parameter of the Fréchet distribution and captures how easy is for workers to substitute jobs between the informal and the formal sector. We assume that in a lower nest, workers choose between foreign and domestic formal producers. In particular the share of workers that decide to work in producer of type s within the formal sector is:

$$\pi_{g(c),s(c)} = \frac{B_{g(c),s(c)} w^{\theta}_{g(c),s(c)}}{\sum_{k\in\{D_F,F_M,F_N\}} B_{g(c),s(c)} w^{\theta}_{g(c),k(c)}}, \tag{A7}$$

where θ corresponds to the labor supply elasticity and captures how easy is for workers to substitute jobs between foreign and domestic formal producers, and between foreign MNEs in the maquila and not-maquila program. We assume that $\theta \geq \kappa$ implying that foreign and domestic formal jobs are easier to substitute than formal and informal jobs.

Similar to the Allen-Uzawa demand elasticities, with this framework, we can compute the Allen-Uzawa labor supply elasticity that measure how workers substitute the different type of producers. The details of the derivations are in Appendix A.

Migration decisions Finally, since we are studying a long-term shock, we follow recent advancements in the economic geography literature and assume that workers can decide the location to live. We assume that workers make the decision based on amenities and real income and draw idiosyncratic shocks from a Fréchet distribution based on the real income measure from each location. The share of workers from group g that live in location c and decide to migrate to location c' is:

[50] This is an extension that BF include in their paper, but they do not calibrate it.

[51] To simplify notation, we assume that these shocks are to amenities instead of efficiency units.

$$\pi_{g(c),c'} = \frac{\left(B_{g(c')} U_{g(c')} d_{g(c),c'}\right)^{\eta}}{\sum_{\ell} \left(B_{g(\ell)} U_{g(\ell)} d_{g(c),\ell}\right)^{\eta}} \tag{A8}$$

where $U_{g(c')}$ corresponds to the real income measure for group g in location c', $B_{g(c')}$ to an amenity level, $d_{g(c),c'}$ to the iceberg bilateral migration costs, and η represents the migration elasticity. With this framework we can compute the EoS on how workers substitute locations.

Armed with the EoS, data on trade flows X_{ij}, income levels λ_i, the set of distortions μ_{ij}, workers' share in each producer type $\pi_{g(c),s(c)}$, migration shares $\pi_{g(c),g(c')}$, and spillover parameters $\gamma_{j,k}$, we can solve the system of equations in subsection 2.3 for any shock by inverting the matrix A. In the same iteration, we can compute reallocation effects and compute real income changes. In section 5 we explain how we can recover the main parameters of the model by matching the reduced form coefficients through indirect inference.

Appendix A.3 Allen-Uzawa demand elasticities

In this section, we derive the Allen-Uzawa elasticities based on the first order approximation. We divide the section into three different blocks, how final consumers substitute products, how producers substitute inputs for factors and other inputs, and how producers substitute factors for factors and other inputs.

Appendix A.3.1 Final consumers

Let's assume that entity c corresponds to final consumers in the respective commuting zone, and that j corresponds to an entity of any of the producer types. Recall that we normalize global GDP, then the total consumption from entity c in goods produced by entity j is:

$$X_{cj} = \tilde{\Omega}_{cj} \lambda_c. \tag{A9}$$

Then we have that we can decompose the change in the expenditure in goods j between the change in the expenditure share and the change in income:

$$d \ln X_{cj} = d \ln \tilde{\Omega}_{cj} + d \ln \lambda_c.$$

We will first focus on the change of $\tilde{\Omega}$ and then compute the changes in the income from location c, λ_c.

Change for foreign MNE varieties Let's start assuming that $j \in F$, this means that j is a variety of foreign MNE producers. Then, the expenditure share in goods j of consumer c is given by:

$$\tilde{\Omega}_{cj} = \left(\frac{\alpha_{cj} p_{cj}^{1-\sigma_F}}{\sum_h \alpha_{ch} p_{ch}^{1-\sigma_F}} \right) \left(\frac{\alpha_{c,j} P_{c,j}^{1-\epsilon}}{P_{c,F\cup D_F}^{1-\epsilon}} \right) \left(\frac{\alpha_{c,F\cup D_F} P_{c,F\cup D_F}^{1-\xi}}{P_c^{1-\xi}} \right)$$

Taking the derivative with respect to the change of all prices, the change in the expenditure from consumer c in goods produced by entity j is:

$$\begin{aligned} d \ln \tilde{\Omega}_{cj} = & (1 - \sigma_F) \left[d \ln p_{cj} - \sum_{h \in F} \tilde{\Omega}_{c,h|c,F} d \ln p_{c,h} \right] \\ & + (1 - \epsilon) \left[d \ln P_{c,F} - \tilde{\Omega}_{c,F|c,F\cup D_F} d \ln P_{c,F} - \tilde{\Omega}_{c,D_F|c,F\cup D_F} d \ln P_{cD_D} \right] \\ & + (1 - \xi) \left[d \ln P_{c,F\cup D_F} - \tilde{\Omega}_{c,F\cup D_F} d \ln P_{c,F\cup D_F} - \tilde{\Omega}_{c,D_I} d \ln P_{c,D_I} \right] \end{aligned}$$

where $\tilde{\Omega}_{c,h|c,F}$ means the normalized expenditure share of producer h within the foreign MNE varieties, and the same logic applies for the domestic formal varieties, and the formal and informal sectors. Deriving each one of the price index we get:

$$
\begin{aligned}
d \ln P_{c,F} &= \sum_{h \in F} \tilde{\Omega}_{c,h|c,F} d \ln p_{c,h} \\
d \ln P_{c,D_F} &= \sum_{i \in D} \tilde{\Omega}_{c,i|c,D_F} d \ln p_{ci} \\
d \ln P_{c,D_I} &= \sum_{r \in \mathcal{I}} \tilde{\Omega}_{c,r|c,D_I} d \ln p_{c,r} \\
d \ln P_{c,F \cup D_F} &= \tilde{\Omega}_{c,F|c,F \cup D_F} d \ln P_{c,F} + \tilde{\Omega}_{c,D_F|c,F \cup D_F} d \ln P_{c,D_F} \\
d \ln P_c &= \tilde{\Omega}_{c,F \cup D_F} d \ln P_{c,F \cup D_F} + \tilde{\Omega}_{c,D_I} d \ln P_{c,D_I}
\end{aligned}
$$

Recall that the system of equations we are solving is:

$$
d \ln \tilde{\Omega}_{cj} = \delta_c(j,j) d \ln p_{cj} + \sum_k \tilde{\Omega}_{ck} \theta_c(j,k) d \ln p_{ck},
$$

where $\theta_c(j,k)$ is how consumer c substitutes the good k for good j, and $\delta_c(j,j)$ is the own elasticity.[52] We can solve for the EoS for the different cases of k. The easiest case is when $k \in D_I$, this is if k is an informal variety, then we get that:

$$
\theta_c(j,k) = (\xi - 1).
$$

In the case in which $k \in \mathcal{D}_{\mathcal{F}}$ or in the complement of F, considering only the partial change in $d \ln p_{ck}$, we get that:

$$
d \ln \tilde{\Omega}_{c,j} = \left[(\epsilon - 1)(\tilde{\Omega}_{c,D_F|c,F \cup D_F} \tilde{\Omega}_{c,k|c,D_F}) + (\xi - 1)(\tilde{\Omega}_{c,F \cup D_F} \tilde{\Omega}_{c,D_F|c,F \cup D_F} \tilde{\Omega}_{c,k|c,D_F} - \tilde{\Omega}_{c,D_F|c,F \cup D_F} \tilde{\Omega}_{c,k|c,D_F}) \right] d \ln p_{ck}.
$$

Note that $\tilde{\Omega}_{c,F \cup D_F|c} \tilde{\Omega}_{c,D_F|c,F \cup D_F} \tilde{\Omega}_{c,k|c,D_F} = \tilde{\Omega}_{ck}$, then:

$$
d \ln \tilde{\Omega}_{c,j} = \tilde{\Omega}_{c,k} \underbrace{\left[(\epsilon - 1) \left(\frac{1}{\tilde{\Omega}_{c,F \cup D_F}} \right) + (\xi - 1) \left(1 - \frac{1}{\tilde{\Omega}_{c,F \cup D_F}} \right) \right]}_{\theta_c(j,k)} d \ln p_{ck}.
$$

The third case to study in this block is when $k \in F$ and in the same group, this means in the maquila and no-maquila program. In this case and considering only the partial change of $d \ln p_{ck}$ we get that:

$$
\begin{aligned}
d \ln \tilde{\Omega}_{c,j} = \Big[& (\sigma_F - 1) \tilde{\Omega}_{c,k|c,F} \\
& + (\epsilon - 1)(\tilde{\Omega}_{c,F|cF \cup D_F} \tilde{\Omega}_{c,k|c,F} - \tilde{\Omega}_{c,k|c,F}) \\
& + (\xi - 1)(\tilde{\Omega}_{c,F \cup D_F} \tilde{\Omega}_{c,F|c,F \cup D_F} \tilde{\Omega}_{c,k|c,F} - \tilde{\Omega}_{c,F|c,F \cup D_F} \tilde{\Omega}_{c,k|c,F}) \Big] \\
& \times d \ln p_{ck}
\end{aligned}
$$

Recall that $\tilde{\Omega}_{c,k} = \tilde{\Omega}_{c,F \cup D_F} \tilde{\Omega}_{c,F|c,F \cup D_F} \tilde{\Omega}_{c,k|c,F}$. Then, we get that:

$$
d \ln \tilde{\Omega}_{c,j} = \tilde{\Omega}_{c,k}
$$

[52] For example, in the CES case $\delta_c(j,j)$ is just $1 - \sigma$.

$$\times \underbrace{\left[(\sigma_F - 1)\left(\frac{1}{\tilde{\Omega}_{c,F|c,F\cup D_F}\tilde{\Omega}_{c,F}}\right) + (\epsilon - 1)\left(\frac{1}{\tilde{\Omega}_{c,F\cup D_F}} - \frac{1}{\tilde{\Omega}_{c,F\cup D_F}\tilde{\Omega}_{c,F|c,F\cup D_F}}\right) + (\xi - 1)\left(1 - \frac{1}{\tilde{\Omega}_{c,F\cup D_F}}\right)\right]}_{1-\theta_c(j,k)}$$

$$\times d\ln p_{ck}$$

Then, the only parameter that we are missing to calculate is $\delta_c(j,j)$, in this case, this is just $1-\sigma_F$

Change for domestic formal varieties Now let's assume that $j \in \mathcal{D}$, by symmetry we then can compute the Allen-Uzawa elasticities:

- If $k \in D_I$:
$$\theta_c(j,k) = \xi - 1$$
- If $k \in F$:
$$\theta_c(j,k) = \left[(\epsilon - 1)\left(\frac{1}{\tilde{\Omega}_{c,F\cup D_F}}\right) + (\xi - 1)\left(1 - \frac{1}{\tilde{\Omega}_{c,F\cup D_F}}\right)\right]$$
- If $k \in D_F$:
$$\theta_c(j,k) = [(\sigma_D - 1)\left(\frac{1}{\tilde{\Omega}_{c,D_F|c,F\cup D_F}\tilde{\Omega}_{c,F\cup D_F}}\right) + (\epsilon - 1)\left(\frac{1}{\tilde{\Omega}_{c,F\cup D_F}} - \frac{1}{\tilde{\Omega}_{c,F\cup D_F}\tilde{\Omega}_{c,D_F|c,F\cup D_F}}\right) + (\xi - 1)\left(1 - \frac{1}{\tilde{\Omega}_{c,F\cup D_F}}\right)]$$
- And finally the own elasticity δ is:
$$\delta_c(j,j) = 1 - \sigma_{D_F}$$

Change for domestic informal varieties The change for domestic informal varieties is easy as there is only one type of variety in the nest, let's assume that $j \in D_I$. Then, we will get the following Allen-Uzawa elasticities:

- If $k \in F$ or $k \in D_F$:
$$\theta_c(j,k) = \xi - 1$$
- If $k \in D_I$:
$$\theta_c(j,k) = \left[(\sigma_{D_I} - 1)\left(\frac{1}{\tilde{\Omega}_{cD_I}}\right) + (\xi - 1)\left(\frac{1}{\tilde{\Omega}_{cD_I}}\right)\right]$$
- And finally the own elasticity δ is:
$$\delta_c(j,j) = 1 - \sigma_{D_I}$$

Appendix A.3.2 Foreign MNE producers

In this section, we derive the Allen-Uzawa elasticities for the foreign MNE producers. Recall that a producer can substitute an intermediate input for an intermediate input, an intermediate input for a production factor or vice-versa, and a production factor for another production factor.

Foreign MNE producers use a nested CES technology to produce output (see equation A5). In this first section, we will look at the EoS for intermediate inputs. Let's start assuming that $j \in F$, which means that the intermediate input is a foreign variety. The expenditure share in varieties F from location c' is:

$$\tilde{\Omega}_{F(c),F(c')} = \left(\frac{\beta_{F(c),F(c')}p^{1-\sigma_F}_{F(c),F(c')}}{\sum_h \beta_{F(c),F(h)}p^{1-\sigma_F}_{F(c),F(h)}}\right)\left(\frac{\beta_{F(c),F}P^{1-\epsilon}_{F(c),F}}{P^{1-\epsilon}_{F(c),F\cup D_F}}\right)\left(\frac{\beta_{F(c),F\cup D_F}P^{1-\zeta}_{F(c),F\cup D_F}}{P^{1-\zeta}_{F(c)}}\right)$$

Then, we get the following EoS:

- If k is a factor of production then:

$$\theta_{F(c)}(j,k) = \zeta - 1$$

- If k is an intermediate input of domestic formal varieties then

$$\theta_{F(c)}(j,k) = \left[(\epsilon - 1) \left(\frac{1}{\tilde{\Omega}_{F(c),F \cup D_F}} \right) + (\zeta - 1) \left(1 - \frac{1}{\tilde{\Omega}_{F(c),F \cup D_F}} \right) \right]$$

- If k is an intermediate input of foreign varieties then

$$\theta_{F(c)}(j,k) = \left[(\sigma_F - 1) \left(\frac{1}{\tilde{\Omega}_{F(c),F}} \right) + (\epsilon - 1) \left(\frac{1}{\tilde{\Omega}_{F(c),F \cup D_F}} - \frac{1}{\tilde{\Omega}_{F(c),F}} \right) + (\zeta - 1) \left(1 - \frac{1}{\tilde{\Omega}_{F(c),F \cup D_F}} \right) \right]$$

- Finally, foreign MNE producers do not use informal varieties, which means that if k is an informal variety then:

$$\theta_{F(c)}(j,k) = 0$$

By symmetry, we get a similar result, if $j \in D_F$. In particular:

- If k is a factor of production, then:

$$\theta_{F(c)}(j,k) = \zeta - 1$$

- If k is an intermediate input of foreign varieties:

$$\theta_{F(c)}(j,k) = \left[(\epsilon - 1) \left(\frac{1}{\tilde{\Omega}_{F(c),F \cup D_F}} \right) + (\zeta - 1) \left(1 - \frac{1}{\tilde{\Omega}_{F(c),F \cup D_F}} \right) \right]$$

- If k is an intermediate input of domestic formal varieties:

$$\theta_{F(c)}(j,k) = \left[(\sigma_D - 1) \left(\frac{1}{\tilde{\Omega}_{F(c),D_F}} \right) + (\epsilon - 1) \left(\frac{1}{\tilde{\Omega}_{F(c),F \cup D_F}} - \frac{1}{\tilde{\Omega}_{F(c),D_F}} \right) + (\zeta - 1) \left(1 - \frac{1}{\tilde{\Omega}_{F(c),F \cup D_F}} \right) \right]$$

- Finally, since foreign MNE producers do not use informal varieties if k is an informal variety then:

$$\theta_{F(c)}(j,k) = 0$$

Case for factors of production *Work in progress.*

Appendix B Establishment-level microdata: Economic Census

Appendix B.1 Data construction

Unit of observation The Economic Census is a complete enumeration of establishments in Mexico with the following characteristics: economic units in a single physical location, settled in a permanent place and delimited by constructions or fixed installations, that combine activities and resources under the control of a single owner or controlling entity to carry out activities of production of goods, purchase and sale of merchandise or provision of services; whether for profit or not (INEGI, 2021).

Coverage The activities subject to the Economic Censuses are divided into two large groups: (i) those for which information is collected throughout the entire Mexican territory: fishing and aquaculture; mining; electricity, water and gas; construction; transport, mail and storage, as well as financial and insurance services; and (ii) manufacturing, commerce and non-financial services, whose information is collected through a complete survey in the largest and most economically-important geographical areas in Mexico and, through a sample in rural areas, where the economic activity in these industries is unimportant (INEGI, 2021).

Data We build an unbalanced panel of establishment-level data uniting six consecutive Economic Censuses from 1994, 1999, 2004, 2009, 2014, and 2019. This panel tracks typical balance sheet variables such as total sales, number of workers, wage bill, and assets (our proxy for capital).

Crucially, we also observe the establishments that are at least partially foreign-owned. We refer to an establishment as a foreign MNE if it is at least 50% foreign-owned in one Census year. Additionally, we track the country of origin of an establishment's foreign capital (which is a key input for our leading instrumental variable). In the rare instances where we observe more than one country of origin, we keep the country with the largest share of ownership in the year with the highest foreign ownership share.

We also observe the municipality of each establishment, which we then map to a commuting zone – abbreviated CZ (out of 781 CZs). The Economic Census also records the industry classification of each establishment at the 4-digit level.

Cleaning rules We drop establishment-years in which an establishment reports zero or missing workers, negative sales, negative value added, or negative production.

Establishment-level identifiers across time INEGI started assigning unique identifiers to each establishment in the 2009 Economic Census, which allows us to track establishments across the 2009, 2014, and 2019 Economic Censuses. In addition, Busso et al. (2018) match the official unique and time-consistent identifiers to the year-specific Census identifiers in 1994, 1999, and 2004. Their iterative procedure finds similar establishments through name matching based on their legal entity name, also considering their geolocation, industry, and birth year. Their algorithm has ten steps to decide on the best match (should it exist) for an establishment comparing two years. If the procedure doesn't find a match, there are two options: the establishment stopped operating or changed locations. Finally, the authors validated their algorithm with the official identifiers, and they found more than 90% of accuracy.

Appendix B.2 Summary statistics

Table B1: Summary statistics by establishment type

	1994			2019		
	Domestic		Foreign	Domestic		Foreign
	Informal	Formal	Multinationals	Informal	Formal	Multinationals
Number of estab.	1,733,699	429,164	6,549	3,997,350	549,347	9,660
Employment	1.7	13.2	153.9	2.8	19.6	304.0
Sales	24.9	895.5	13,754.3	102.5	1,261.5	24,133.0
Assets	3.7	267.5	3,382.6	45.3	445.7	6,269.1

Notes: Table B1 presents summary statistics on the sample of establishments in our analysis, separated into three groups (foreign MNE, domestic formal, and domestic informal). Namely, Table B1 shows the averages across all CZs (weighted by the number of establishments) at the beginning and end of our sample period (1994 and 2019). We measure size as total sales, number of workers, and assets. Values for sales and capital are expressed in 2019 CPI-deflated thousands of U.S. dollars. Wages are reported as annual earnings per worker in 2019 CPI-deflated U.S. dollars.

Table B2: Importance in the Mexican economy of domestic informal and foreign MNEs

	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

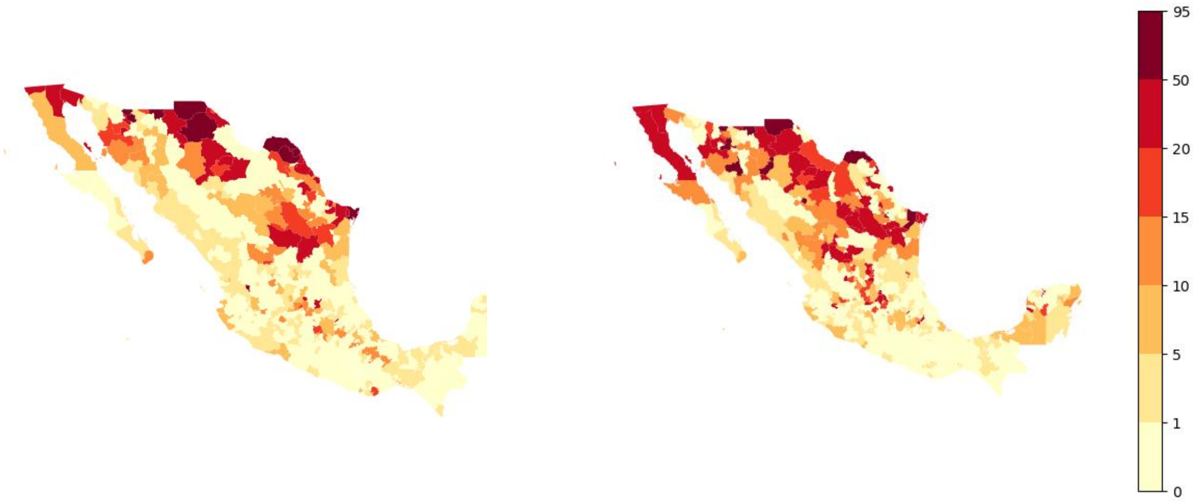
Notes: Table B2 shows the importance of domestic informal establishments and foreign MNEs as a share of the economy-wide totals of the number of workers, sales, wage bill, and assets in 1994 and 2019. Values are reported as percentages. Domestic formal establishments are the complement to 100%.

Table B3: Summary statistics for maquila and 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

Notes: Table B3 presents summary statistics separately for foreign MNEs in Mexico with or without income from maquila activities. The shares in columns (1) and (2) are with respect to the totals in foreign MNEs. Shares in column (7) are with respect to the total sales of the respective type of foreign MNEs (foreign MNEs with or without income from maquila activities). Values for sales, sales per worker and assets per worker are expressed in 2019 CPI-deflated thousands of U.S. dollars.

Figure B1: Percentage of CZ-level employment in foreign MNEs



(a) 1994

(b) 2019

Notes: Figure B1 presents the percentage of CZ-level employment in foreign MNEs in our initial (1994) and last year of analysis (2019).

Figure B2: Percentage of CZ-level employment in domestic informal establishments

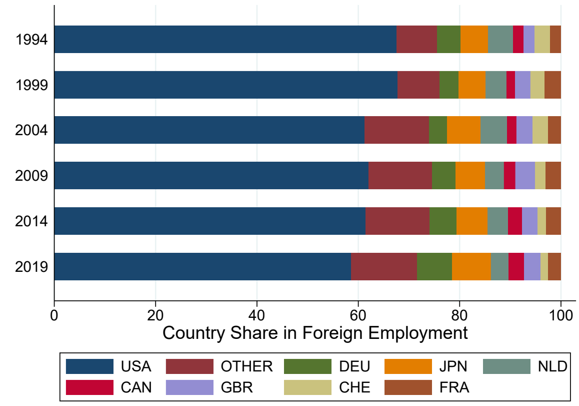
(a) 1994

(b) 2019

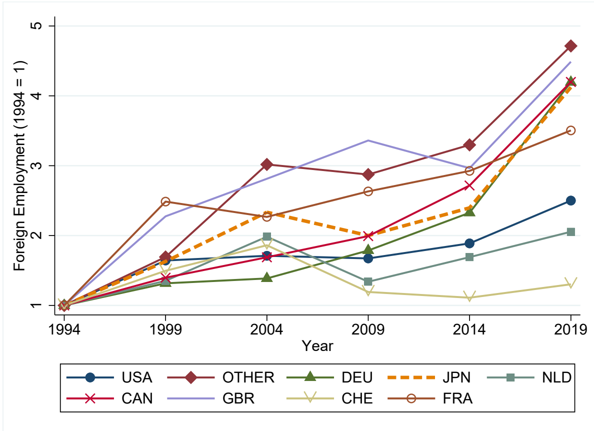
Notes: Figure B2 presents the percentage of CZ-level employment in domestic informal establishments in our initial (1994) and last year of analysis (2019).

Appendix B.3 Supportive evidence for the IV

Figure B3: Evolution of employment in foreign MNEs by country of origin



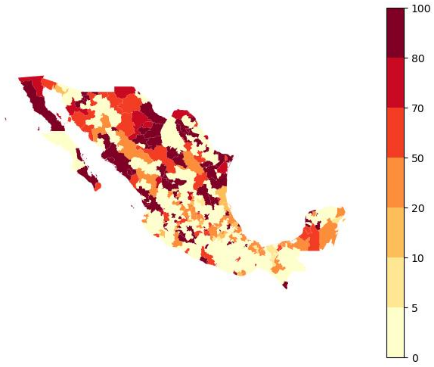
(a) Share of foreign MNEs by country of origin



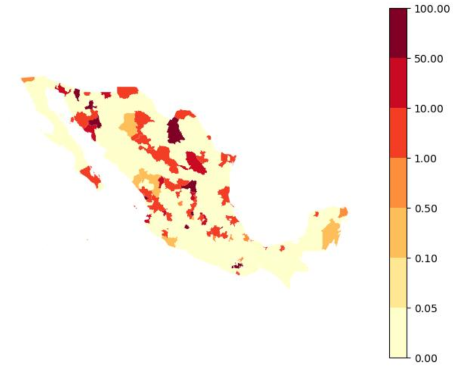
(b) Foreign MNE employment growth (1994=1)

Notes: Panel (a) in Figure B3 shows the composition of employment in foreign MNEs in Mexico by the country of origin of the foreign capital (from 1994 to 2019). Panel (b) normalizes to 1 the Mexico-wide employment in 1994 in establishments owned by Mexico's eight largest investor countries. Each line tracks the evolution since 1994 of foreign MNE employment in Mexico from each of those eight investor countries (plus from any other origin country labelled "other").

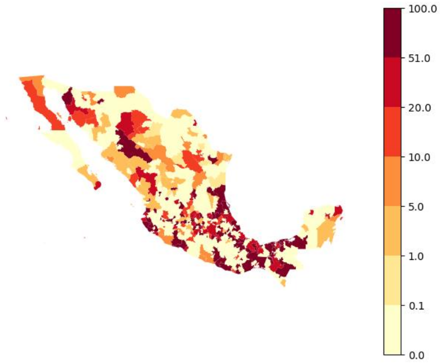
Figure B4: Spatial concentration of foreign MNEs into Mexico by country (region) of ownership (2019)



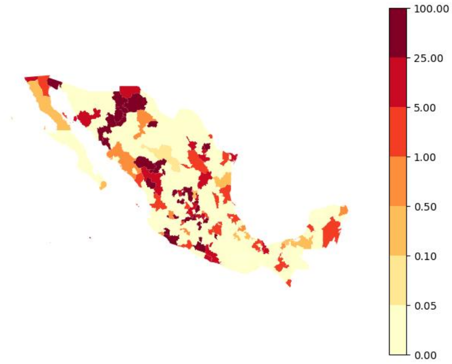
(a) United States



(b) Canada



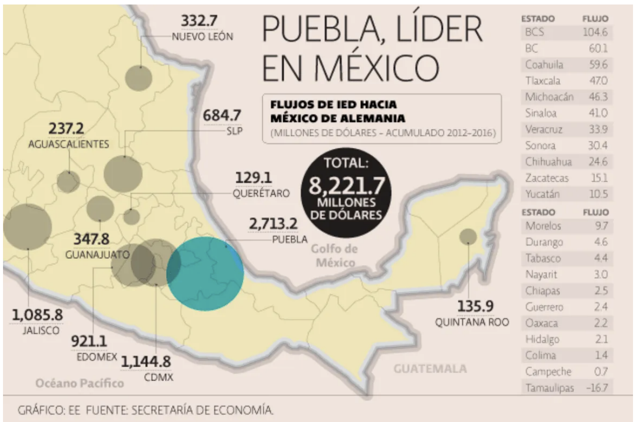
(c) Western Europe



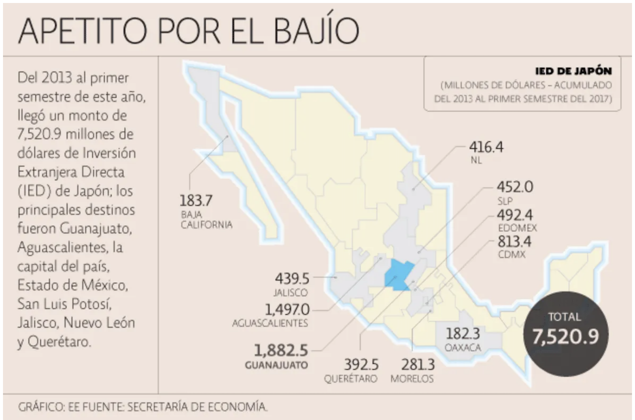
(d) Japan

Notes: Figure B4 displays the spatial variation in the importance of employment at foreign MNEs across commuting zones in Mexico in our end-year 2019. Namely, we plot the share of employment in foreign MNEs from a given country (region) of origin as a share of the total employment in foreign MNEs in a commuting zone. Panel A focuses on foreign MNEs into Mexico from the United States, Panel B on foreign MNEs from Canada, Panel C on foreign MNEs from Western Europe and Panel D on foreign MNEs from Japan. Most foreign MNEs from Western Europe comes from Germany, Netherlands, Great Britain, France, and Switzerland (sorted in descending order based on overall employment in 2019).

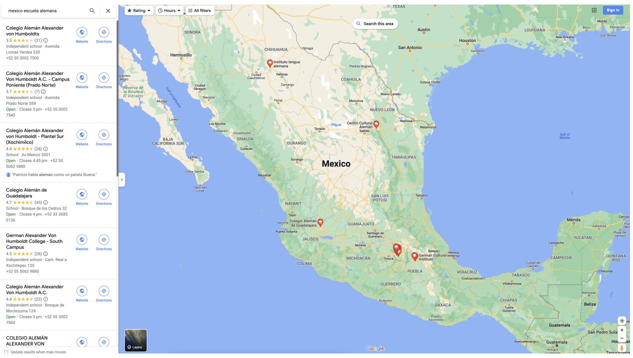
Figure B5: Spatial concentration in Mexico of German and Japanese MNEs and relevant amenities



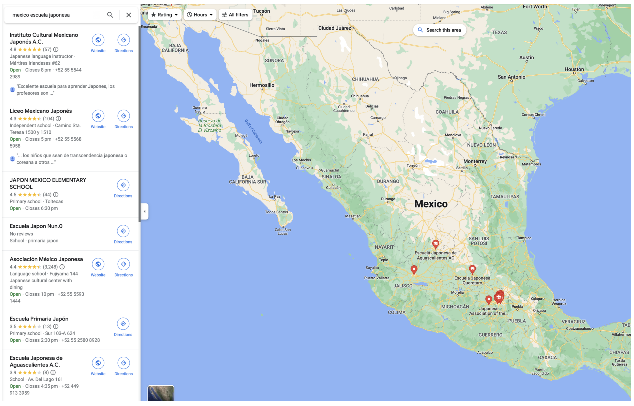
(a) German MNEs cluster in Puebla (2012-2016)



(b) Japanese MNEs cluster in Guanajuato (2017)



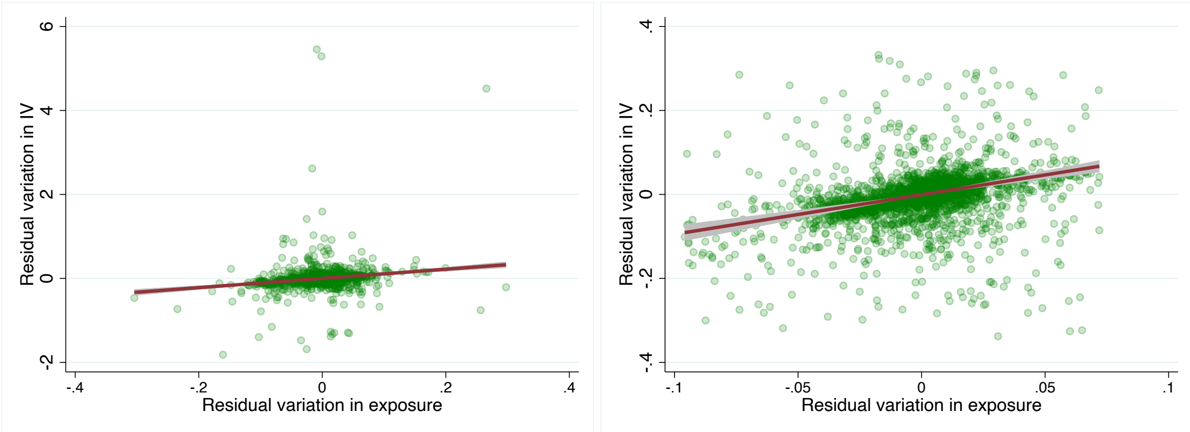
(c) German schools in Mexico (Google Maps)



(d) Japanese schools in Mexico (Google Maps)

Notes: The maps in Panels B5a and B5b come from two articles in the Mexican newspaper *El Economista* (see here and here). The message of these maps and the articles more broadly is twofold: (i) foreign MNEs from specific origin countries (Germany and Japan in these particular examples) tends to be spatially concentrated (e.g., Germany keeps investing in Puebla, whereas Japan keeps investing in Bajío) and (ii) different origin countries have different spatial clustering patterns (even when the countries are similar in GDP per capita and invest in similar industries). The maps in Panels B5c and B5d are print screens of Google Maps searches for German and Japanese schools in Mexico, respectively. The exact searches used were "mexico escuela alemana" and "mexico escuela japonesa." Two patterns stand out. First, as expected, Mexico City concentrates both foreign MNEs and amenities (including amenities relevant to the varied countries of foreign MNE ownership). Second, beyond Mexico City, the geographic clusters of foreign MNEs from a given origin country are also clusters for the amenities relevant to that origin country. For instance, foreign MNEs from Germany clusters in Puebla, and so do German schools.

Figure B6: First stage of the instrument



(a) $\widehat{Z}^F_{cz,t}$ vs. $\widehat{X}^F_{cz,t}$. Full sample

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

Notes: In both panels, the X-axis presents the residualized measure of exposure to foreign MNEs ($\widehat{X}^F_{cz,t}$) and the Y-axis presents its residualized instrument ($\widehat{Z}^F_{cz,t}$). 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).

Appendix C Establishment-level distortions

Appendix C.1 Data construction

Work-in-progress.

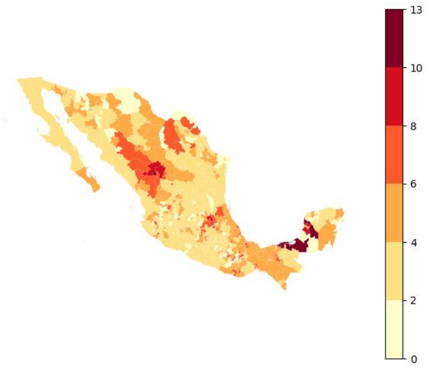
Appendix C.2 Summary statistics of distortions in Mexico

Table C1: Distortions as a share of sales by sector (percentages): 1994

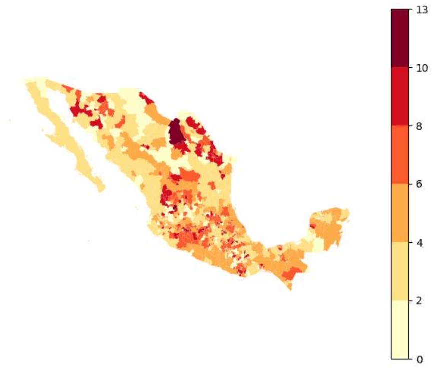
2-digit sector	Security	Bribes	Crime	Bureau.	Regulation	VAT	Labor Tax	Capital
Agriculture/Mining	0.80	0.02	3.25	0.68	4.66	2.20	20.54	12.67
Energy/Maintenance	0.61	0.02	4.11	0.23	1.75	7.77	37.11	11.09
Construction/Rentals	1.92	0.04	4.56	0.44	4.66	7.56	11.42	12.61
Foods/Textile	1.38	0.03	4.28	0.44	2.12	2.54	16.64	12.04
Chemical/Paper/Non-metallic	1.31	0.03	4.14	0.52	3.58	5.32	18.04	12.17
Metallic/Machinery/Equipment	1.05	0.02	3.55	0.55	3.30	3.30	22.68	10.73
Wholesale Trade	1.18	0.03	4.71	0.64	4.57	7.69	15.24	12.93
Retail Trade	2.57	0.04	3.06	0.44	5.53	4.49	6.59	14.23
Transport	1.01	0.03	4.04	0.52	2.57	6.67	15.63	11.59
Postal and Storage	1.59	0.02	3.31	1.12	7.62	10.69	26.84	14.04
Media	1.98	0.04	4.75	0.49	4.26	8.10	12.36	11.72
Professional Services	1.73	0.04	5.14	0.70	4.34	6.66	13.75	13.58
Healthcare/Education/Social Assistance	1.87	0.04	4.72	0.59	4.93	1.42	12.48	12.87
Other Services	2.69	0.04	3.99	0.42	5.74	1.94	6.04	11.07
Accommodation Services	2.17	0.04	4.13	0.47	4.13	3.06	10.01	14.71

Notes: Table C1 reports weighted averages for each distortion. The weights are the number of workers in each CZ-industry-establishment type. Security, bribes, crime, bureaucracy time, regulation payments, markups, and VAT distortions are shares of total annual sales. Labor taxes are reported as a share of wagebill. Capital distortion is reported as interest rates. All values are presented as percentages.

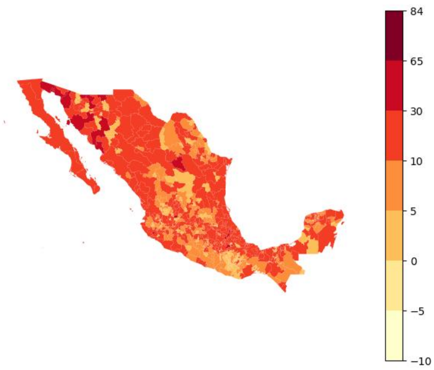
Figure C1: Spatial distribution of sales distortions by commuting zone



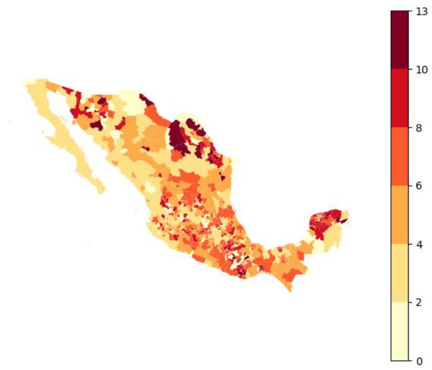
(a) Bribes



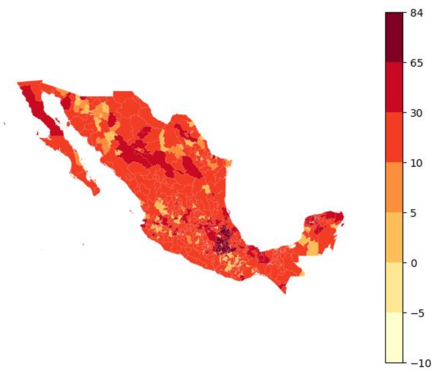
(b) Crime damages



(c) Extra payments to government



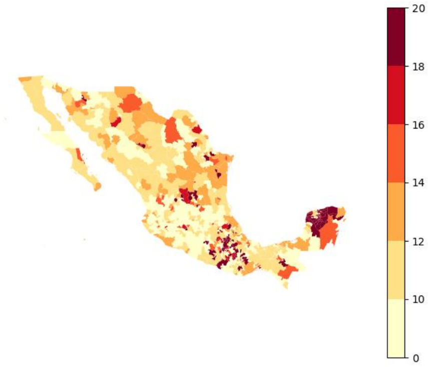
(d) Security expenses



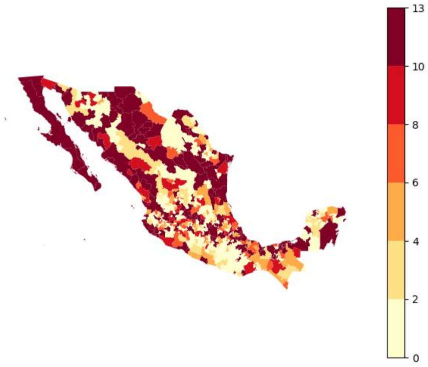
(e) Bureaucracy time

Notes: Figure C1 shows the weighted averages of sales distortions in each CZ as shares of annual sales for our initial year 1994. The weights are the number of workers in each CZ-industry-establishment type. Namely, we plot the expenditure of producers on bribes, crime, extra payments to government, security, bureaucracy time and sales markups for each CZ within Mexico.

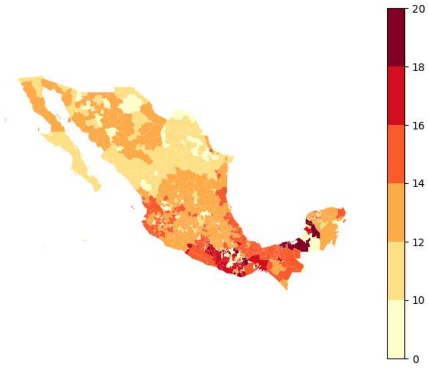
Figure C2: Spatial distribution of tax and capital costs distortions



(a) VAT



(b) Labor tax



(c) Capital distortion

Notes: Figure C2 shows the weighted averages of tax and capital distortions in each CZ for our initial year 1994. The weights are the number of workers in each CZ-industry-establishment type. Namely, we plot the weighted average expenditure on VAT taxes, labor taxes and cost of access to capital as shares of their respective input costs for each CZ within Mexico.

Appendix D Trade flows data

Work in progress.

Appendix E Other data

Time-consistent commuting zones Between 1994 and 2019, Mexico both created new municipalities and merged some municipalities, making it necessary to create time-consistent commuting zones (CZs). We began with an initial mapping of municipalities to CZs for 2019, which became our reference for the CZ definitions. In 2019, there were 781 CZs in Mexico. Then, to keep track of changes in municipality codes, new municipalities, and municipalities that split or merged, we used the "Catálogo Único de Claves de Áreas Geoestadísticas Estatales, Municipales y Localidades" from INEGI for the 2000-2020 period. For the 1994-2000 period, we used INEGI's census reports of new municipalities.

In 1994, CZs had a mean of 12,196 workers per CZ, a median of 980, a minimum of 4 workers, and a maximum of 2,535,464 workers. In 2019, CZs had a mean of 30,379 workers and a median of 3,081, whereas the minimum and maximum of total workers were 9 and 4,872,287, respectively. CZs have an average area of 2,460.2 km^2 and a median of 666.4 km^2. The smallest CZ has 4.3 km^2, and the biggest has an area of 52,982 km^2.

Migration flows We used various sources of data to construct the 1990 municipality-municipality (MUN-MUN) migration matrix. Firstly, we use the IPUMS 1990 data for Mexico which provide us with the residence of each individual 5 years before the 1990 survey. However, the questionnaire employed in this Census asked for the Mexican Entidad (ENT) or country of residence in 1985. This implied two problems: (i) we had only had ENT-MUN flows, and (ii) we were missing the MUN-Rest of the World (RoW) and RoW-RoW flows. To address the first problem, we made a proportionality assumption to assign the total outflow of each "Entidad" of origin to each municipality within its boundaries by its share of the population. Once we made this assumption, we were able to construct the MUN-MUN matrix. To address the second problem, the MUN-RoW flows, we used the 1990 ACS US Census data from IPUMS, since the US is the principal destiny of Mexican migration, to find how many people had migrated between 1985 and 1990 and were living in the US. Once we had the aggregated value, we proportionally assign the total outflow of migrants from Mexico to the US to each municipality using the 1993 "Encuesta sobre Migración en la Frontera Norte de México", which collected data on the residence of the surveyed immigrants. Finally, we added the total population in 1990 of all the countries from which people migrating from abroad to Mexico in the 1990 Mexican Census data for the RoW-RoW flow.

Concordance between industry classifications The industry classification used in the 1994 Economic Census differs from the NAICS classification used in the subsequent Economics Censuses (1999-2019). In the 1994 Economic Census, INEGI used the "Mexican Classification of Activities and Products" (CMAP in Spanish). CMAP comprises nine sectors that disaggregate into sub-sectors, branches, and classes. We created a manual mapping between the 30 CMAP sub-sectors (used in 1994) and the 21 NAICS two-digit codes (used between 1999 and 2019) to a set of 16 broad sectors. Table E1 shows the concordance between these 16 broad sectors and each industry classification.

Commuting-zone level controls Data for part of our commuting zone-level controls comes from the "Integrated Public Use Microdata Series" (IPUMS) for Mexico. The Mexico IPUMS data is based on the General Population and Housing Census taking place every ten years. We use beginning-of-decade General Population and Housing Census data for the two years we observe each decade in the Economic Census. Namely, we use the 1990 values for 1994 and 1999, the 2000 values for 2004 and 2009, and the 2010 values for 2014 and 2019. From IPUMS, we use the following commuting-zone level controls: (i)

Table E1: Concordance table INEGI-NAICS

Sector	CMAP (1994)	NAICS (1999-2019)
Agriculture/Mining	11, 21, 22, 23, 29	11, 21
Energy/Maintenance	41, 42	22, 56
Construction/Rentals	50, 82, 83	23, 53
Foods/Textile	31, 32	31
Chemical/Paper/Non-metallic	33-36	32
Metallic/Machinery/Equipment	37-39	33
Wholesale Trade	61	43
Retail Trade	62	46
Transport	71	48
Postal and Storage	72	49
Media	94	51
Finance and Insurance	81	52
Professional Services	95, 97	54
Healthcare/Education/Social Assistance	92	61-62
Other Services	96	71, 81
Accommodation Services	93	72

the share of individuals living in a place designated as urban; (ii) the share of individuals working in manufacturing; (iii) the share of individuals with a completed secondary degree; (iv) the share of individuals who are employed; (v) the share of individuals in routine occupations; (vi) the share of indigenous individuals; and (vii) the share of foreign-born individuals.

We also use Comtrade data to build three measures of CZ-level exposure to imports of Mexico from the United States and China and to the growing exports of China to Mexico's main export markets from 1994. These measures adapt to the Mexican setting the exposure measures proposed by Autor et al. (2013). We use two-digit HS import data from Comtrade and map these HS codes to ISIC4 two-digit industry codes using the R package concordance by Liao et al. (2020).

The first two measures aim to control for changes in the import patterns of Mexico from two important global trade partners, China and the United States. China's becoming a member of the WTO in 2001 is an event with plausible repercussions for Mexican labor markets. The United States gained preferential access to the Mexican market after NAFTA came into force in 1994. Instead of directly using the change in imports of Mexico from these two countries (which might reflect endogenous responses to demand or supply shocks in Mexico), we leverage the changes in the imports of countries Ω from the United States and China, respectively. Namely, Ω includes Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Jamaica, Nicaragua, Panama, Peru, Paraguay, Uruguay, and Venezuela (as in Blyde et al., 2020). Changes in imports of countries Ω from China and the United States capture the supply-driven component in Mexico's imports from China and the United States, in addition to changes in demand from China from countries at comparable levels of development as Mexico and distance to China. In addition, for the United States-specific measure, we add Canada to the set Ω, as NAFTA has plausibly affected Canada's imports from the United States similarly to how it has affected Mexico's imports.

To build CZ-level measures of exposure to the imports from the United States and China, we apportion the "shock" (the change in imports of countries Ω from the United States and China) to CZs based on their 1994 employment in the relevant industry j and CZ cz. The measure is then translated into a per-worker measure by dividing it by the CZ cz overall employment in 1994. Namely, we build the following CZ-level measure of exposure to changes in imports from the United States and China as follows:

$$\Delta IPW_{o,cz,t} = \frac{1}{L_{cz,1994}} \sum_j \frac{L_{cz,j,1994}}{L_{j,1994}} \Delta M_{jt}^{H\rightarrow\Omega} \quad \text{(E10)}$$

where cz indexes CZs in Mexico, j is a broad sector category, $H \in \{UnitedStates, China\}$, and L is employment. $\Delta M_{jt}^{H\rightarrow RoW}$ represents the change in exports from either the United States or China to the set of countries Ω between $(t-5)$ and t.

Second, we build a CZ-level measure of Mexico's competition with China in the markets to which Mexico traditionally exported. Namely, we build the changes in the exports of China to the main importing partners of Mexico in 1994, i.e., the exports of China to the United States, Canada, Japan, Spain, and France (who jointly account for about 90% of Mexico's export that year).

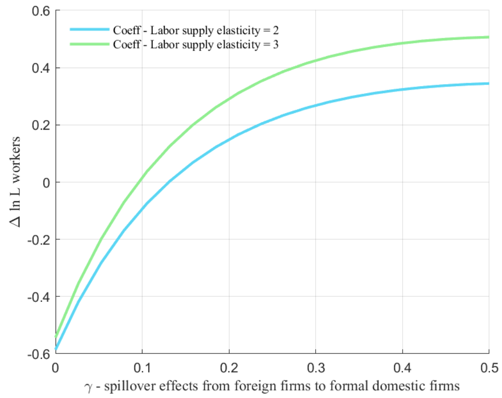
The measure of exposure to competition with China is given by equation (E11), where $k \in$ {Japan, Spain, France, United States, Canada}. We aggregate across countries k the changes in exports of China to each country k, weighted by the importance of imports from Mexico for that specific country. For a CZ cz and industry j, we weigh the export competition shock by the importance of industry j in the employment of that CZ cz in 1994.

$$Exp_{cz,t} = \frac{1}{L_{cz,1994}} \sum_j \frac{L_{cz,j,1994}}{L_{j,1994}} \left[\sum_k \frac{M_{j,1994}^{MX\rightarrow k}}{M_{j,1994}^{k}} \Delta M_{jt}^{China\rightarrow k} \right] \quad \text{(E11)}$$

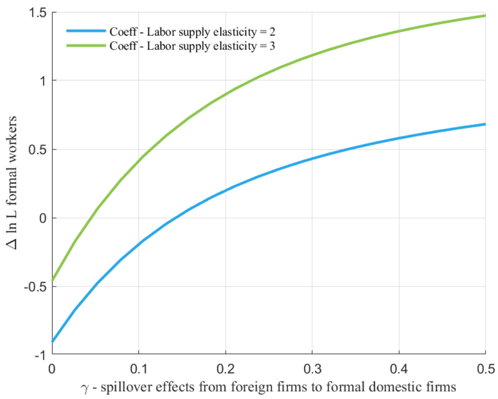
where cz indexes CZs in Mexico, j is a broad sector category, L is employment, $\frac{M_{j,1994}^{MX\rightarrow k}}{M_{j,1994}^{k}}$ is the share of imports of country k from Mexico out the total imports of country k in 1994, and $\Delta M_{jt}^{China\rightarrow k}$ denotes the change of imports of country k from China between $(t-5)$ and t.

Appendix F Additional quantitative results

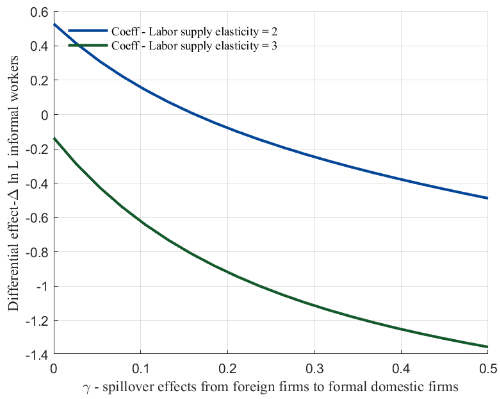
Figure F1: Effects on employment for different values of $\gamma_{D_F,F}$ and $\gamma_{D_I,F} = 0.7 \times \gamma_{D_F,F}$



(a) Effect on workers



(b) Effect on formal employment



(c) Differential effect on informal employment

Notes: This figure plots the coefficients β_1 and β_2 in equation (13) for domestic formal and domestic informal establishments for several simulations changing the spillover effects from foreign MNEs to domestic establishments. Section 6 provides more details.

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