

Trading Non-Tradables: The Implications of Europe's Job Posting Policy

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Abstract

Are local services jobs, such as plumbers or drivers, sheltered from globalization? Within the European Union, the posting policy allows firms in one country to send ("post") their workers to perform such services in another country. I combine novel administrative data on posting missions, quasi-experimental variations in the policy, and a model of service trade, to evaluate the redistributive implications of exposing novel jobs to international competition. I show that the staggered liberalization of posting to low wage countries permanently increased trade in services in Europe: 2% of EU GDP is offshored "on-site" through posting, mostly in "non-tradable" sectors, while within-EU geographic mobility is twice as large once accounting for posted workers. In receiving countries, domestic employment in exposed sectors and local labor markets decreased by 6% following the liberalization. These market-level displacement effects are driven by posted workers being substitutes rather than complements for domestic workers at receiving firms, and posting services being cheaper. I then demonstrate that posting openness triggered large economic gains in low-wage sending countries: firms in formerly "non-tradable" sectors increase their sales by 55%, their profits by 37% and their wages by 14% when accessing foreign markets through posting. Calibrating a model of services' trade with posting elasticity estimates, I finally quantify that the liberalization increased European consumers' welfare by 0.3% on average. My results suggest that expanding the range of tradable jobs through trade policies, as proposed in several major recent trade agreements, hurts low-paid workers in high wage countries, benefits sending firms in low wage countries, and has small efficiency effects for consumers.

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About 7.6 million Americans worked in construction (...) their jobs were not in danger of moving offshore. (You can't hammer a nail over the Internet.).

— Alan S. Blinder in “Offshoring: The New Industrial Revolution”, Foreign Affairs (2006)

1 Introduction

How increased trade integration may benefit or harm workers, firms, and consumers is a central topic in the public and academic debate. As commonly defined, *tradable* goods and services are produced in one country and consumed in another ([Grossman and Rossi-Hansberg \[2008\]](#), [Blinder and Krueger \[2013\]](#)). Concerns regarding international competition therefore focus on manufacturing (factories moving to China) or intangible services (call centers moving to India). Most jobs in advanced economies, however, are in *non-tradable* industries, and consist of locally provided services. Drivers, caregivers, or construction workers are considered sheltered from import competition. Consequently, we assume that firms operating in these sectors cannot access foreign markets and export opportunities.

This paper challenges this assumption by showing that non-tradable jobs can be offshored “on-site”, as foreign firms perform services in the country of the customer’s residence. To study this novel offshoring channel, I exploit the largest episode ever of trade liberalization in services: the European posting policy.

The European Union (EU) lifted all mobility restrictions for foreign suppliers’ employees within the EU in 1959. Through the posting policy, a firm located in France can subcontract a job to a firm located in Poland. Posted workers stay formally employed by the Polish (sending) firm but cross the border to perform the service at the French (receiving) establishment. Unlike standard trade, the service exported by Poland is produced on France’s territory. Unlike standard migrants, posted workers are paid by the Polish firm and have no employment contract in France. Potentially, these novel offshoring transactions could allow receiving firms to access cheaper labor, sending firms to access larger markets, and posted workers to benefit from higher wages. While many recent trade agreements have proposed to liberalize posting, following the EU example, the implications of such policy choices, however, remain unknown.¹

To fill this gap, I gather novel social security information on workers posted abroad that overcome the usual lack of reliable data on service flows ([Francois and Hoekman \[2010\]](#)). To track cross-border provision of services in Europe, I collect social security posting forms aggregated at the bilateral level for all EU countries. In order to measure granular exposure of workers and firms to posting, I further assemble novel administrative registries on posted workers. In two major receiving countries (France, Belgium), I use exhaustive linked employer-employee data merged with information on receiving firms’ use of posted

¹See for instance recent USMCA negotiations regarding the list of occupations for foreign employees allowed to temporarily enter in the U.S to provide services “on-site”. Cross-border provision of services has also been recently liberalized in ECOWAS, APEC or in the Argentina-Chile bilateral agreement.

workers. In two major sending countries (Luxembourg, Portugal), I use granular firm-level tax returns merged with information on sending firms' provision of posting services abroad.

Armed with these novel datasets, I answer four fundamental questions raised by this novel offshoring channel: (i) are firms and workers more exposed to globalization when services can be offshore "on-site"? (ii) in receiving countries, are domestic employees displaced by posted workers, and what are the gains derived by receiving firms? (iii) in sending countries, how much do firms and workers gain when accessing foreign markets through posting? (iv) overall, are there aggregate efficiency gains in allowing firms to offshore formerly "non-tradable" jobs?

The first finding of my paper is that non-tradable services are, in fact, effectively traded in substantial amounts through posted workers. I start by showing that the liberalization of the posting policy to low-wage Eastern European countries between 2004 and 2013 permanently increased services offshoring within the EU. Firms established in new member states (henceforth NMS) gradually gained the right to freely post workers to perform services within the EU, with the timing of service trade liberalizations set across sending and receiving countries by the European Commission (EC). Exploiting this differential timing across country pairs, I estimate a dynamic staggered difference-in-differences model to isolate the causal effect of the posting policy while controlling for all shifters of services supply and demand. Posting flows in affected country pairs increase immediately by 500% in the year of the liberalization event, generating large and permanent import exposure changes in receiving labor markets and opening substantial export opportunities in sending countries. Following this increase, services exported through posted workers represent 30% of service trade in the EU, or 2% of EU GDP. The number of workers posted abroad by service suppliers each year is *twice* as large as the number of within-EU standard migrants, suggesting our standard measures of international workers' mobility are largely biased downward. Posting occurs in sectors commonly protected from international trade and consists mostly of manual service tasks performed by blue collar workers. Top offshored jobs are in construction (builders, carpenters), agriculture (farm workers), industrial services (assembly, mechanicians) and other services (drivers, caregivers). In sending countries, firms in "non-tradable" sectors, such as temporary employment agencies or constructions firms, are in fact as internationally integrated as wine manufacturers or programmers.

The second finding of my paper is that the trade liberalization of services displaced workers previously sheltered from import competition in receiving countries. To estimate the causal effect of the posting policy on domestic employment, I use the large and permanent supply shock caused by the liberalization of the posting policy to NMS countries. While local exposure to standard import shocks is usually indirectly imputed ([Autor et al. \[2014\]](#)), French administrative data allow me to track posting inflows at the local and sectoral level before and after the liberalization. In a difference-in-differences design, I exploit large hetero-

genetics in French provinces' exposure to the reform, predicted by their spatial and industrial exposure to the posting scheme before the liberalization. Provinces located in different French regions are exposed to different pre-existing networks of posting supplier relationships, to which they are heterogeneously exposed through their pre-reform industrial composition. I show that while employment in high and low-exposure provinces was following perfectly parallel trends during the 10 years preceding the reform, domestic employment in exposed sectors and provinces decreases differentially by 7% after the liberalization. The absence of pre-trends confirms that differences in pre-reform exposure levels do not affect the differential evolution of employment through other channels than the liberalization shock, an assumption usually untestable in standard shift-share designs ([Goldschmidt-Pinkham, Sorkin, and Swift \[2020\]](#)). Turning to the overall employment effects of the liberalization, I show that domestic employment in occupations sheltered from posting competition has not evolved differentially after the shock, suggesting displacement effects in exposed industries were not followed by a large reallocation of domestic workers within affected local labor markets. As a result, overall unemployment remains permanently higher in exposed local labor markets, emphasizing the long-lasting effects of the trade liberalization in services in receiving labor markets.

I explain these market-level displacement effects by two main mechanisms at the receiving-firm level. I first demonstrate that receiving firms use posted workers as substitutes rather than complements for domestic workers in their production function. To make this point, I combine granular data on posting purchases in a major receiving country, Belgium, and an event study design comparing firms that start purchasing posting services to future receiving firms. I estimate that receiving firms significantly scale down their domestic employment when they start outsourcing tasks to posted employees. On average, receiving firms decrease their employment of domestic workers by 16% four years after they started using services supplied by posted workers. When hiring posted workers, firms increase their overall size, but this effect fades-away gradually, as displacement of domestic workers takes place over time. Confirming substitution of posted for domestic workers, employment responses are exclusively driven by changes in blue collar employment and by posting contracts where the offshored task is similar to the one performed by domestic workers at the receiving firm.

I then show that displacement effects can also be rationalized by receiving firms lowering their costs through the use of posting services. While administrative measures of inputs and outputs' prices at offshoring firms are usually hard to come by, payroll tax data allow me to compare wages of domestic and posted workers. I first show that firms that purchase posting services are those initially paying higher wages to their domestic employees, consistent with cost-saving motives of posting.² In detailed matched

²[Bilal and Lhuillier \[2020\]](#) recently illustrate theoretically and empirically these motives for domestic outsourcing.

employer-employee data from France, the [Abowd et al. \[1999\]](#) wage premium for domestic workers at receiving firms is 23 log points higher than in non-receiving firms. I then demonstrate that these receiving firms can effectively discriminate posted workers' pay compared to domestic workers' wages. Posted workers are paid 30% less than domestic incumbent workers at the same workplace, a wage penalty twice larger than for domestic temporary agency workers.³

The third finding of my paper is that the posting policy triggered large economic gains in sending countries. I study the export-mobility gains from the posting policy using granular firm data from a major sending country, Portugal. I use an event study design comparing firms posting services abroad to matched control firms in sectors sheltered from posting opportunities, or future posting firms. I demonstrate that firms undergo a significant scale-up in their activity once they access foreign markets through posting, with turnover, employment, wages, profits, and cash rising immediately after they start providing non-tradable services abroad. Two years after their first posting event, sending firms have 30% more employees and 56% higher sales relative to the year before the event. To show that posting drives these effects, I exploit heterogeneities in posting mission durations across firms, within a sector-province. Employment and sales gains at sending firms disappear immediately after the provision of services abroad ends, confirming that the export opportunities opened by the posting policy are the prime driver of sending firms' growth. The large export-mobility surplus is unequally shared between workers and capital-owners: profits increase by 37% after a posting event, while wages rise by 14%. Posted workers' wage gains are explained by destination-level minimum legal wages, rather than surplus sharing at sending firms. The posting policy also generates a positive fiscal externality for sending governments: sending firms pay more social security contributions and corporate taxes when they start supplying services abroad.

To gauge the magnitude of the export gains triggered by trade liberalization in services, as compared to more standard trade instruments, I repeat my analysis on the sample of manufacturing exporters in the same dataset. I find that gains from posting opportunities are of similar magnitude to gains from export of goods, the usual focus of industrial policy. Given the size of the export-mobility opportunities opened by the posting policy, low-wage countries with competitive advantage in services have large incentives to lift barriers to cross-border provision of services.⁴

The incidence of these alternative trade instruments, however, appears to be different. I show that sending firms are significantly smaller, younger, less capital intensive, and pay lower wages, than manufacturing exporters. Trade policies focusing on "non-tradable" sectors may thus have different redistributive

³This finding holds after controlling for workers' permanent characteristics, as workplace premia for posted workers at receiving firms are 53% lower than for domestic employees. The pass-through of regular firm fixed effects in wages to posted workers is almost nil, with an estimated elasticity of 0.1 (0.01).

⁴Export-mobility gains from posting are also similar in size compared to gains from global value chains' integration ([Alfaro-Ureña, Manelici, and Vasquez \[2019\]](#)).

implications in sending countries, compared to more standard policies. Nevertheless, I show that services are characterized by weaker scope for productivity gains and “learning by exporting” than standard manufacturing ([Atkin et al. \[2017\]](#)). Gains from posting do not last after that the posting mission ends, and sending firms do not improve their productivity or investment once they get exposed to foreign markets through posting.

The last finding of my paper is to quantify the efficiency gains from the trade liberalization of services. To this end, I calibrate a model of services’ trade building on [Eaton and Kortum \[2002\]](#) and [Arkolakis, Costinot, and Rodríguez-Clare \[2012\]](#), where formerly “non-tradable” services are traded through posting.

The model yields a tractable formula to measure changes in real wages from the trade liberalization of services in Europe, accounting for general equilibrium changes in countries’ income. I consider the liberalization of the posting policy to NMS countries as my main experiment. Applying the [Dekle, Eaton, and Kortum \[2008\]](#) “exact hat algebra” to my set-up, welfare changes following the reform can be obtained from current posting service flows, the elasticity of these flows, and a measure of the liberalization shock. I observe the first empirical moment in the EU-wide dataset on bilateral posting flows, and identify the two others with policy variations. In place of standard import tariffs, I leverage payroll tax and minimum wage reforms to estimate the responsiveness of posting service flows. Combining quasi-experimental evidence with a theory-consistent estimation, I find that the posting elasticity lies between 1.3 and 1.6 in the reduced-form settings, and has a median estimate of 1.1 in the structural gravity estimation. Using the structure of the model and these estimates, I can convert the reduced-form effect of the liberalization shock estimated in the first part of the paper into the structural policy shock needed for my counterfactual analysis.

The liberalization shock, or decrease in trade costs of services for NMS, acts as a positive productivity shock in the model, allowing all countries to source services from newly available suppliers. My calibrations show that after accounting for general equilibrium effects, the liberalization increased real wages by 0.3% on average in Europe. This effect masks heterogeneous gains: large sending countries such as Slovenia, Croatia, or Slovakia emerged as the top winners of the liberalization, while countries such as France or the Netherlands derived much smaller gains. While my finding of small aggregate efficiency gains is close to what has been found for manufacturing, the underlying forces differ in some dimensions. The consumption shares of services performed by posted workers are small, and much smaller than the consumption shares of imported goods. This usual “small number effect” is however counterbalanced by much lower substitutability of foreign and domestic services as compared to standard traded goods. My estimates of the posting services elasticity- four times lower than the usual trade elasticity ([Head and Mayer \[2014\]](#))- thus provide key parameters to inform current discussions on the trade liberalization of services.

This paper contributes to several lines of research. First, it expands the standard concept of offshora-

bility describing tradable services as tasks that can be moved abroad electronically ([Grossman and Rossi-Hansberg \[2008\]](#), [Blinder and Krueger \[2013\]](#), [Goos et al. \[2014\]](#)). I show that cross-border provision of services offshores locally-provided jobs, leading the scope of globalization to be substantially larger than previously thought.⁵ This paper thus also builds on [Saint-Paul \[2007\]](#), who theoretically studies the political economy of trade policies that widen the range of goods that are tradable. I further complement recent papers that have assessed the magnitude of international integration in Europe ([Dorn and Zweimuller \[2021\]](#), [Head and Mayer \[2021\]](#)). My results emphasize that cross-border service flows must be integrated to standard measures of international trade and migration to measure globalization accurately. Identifying service trade through payroll tax information on posted workers, my research also helps reconstruct administrative records of service trade. It thus contributes to filling the gap on the measurement of trade in services at the micro level ([Francois and Hoekman \[2010\]](#)).

Second, my paper complements studies on the labor market effects of immigration and trade. A large literature studies the effects of immigration on domestic workers' employment and wages, establishing that displacement effects tend to be moderate or non-existent ([Butcher and Card \[1991\]](#), [Ottaviano and Peri \[2012\]](#)).⁶ In contrast, the surging literature on local labor market exposure to import competition finds that manufacturing employment is heavily affected by foreign competition ([David, Dorn, and Hanson \[2013\]](#), [Autor et al. \[2014\]](#)). A substantial amount of work has finally investigated firm-level effects of both offshoring practices ([Bernard et al. \[2020\]](#), [Hummels et al. \[2014\]](#)). Bringing these three literatures together, I show that "on-site offshoring" shocks impose large labor adjustment costs on domestic, blue-collar employment in service sectors formerly sheltered from import competition, both at the industry and receiving-firm level.

Third, I relate to research measuring granular gains from international integration in manufacturing firms ([Atkin, Khandelwal, and Osman \[2017\]](#) for trade, [Alfaro-Ureña, Manelici, and Vasquez \[2019\]](#) for global value chains). I show that cross-border services generate export gains of similar magnitude than for more standard integration channels. These gains are however temporary, suggesting that unlike manufacturing industries, non-tradable sectors have weaker scope for productivity gains. I also contribute to the literature estimating "gains from trade" ([Arkolakis, Costinot, and Rodríguez-Clare \[2012\]](#)) by extending this approach to non-tradable sectors. I find that aggregate efficiency effects of service trade liberalization is limited, driven by much smaller expenditure shares in posting services, but this effect is partly counterbalanced by much smaller elasticities of manual services as compared to standard trade ([Head and Mayer](#)

⁵I thus also contribute to the substantial amount of work which has studied complementarities or substitution between trade and migration, starting from [Mundell \[1957\]](#). Recently, [Caliendo, Opromolla, Parro, and Sforza \[2017\]](#) consider the joint effect of trade and migration liberalization on overall welfare in Europe. I shed light on an additional, more direct, dimension of the trade-migration interplay: workers' geographic mobility triggers mobile services exports.

⁶[Dustmann et al. \[2017\]](#) is an exception.

[2014]).⁷

The rest of the paper is organized as follows. Section 2 describes the institutional framework of cross-border provision of services in the European Union and describes the data used in the analysis. Section 3 documents novel facts on exposure to globalization. Section 5 explores the consequences of on-site offshoring for firms and workers in receiving labor markets, and Section 6 quantifies export surpluses after liberalizing cross-border provision of services in sending countries. Section 7 quantifies the aggregate consumer gains following the trade liberalization of services, and Section 8 concludes.

2 Institutional Framework and Data

2.1 What Is On-Site Offshoring?

This paper documents a trade mobility channel where firms' cross-border services supply relies on workers' mobility across space. To export non-tradable services, foreign suppliers temporarily send their employees abroad to perform a service mission, a phenomenon I call *cross-border provision of services* or *on-site offshoring*. Services suppliers are not physically located in the receiving country: the service is accounted for in the sending country's production while being performed abroad.⁸

We usually describe standard international trade as an exchange of good or service that is produced in one country while being consumed in another country. Cross-border provision of services departs from the standard conceptual framework of services' trade, where a service is produced remotely in a foreign country and is then imported by electronic means by domestic entities. The provision of services through posted workers allows services to be performed by a foreign supplier *in the territory* of the domestic consumer. The services involved in these transactions cannot be exchanged by electronic means, for example, cleaning or plumbing. Because of this unique intersection between foreign services provision and consumer location that is absent in standard trade, receiving countries choose what taxes, entry, and regulations apply to posted workers in their territory.⁹

⁷I thus contribute to the large literature on the effects of traditional trade instruments on trade flows. Francois and Hoekman [2010] stress that while the literature on standard service trade and policy is growing, there is still no evidence on cross-border services supply due to a lack of data. Assembling an array of new datasets on trade mobility flows allows me to fill this gap and to estimate the distinct responsiveness of services' trade. My estimates thus also contribute to a small but growing body of literature, recently surveyed in Kleven, Landais, Munoz, and Stantcheva [2020], that establishes that top-income workers react to taxation through international migration. I extend this result to the international mobility of blue collar workers intermediated by firms.

⁸Such provision of services is called *mode 4 service supply* in the WTO service trade framework. A service performed by a services supplier located in country A in the territory of country B through posted workers will be accounted for in country A's GDP and exports country B's imports. It has a different incidence compared to FDI (mode 3 services supply), where foreign firms open an establishment in a receiving country. In that case, foreign establishment's sales are included in destination-level GDP, not origin-level GDP.

⁹This is emphasized by the WTO framework for general trade in services agreements (GATS): regulations on labor taxes, work, and entry are part of GATS negotiations for mode 4 services supply, e.g., cross-border services (see Appendix B for more details).

The international mobility of employees triggered by service trade is also conceptually different from standard migration, or trade in factors. Posted workers do not change their residence country: they stay in the employment area of the sending country while performing their work abroad, in contrast with immigrants who integrate their receiving country's labor market.¹⁰ Posted workers have no employment contract nor tax liability in the receiving country, while standard immigrants are hired "on-site" like other domestic workers.

2.2 The European Laboratory: Posting Policy

Established in 1959, the EU posting policy allows firms located in the territory of one member state to send their workers in any other member state to perform a temporary service mission, without having to open an establishment in that country. Provision of services through posted workers within the EU is authorized *de jure*: receiving countries have no right to refuse the foreign intervention in their territory. Posted workers can be employees posted by their permanent employer, by a temporary employment agency, or between firms of the same group. Firms are allowed to hire workers for the sole purpose of posting them; self-employed workers can also post themselves abroad.

The posting policy is described in Figure A.1 and determines what taxes and regulations apply to these novel migration trade flows in the receiving country. Receiving countries must grant large exemptions to posted workers: sending firms only have to pay payroll taxes in the sending country.¹¹ Posted workers are also not liable to most employment regulations in the receiving country. However, to combat social dumping and prevent distortion of competition, the EU provided posted workers with a legal right to the *basic minimum* rights and conditions in receiving countries. Since 1996, posted workers have thus benefited from destination-level minimum legal wages and maximum work durations. In receiving countries without a minimum legal wage, and for the self-employed, the prevailing minimum pay rule does not apply. Furthermore, since 2020, posted workers must receive the same *pay* as domestic employees at the receiving firm and are covered by some collective labor agreements.

While the posting policy is meant to regulate "temporary" services provision between member states, there is not a legal limitation to posting mission. The sending firm must, however, have a "substantial" activity in the country of establishment. Exemptions from receiving payroll taxes are also granted for a limited duration: 12 months until 2010, 24 months from 2010-2020, and 18 months since 2020.¹² If firms

¹⁰Posted workers are therefore not accounted for in destination-level employment and economic statistics. Another difference is that posting flows are only driven by firms' transactions. Unlike standard migration, posting flows should not be explained by non-economic factors that affect permanent location choices of individuals.

¹¹Sending firms pay the corporate income tax in the country of origin, while the VAT on the service mission is paid by the client in the receiving country.

¹²Until 2010, labor tax exemptions could be renewed without restrictions. Since 2010, these exemptions are only granted for a new posting mission if two posting periods involving the same worker, sending and receiving firms are separated by a two-month

located outside the EU want to provide a service in the EU, they must obtain a work authorization and temporary visa for each of their workers. Posting from non-EU member states is thus as regulated as in other free trade areas (see Appendix B).

2.3 Data

The lack of evidence on cross-border provision of services can be traced to the absence of reliable data to measure these novel trade-migration flows. This subsection discusses the novel administrative datasets on postings within the EU that fill this gap. Datasets are summarized in Table A.1 and Table A.2 and are described in separate data appendices.

2.3.1 Europe-Wide Dataset on Bilateral Posting Flows

The first dataset leveraged for the analysis builds on administrative social security certificates E101/A1 issued for each posting mission within the EU. This certificate is a mandatory document that posted workers must hold during their mission to prove their affiliation to their sending country's social security system.¹³ The posting certificates are issued by sending countries and are linked to the work mission rather than to the worker: a unique worker may be linked to several posting forms. One E101/A1 form identifies simultaneously a flow of a worker moving abroad and a service mission export.

Using exhaustive information on issued posting forms by receiving countries for each sending member state each year collected from the EC, I build the full matrix of bilateral posting flows from 2005 to 2017.¹⁴ I merge this dataset with measures of countries' wages and GDP from Eurostat. The final dataset allows me to track yearly bilateral posting service flows within the EU from 2005 to 2017 with joint information on sending and receiving countries' income.¹⁵ This dataset allows me to recover standard "gravity" information on bilateral trade-in-services in Europe, overcoming two major measurement challenges usually faced by trade economists. First, unlike for standard exports, social security forms do not have a minimum declaration threshold: I thus have limited missing flows in my dataset.¹⁶ Second, while services' transactions are usually poorly measured due to their intangible nature, payroll tax information on posted workers helps reconstruct reliable administrative records of trade in services.

break.

¹³The absence of the E101/A1 social security forms implies a fine for services supplier and receiving firms and can lead social security contributions to be paid in both sending and receiving countries. The E101/A1 only concerns trade-related mobility within the EU and does not apply to postings from outside the EU. As these flows are very heavily regulated, they are, however, very small, as shown in the rest of this paper.

¹⁴Historical data on E101/A1 forms also exist for the 1988-2000 period but are aggregated for the entire EU.

¹⁵To document the relationship between labor cost and posted worker flows, I also merge this dataset with measures of employers' labor cost measured by Eurostat in each member state from 2009 to 2017. The final dataset allows me to track yearly bilateral posting service flows within the EU from 2009 to 2017 with joint information on sending and receiving countries' wages, employer payroll taxes, and minimum legal wages.

¹⁶Silva and Tenreyro [2006] discuss the issue of missing or zero flows in standard trade datasets.

To quantify the *monetary value* of service trade through posting, I use additional data on within-EU trade in services through the posting of workers abroad collected from Eurostat.¹⁷

2.3.2 Country-Level Micro Data on Posting

To measure granular exposure of firms and workers to the posting policy, I complement the EU-wide posting dataset with micro administrative data on posting in six countries.

Administrative Registries of Posted Workers in Receiving Countries Linked employer-employee data in receiving countries allow me to study the consequences of posting for domestic workers. I use administrative registries on incoming posted workers in receiving countries where these registration requirements exist: France and Belgium, which are the top second and third importers of posting services.

All firms that post their employees to France (respectively, Belgium) to perform a service are required to file a DPD/SIPSI (respectively, LIMOSA) posting declaration. If the declaration is missing, both sending and receiving firms are liable to sanctions and fines and the posting mission is interrupted. For France, I use exhaustive received posting declarations by province-year-sector from 2000 to 2015 and disaggregated declaration data for 2017-2020. For Belgium, I use the universe of disaggregated posting declarations for 2010-2020.

For the LIMOSA and DPD/SIPSI datasets, I use the unique receiving firm identifier to link posting registries with linked employer-employee and balance sheet administrative data on domestic workers and receiving firms.¹⁸ I can identify which firm purchased a service performed by posted workers, which foreign supplier and posted workers performed this mission, and detailed information on the posting mission. The final merged datasets allow me to observe jointly posted and domestic workers' hours of work, tenure, wages, occupation, and demographics and to link them to their common workplace in receiving countries.¹⁹ These datasets are described in Appendix H for France and Appendix J for Belgium.

In Germany, all companies posting workers in the construction sector must pay a compulsory contribution to the national fund for holiday leave, SOKA-BAU. I use data provided by SOKA-BAU on the universe of workers posted to the construction sector in Germany since 2000.

In Austria, all companies that post workers in the construction sector must contribute to the national fund for holiday leave by making a payment to the national building union BUAK. I use data provided by

¹⁷The data on services' export by mode of supply built by Eurostat are, however, not available at origin-destination level and are only available for the recent years. It applies the balance of payment methodology to aggregate services' flows within the EU, to infer the amount of services exports performed by workers sent abroad (WTO mode 4 of services supply).

¹⁸All domestic registries on firms and workers are listed in Table A.2 and in data appendices.

¹⁹Extensive information on the posting mission include duration of the work mission, location of the work performed, and whether the foreign supplier provided food/housing to the posted workers. Posted workers' wage is only observable in the DPD/SIPSI dataset (France), as the Belgian authorities do not keep this information.

BUAK on the universe of workers posted to the construction sector in Austria since 2006.

Administrative Registries of Posted Workers in Sending Countries Firm-level administrative data in sending countries allow me to analyse services export gains for sending firms and posted workers.

I use administrative employer-employee data on the universe of workers employed in Luxembourg merged with information on posting social security forms at the worker level for 2002-2019.²⁰ I observe all job spells in Luxembourg for posted and domestic workers, together with detailed information on employers, employees, and jobs characteristics, such as wages, tenure, hours of work, employer's two-digit sector code, and employee demographics. This dataset is described in Appendix [I](#).

To obtain granular data on posting companies and their performance, I finally leverage administrative tax data on firms in Portugal, one of the top exporters of posting services. The dataset provides detailed information on firms' five-digit sector code, wages, employment, investments, sales, and other balance sheet components. Each year, firms established in Portugal report to the tax administration the amount of services performed abroad by the geographical market of destination. I use this information to identify the universe of Portuguese firms that supplied posting services in another EU country between 2006 and 2017.²¹ Appendix [G](#) provides more detail on the dataset.

3 Trading Non-Tradables: Who is Getting Globalized?

In this section, I use my datasets on posting in Europe to document two core facts that motivate my analysis: (i) globalization is larger once we account for the novel trade-migration flows caused by the posting policy, and (ii) it has a radically different incidence compared to standard trade and standard migration.

3.1 Globalization is Larger Once Accounting For Posting Flows

This subsection shows that the posting policy causally increased trade and migration flows in Europe, leading international integration of the European economy to be larger than previously thought.

Causal Effect of the Posting Policy on Trade-Migration Flows Most free trade areas regulate cross-border service trade with entry barriers in destination countries. In contrast, the posting policy lifted all entry restrictions for cross-border provision of services within the EU. I start by showing the causal effects of the posting policy on cross-border service trade.

²⁰Because small countries are more exposed to trade, Luxembourg has one the highest postings-to-employment ratio.

²¹The dataset also includes information on manufacturing exports, allowing me to compare non-tradable services exporters to standard manufacturing exporters.

I focus on the transition from quasi-autarky to full liberalization of cross-border service trade for 13 new EU member states (henceforth NMS) from 2004 onwards. Postings from non-EU to EU countries face entry barriers and are regulated as in other free trade areas. When a country is an EU member, entry restrictions for its firms' employees are lifted in all other EU countries. The EU enlargements of 2004, 2007, and 2013 triggered the service trade liberalization for successively 10 (Poland, Lithuania, Hungary, Estonia, Latvia, Slovakia, Slovenia, Czech Republic, Malta, and Cyprus), 2 (Bulgaria and Romania), and 1 (Croatia) low-wage countries located in Eastern Europe (Figure A.3, Panel A).²² Different timings of the liberalization for workers posted from these countries were further allocated to different receiving countries by the EC. Austria and Germany kept the pre-enlargement entry restrictions in some sectors for the seven years that followed EU accession events.²³ All other EU countries had to grant free access to services suppliers from new member states right after each EU accession event. The timing of services' trade liberalization events is exemplified in Figure A.3, Panel B. Importantly, in most cases, the timing of posting liberalization reforms differs from the timing of standard migration liberalization for NMS.²⁴

To estimate the causal effect of the posting policy, my identification strategy uses a triple differences approach where I compare posting flows from treated versus control countries before and after services' trade liberalization to countries that did or did not lift entry barriers. The origin-destination staggered dimension of these reforms allows me to effectively control for any unobserved posting determinants that vary at the country-by-year level. For instance, Poland's entry in the EU in 2004 may enhance its economic relationships with France, which could in turn increase posted worker flows from Poland to France in 2004. I control for origin-year and destination-year fixed effects to filter out these confounders.

One may be concerned that the timing of the service trade liberalization in a given origin-destination country pair is correlated with the future evolution of posting flows in that country pair after the event. For instance, if countries lifted entry restrictions right after EU accession because they expected to receive more service flows compared to countries that kept the restrictions, my estimates could be biased upward. The EC held posting restrictions in Austria and Germany because these countries were "at risk" to be heavily affected by foreign suppliers' competition from lower cost countries.²⁵ If any, keeping entry barriers at EU accession is correlated with expecting large posting inflows compared to other receiving countries, leading

²²These 13 countries represent 20% of the current EU population.

²³The sectors that kept posting restrictions were in Germany: construction, industrial cleaning, and interior decorators; and in Austria: horticulture, stone cutting, metal structure manufacturing, construction, security activities, industrial cleaning, home nursing, and social work

²⁴For instance, France lifted entry restrictions for posted workers from NMS of 2004 in 2004, but kept entry restrictions for standard migrants until 2008. Similarly, Belgium opened its labor market to workers posted from NMS of 2004 in 2004, while migrants were only able to come in 2009. I exploit these differences to document potential substitution between posting and standard migration.

²⁵The geographical proximity between Austria and Germany and the 10 new member states of 2004 was the key argument for allowing some services sectors in these receiving countries to be "protected" from the service trade liberalization at EU accession.

my estimates to be biased downward. Ultimately, the inspection of pre-trends before the event will allow me to test directly whether posting flows from treated versus control countries evolved differentially before the event. Finally, to observe posting flows from NMS *before* the posting policy, I use data on posting flows in receiving countries that have a country-level registration tool: France, Belgium, Austria, and Germany, that are the top four importers of posting services in EU.²⁶

Figure 3 illustrates how postings from countries treated by the service trade liberalization event (red series) evolved compared to postings from countries not affected by it (blue series), before and after the reform (vertical red line). In the six country-level experiments, postings from treated and control countries do not exhibit differential trends before the reform. Panels A, C, and E show that posting flows increase immediately after mobility barriers are lifted at EU accession. In countries where restrictions are kept, no differential evolution of posting flows is observed at EU accession, while postings from treated countries start to differentially increase when regulatory entry barriers are lifted later on (Panels B, D, and F).

To pool all entry reforms, I estimate a dynamic staggered difference-in-differences model:

$$\ln S_{ijt} = \alpha_{ij} + \alpha_{jt} + \alpha_{it} + \sum_{k=c}^{\bar{c}} \beta_k D_{ijt}^k + \varepsilon_{ijt}, \quad (1)$$

where S_{ijt} is the number of postings from country i to country j at time t and α_{ij} is an origin-destination fixed effect. The treatment is defined as country i gaining the right to post workers without entry restrictions to country j at time t . I define the event dummy as $\mathbb{1}[t = d_{ij} + k]$, where d_{ij} is the year at which country j lift mobility barriers for employees sent from country i . D_{ijt}^k is equal to one for treated country pairs in year k of the liberalization event while is equal to zero for country pairs that are never or yet to be affected by a liberalization reform. Including origin-year and destination-year fixed effects controls for all time-varying factors in sending and receiving countries that affect the equilibrium level of bilateral posting flows. I normalize $\beta = -1$, set $\underline{C} = -5$ and $\bar{C} = +9$ and $D_{ijt}^{\bar{c}} = \mathbb{1}[t = d_j \geq \bar{C}] \times \mathbb{1}[T_i = 1]$ and $D_{ijt}^c = \mathbb{1}[t = d_j \leq \bar{C}] \times \mathbb{1}[T_i = 1]$. I estimate Equation (1) using the OLS two-way fixed-effects estimator and the [De Chaisemartin and d'Haultfoeuille \[2019\]](#) estimator accounting for heterogeneous treatment effects.

The coefficient of interest estimated from Equation (1) compares postings between country pairs that are treated by a posting liberalization reform in event year k compared to postings between country pairs that are never or yet to be treated by such a reform.²⁷ I plot the series of estimated β_k and their 95%

²⁶Unlike the A1/E101 data, country-level registration tools record postings from non-EU countries. Figure F.65 shows postings from new member states using the E101/A1 dataset. For Germany and Austria, I focus on postings to the construction sector (recorded in BUAK and SOKA-BAU datasets), as the liberalization only affected a subset of sectors including construction in these countries.

²⁷For instance, it compares how posting flows from Poland to France evolved in 2005 (one year after the liberalization event for France-Poland) compared to the evolution that is observed the same year for postings from Spain to France (never affected by an entry liberalization reform over the estimation periods and treatment window) and from Poland to Germany (yet to be affected).

confidence intervals in Figure 4.

I find no evidence of differential pre-trends, which indicates that the timing of the liberalization reform is not correlated with differential evolution of postings between control and treated country pairs before mobility barriers are lifted. The number of workers posted from countries that benefit from the posting liberalization reform starts to increase right after the event, indicating that the reform causally increases cross-border services supply. The estimated treatment effects are large and statistically significant at the 1% level. Posting flows between treated country pairs increase by 500% the year of the liberalization event relative to the year before, and the effects last permanently after the end of posting restrictions. The estimated trade-migration effects of the posting policy are unchanged by the inclusion of origin-year and destination-year fixed effects that filter out the overall effects of EU accession for NMS, and to heterogeneous treatment effects. Figure 4 confirms that the posting policy causally affects trade-migrations flows, and that the liberalization of posting mobility from 2004 onwards dramatically increased cross-border service trade in the EU. I refer to this episode as “liberalization” in the rest of the paper.

A natural question raised by Figure 4 relates to crowding-out effects of the posting policy on standard migration. To understand if posting and migration flows are substitutes, I exploit the fact that most countries liberalized posting and migration flows in different years. In Figure A.11, I estimate posting flows responses to bilateral migration reform events in place of posting reforms. Posting flows do not react to the migration reforms, suggesting posting is not used as a substitute for standard migration. Hence, baseline results are unchanged when controlling for bilateral migration reforms implemented in different years than posting reforms (Figure A.5). This is consistent with migrants being very different in terms of characteristics compared to posted workers, as showed in Figure A.10.²⁸ I further show in Figure A.4 that the estimated effects of the liberalization reform are robust to excluding events where posting and migration liberalization occur simultaneously, confirming that the baseline results are driven by posting reforms only.

Rethinking Standard Measures of Globalization How is our measure of globalization changed once we account for the novel trade-migration flows triggered by the posting policy? Following the liberalization, the cross-border provision of services has increased tenfold since 2000, reaching almost two million posting missions in 2017 (Figure 2).²⁹ Using data on services’ export through posted workers within the EU, I quantify that posting transactions are currently worth around 300 billion euros in 2017; which accounts for 27% of overall trade in services within the EU and 10% of within-EU manufacturing trade (Figure 1). Therefore, almost 2% of EU GDP is additionally traded through the novel migration-trade channel opened

²⁸ Appendix E discusses the question of complementarity between posting and migration in more details.

²⁹ There is a gap in data collection between 2000 and 2005 at the EU-wide level, but Figure A.21, Panel B shows the equivalent increase for postings to France without a break in data collection.

by the posting policy.

Cross-border provision of services also affects measures of international mobility of workers. Comparing flows of posted workers with the number of workers changing their residence country each year to work abroad (standard migrants), I find that trade-related mobility flows are *twice* as large as international migration flows of workers within the EU (Figure 2, Panel B). This finding holds when comparing the number of *unique* workers posted abroad with the number of *unique* working immigrants in receiving countries. Using administrative data on incoming posted workers and migrants in France, I show that incoming flows of (unique) posted workers account for almost 70% of all unique foreigners entering in the French labor market each year (Figure 1). Our standard measures of international mobility of workers and trade in factors thus appear to be severely biased downward.

3.2 Novel Exposure to Globalization

Cross-border provision of services increased international trade and international mobility of workers in the European economy. The incidence of these novel flows is different compared to standard trade and standard migration: the posting policy exposes novel sectors, workers and firms are globalization.

3.2.1 Formerly Non-Tradable Jobs Become Offshored Through Posting

The posting policy is mostly used by firms to offshore services commonly sheltered from trade. Using detailed data on posting missions in France, the second importer of posting services in the EU, Figure 5, Panel A shows that almost 35% of the missions performed by posted workers occurs in the construction sector, 35% in manufacturing services (e.g., welding, electronic installation, or pipe-fitting), 18% in business services (e.g., driving, cleaning or food catering), and 10% in agriculture.³⁰ Those offshored jobs are mostly manual services: blue collar workers account for 65% of all workers posted abroad and 58% of all on-site offshored services (Figure 5, Panel B). Top occupations of the workers posted to France include builders, plumbers, electricians, welders, pipe fitters, farm workers, mechanics, and drivers, who are typically thought as sheltered from direct import competition.³¹

The intensive use of the posting scheme observed since 2005 led to a relatively large international integration of “non-tradable” sectors within the EU compared to other areas of the world. Comparing service trade statistics within the EU and between NAFTA members, I show that in Europe, the international inte-

³⁰In comparison, construction represents roughly 7% of French domestic employment, while it is 2.5% for agriculture. The amount for overall within-EU postings based on E101/A1 forms are similar: Figure A.2 shows that construction represents more than 40% of postings in the EU but less than 10% of EU employment.

³¹Note that 22% (56%) of posting contracts involve firms buying posting services in the same five-digit (two-digit) sector as their main sector (Figure A.8). If services offshored on site are non-tradables, receiving firms may operate in standard tradable sectors like manufacturing (Table A.9).

gration of standard “tradable” services such as finance or communication is in fact as important as international integration of locally-provided services such as construction, road transport and industrial services performed abroad. In contrast, trade in non-tradables within the NAFTA, where export of services through posted workers are still heavily restricted, has been much lower than trade in services easily exchangeable across borders. In 2017, the gap between non-tradable services’ trade and standard “tradable” services’ flows was 15% in Europe, but 65% in the NAFTA. Figure A.7 emphasizes the scope for potential service trade expansion in “non-tradable” sectors following policies that liberalize posting of workers.

3.2.2 Firms Formerly Sheltered From Export Opportunities Become Exporters Through Posting

Following the different type of jobs offshored through posting, firms in sectors usually thought as “non-tradables” are in fact internationally integrated. Using detailed firm-level tax and trade data on firms located in Portugal, Figure 6, Panel A, shows that firms formerly sheltered from export opportunities in fact access foreign markets through posting. The share of firms in non-tradable sectors exporting services each year is large: 34% for temporary employment agencies, 29% for road transport, 15% for building completion, and 7% for residential construction. As a consequence of this large international integration of services’ suppliers, cross-border provision of services represents a sizeable share of sending countries’ economic activity in non-tradable sectors. The weight of non-tradable services’ exports in total sectoral turnover is 28% for the road transport industry, 25% for floor covering, 19% for temporary employment agencies and 13% for painting. In contrast, export of goods represent less than 2%, on average, of services suppliers sales, confirming that these sectors would be sheltered from export opportunities in the absence of cross-border services.

As a result, Figure 6, Panel B, shows that exports of residential construction and road transport services are much larger in absolute than, for instance, exports of wine ([Ricardo \[1891\]](#)). In the words of [Grossman and Rossi-Hansberg \[2006\]](#), “it’s not wine for cloth anymore”. But perhaps surprisingly, drivers and builders rather than programmers have replaced wine manufacturers. Temporary employment agencies make almost as much abroad than firms specialized in computer services.

3.2.3 Workers’ Usually Sheltered From International Mobility Become Mobile Through Posting

Using detailed posting data from France and Belgium, Figure A.10 shows that posted workers are older than migrants, work more frequently in non-tradable manual jobs such as construction, originate more from Eastern European countries, and are less likely to have a tertiary level of education, even after controlling for sending countries. Cross-border provision of services thus also exposes a different set of workers to international mobility compared to standard migration.

4 Employment Effects of Posting Flows in Receiving Countries

I have provided substantial evidence that the posting policy increased the level of international integration in Europe and affected workers in “non-tradable” sectors. In this section, I study how posting affects receiving labor markets and domestic workers exposed to this novel form of foreign competition. I start by investigating the causal effects of the posting policy on domestic employment at the *market-level*, focusing on local-labor markets exposure to the posting shock. I then investigate two receiving-firm-level mechanisms that explain these displacement effects: substitutability between posted and domestic workers, and lower prices of newly offshored inputs.

4.1 Causal Effect of the Posting Policy on Local Labor Markets

To estimate the causal effect of the posting policy on domestic employment, this section studies local labor markets’ responses to a large and exogenous shock in the supply of posting services. More specifically, I exploit the lifting of posting restrictions for firms located in NMS countries in 2004. To study the effects of this reform, I focus on France, the second largest importer of posting services in Europe, because data on incoming posting flows are available since 2000. While local labor market exposure to import shocks is most of the time imputed rather than observed ([Autor, Dorn, Hanson, and Song \[2014\]](#)), I am able to measure local labor markets exposure to posting. More specifically, I exploit the aggregated version of the DPD/SIPSI dataset that provides province \times sector \times origin \times year posted worker flows to France from 2005 to 2015, and region \times sector \times origin \times year for 2000-2004. I then combine the posting dataset with administrative data on employment produced by INSEE (“*emploi salarié localisé*”) that measures the number of (salaried) employees in France by year, sector, and province since 1989.³² Importantly, posted workers are not accounted for in the French employment data, as they are employed by foreign firms and do not have an employment contract in France.

4.1.1 Identification Strategy

Identifying the causal effect of posted worker inflows on domestic employment is challenging because these inflows could be correlated with unobserved shocks that simultaneously affect demand for posted and domestic workers. In that case, unobserved changes in demand for both domestic and foreign services would lead estimated employment effects to be biased upward, e.g., would lead to underestimating potential displacement effects from posting. To circumvent this issue, I exploit supply-driven changes in posting competition. More specifically, my identification strategy exploits differences in exposure to a large supply

³²This dataset is based on micro administrative data on all employers’ administrative payroll declaration in France.

shock in posting services driven by regulatory changes. In a difference-in-differences spirit, I study the differential effect of the liberalization reform on the employment of domestic workers in sectors exposed to posting competition that are in local labor markets more or less exposed to the shock. This approach combines Bartik exposure measures with quasi-experimental difference-in-differences design, following the recent literature on shift-share instruments ([Goldsmith-Pinkham et al. \[2020\]](#)). It allows me to gauge the plausibility that pre-reform differences in exposure *levels* are not correlated with *changes* in the outcome of interest, an assumption untestable in standard shift-share designs.

Nation-Wide Policy Shock The first dimension of my identification strategy uses the large and exogenous posting supply shock that followed the opening of the French labor market to services performed by employees of the ten NMS of 2004. As shown in the bottom panel of Figure [A.21](#), posting exposure measured as the number of posting missions in total French employment increased dramatically after 2004, from 0.03% in 2003 to almost 1% in 2015.³³ This supply shock has been concentrated on a set of occupations. Some jobs require a set of skills, such as language, that make them hardly substitutable with posted workers. Other occupations are further covered by additional regulations such as licensing for posted workers. The heterogeneities in posting exposure between workers of different sectors are exemplified in Figure [A.21](#). Non-tradable sectors like agriculture and construction are heavily exposed to posting competition, as they require little domestic-specific skills and sending countries are relatively well endowed in this type of labor. By contrast, public administration, skilled services (accounting, administrative staff, engineering services), or health have almost zero exposure to posting. I thus focus on the effects of the shock on domestic employment in sectors experiencing a large change in posting exposure. Investigating the differential evolution of employment in sheltered sectors before and after the posting shock allows me to detect potential reallocation of French workers after foreign services suppliers were allowed to send posted workers to France.

Local-Labor Market Pre-Reform Exposure to the Shock The second dimension of the difference-in-differences exploits large geographical heterogeneities in posting exposure that have been persistent over time.³⁴ To isolate supply-driven shocks in posting exposure across French provinces, I measure their exposure to the shock before the reform, in 2003. More specifically, I exploit pre-existing differences in geographical and industrial exposure of French provinces to the nation-wide shock of 2004. To capture ge-

³³Importantly, the French labor market opened to standard migrants from NMS-2004 only in 2008, not in 2004. The “standard migration” shock is thus not simultaneous to the posting shock. Furthermore, the opening of the French labor market to standard immigrants from NMS did not lead to significant increase in immigration flows, as showed by [Caliendo et al. \[2017\]](#). Finally, standard immigrants have an employment contract in France and are therefore included in “domestic workers” here.

³⁴Figure [A.55](#), Panel A shows that the 2004 services supply shock has been initially concentrated on a restricted set of provinces, while other were unaffected. These geographical heterogeneities in posting exposure across localities are plausibly driven by exogenous factors such as distance to sending countries or an initial sectoral mix of province activities.

ographical heterogeneities in posting exposure across French provinces, I use the spatial distribution of posting inflows in French regions in 2003. Provinces located in regions with relatively more pre-existing relationships with suppliers of posting services should benefit more from the nation-wide supply shock of 2004.³⁵ I measure provinces differential exposure to pre-existing spatial exposure to posting by exploiting differences in provinces industrial composition *within* a given region. Formally, I measure province-level pre-reform use of posting services by interacting 2003 regional posting inflows with the employment shares of each province in that region, following the specification:

$$e_{p \in r}^{2003} = \sum_s \frac{Emp_{p,s}^{2003}}{Emp_{r,s}^{2003}} \times P_{r,s}^{2003} \quad (2)$$

Where $Emp_{p,s}^{2003}$ is 2003 employment of province p in sectors s , $Emp_{r,s}^{2003}$ is overall employment in sector s in region r , and $P_{r,s}^{2003}$ measures posting flows to region r in sector s in 2003. The term e_p^{2003} captures province's geographical \times industrial exposure to information on posting, but is not directly linked to province-specific future demand of posting services.³⁶ Variations in e_p^{2003} stems from provinces being located in regions with different pre-existing posting relationships, and provinces being differentially exposed to that specific information through their pre-reform industrial composition.

To test the sensitivity of my results to measures of pre-reform exposure, I use three alternative indicators of local labor market exposure to posting. I first use 2000 employment shares to compute e_p^{2003} to alleviate worries that industry composition the year before the shock affects employment changes the year after. I then use pre-reform regional exposure of posted workers in 2003, exploiting solely the initial spatial distribution of pre-reform posting relationships across French regions. I finally correct e_p^{2003} with a leave-out approach. More specifically, to avoid capturing province-specific demand shocks in the exposure measure, I compute e_p^{2003} with regional posting flows *minus* flows to that province. That way, the pre-reform exposure only relies on supply-shock affecting neighbouring provinces in the same region, while excluding direct use of posting services in that province.³⁷

Ultimately, my set-up provides me with two major advantages for identification. First, observed data on province-level posting flows make it possible to verify that pre-existing exposure to the posting scheme is a good predictor of provinces differential exposure to the nation-wide liberalization. Table 3 confirms that pre-existing exposure to posting services strongly predicts province-level posting inflows after the

³⁵In spirit, the idea is similar to exploiting pre-existing trade or immigration relationship. There are 5 provinces by region on average in France. In 2003, I observe sectoral posting flows to each French region, not provinces.

³⁶I follow David et al. [2013] and normalize $e_{p \in r}^{2003}$ by province's total employment in 2003 to capture the intensity of posting use, rather than differences in provinces' size. I further show that the results are robust to normalizing pre-reform flows by working age population, or by 2000 employment levels.

³⁷Formally, this alternative exposure measure is computed as $e_{p \in r}^{2003} = \sum_s \frac{Emp_{p,s}^{2003}}{Emp_{r,s}^{2003}} \times (P_{r,s}^{2005} - P_{p,s}^{2005})$. I use posting flows in 2005 because before, only region flows are observed, not province-level flows.

2004 reform. My baseline measure of pre-existing exposure predicts province-level posting inflows in 2015 with a coefficient of 0.2(.05) and a F-statistic of 14.7 (column 1), and predicts average posting inflows for 2005-2015 with a F-statistic of 26.6 (column 7). Alternative measures relying on 2000 employment shares (column 2) or regional exposure (column 4) also exhibit strong prediction power, with first stage F-statistics above 15.

Second, I observe differential evolution of employment in high and low exposure provinces up to 10 years before the reform. Given that my design exploits level differences in exposure shares, I can assess the plausibility of the assumption that the common shock caused the change in the changes, or whether there were pre-existing differences in the changes ([Goldsmith-Pinkham et al. \[2020\]](#)).

I estimate the differential effect of the large and permanent posting shock of 2004 on the domestic employment of workers in sectors treated by the posting shock, in provinces with high and low exposure to this supply shock. To obtain the differential evolution of exposed employment in high and low exposed local labor markets following the exogenous shock, I estimate the following equation:

$$\ln(Emp_{it}) = \alpha + \lambda_t + \gamma_2 \mathbb{1}(i = 1) + \zeta \mathbb{1}(i = 1) \times \mathbb{1}(t \geq 2004) + u_{it}, \quad (3)$$

where Emp_{it} is employment in localities i in sectors exposed to posting competition at calendar time t , expressed either in level or in share of province-level working age population, and where $i = 0, 1$ is an indicator for being a top or bottom exposure locality. The interaction variable ζ captures the difference in domestic employment trends between top and bottom exposure localities after the supply shock of 2004. To leverage all variations in posting exposure across provinces, I finally correlate 2003-2015 employment changes with posting exposure following the 2004 reform:

$$\Delta(Emp_{pt}) = \alpha + \zeta \ln P_{pt} + u_{pt}, \quad (4)$$

I follow [David, Dorn, and Hanson \[2013\]](#) by normalizing the dependent variable by province-level working age population, and the regressor by total employment in that province. Hence, $\Delta(Emp_{pt})$ is the log change in the share of working age population of province p working in sectors exposed to posting competition between 2003 and 2015 and $\ln P_{pt}$ is the log of province exposure to posting after the liberalization.³⁸ To account for the endogeneity in received posted workers after the reform, I instrument posting exposure after the reform by the pre-existing exposure to the shock.

³⁸This is measured by posting exposure (posting inflows in total province employment) in 2015, or average posting exposure over the post reform (2004-2015) period.

4.1.2 Results

Figure 7, Panel A displays the result for the baseline difference-in-differences strategy. Compared to localities that were less exposed to the shock, localities with a high initial exposure to posting saw a decrease in the share of their population working in exposed sectors after 2004, while following remarkably similar evolution before the reform. The absence of pre-trends in the 10 years before the liberalization confirms that differences in pre-reform exposure levels do not affect changes in employment through other channels than the reform. Employment of French workers in exposed industries starts to diverge immediately after the 2004 shock, suggesting that the reform is causing the result, not unobserved demand shocks. The estimated coefficient ζ reported on the graph is negative and significant at the 1% level. The share of population working in postable employment decreased by 6% in high-exposure provinces after the posting shock compared to provinces not exposed to the posting supply shock. The openness of the French labor market to workers posted from low-wage NMS countries causally decreased employment in exposed sectors and exposed local labor markets. Estimating the difference-in-differences design using alternative thresholds for top and bottom exposure provinces yields similar changes in trends after 2004, while no pre-trends can be detected before the reform (Figure A.22, Figure A.23).

Were these employment effects followed by reallocation of domestic workers in sheltered sectors within exposed local labor markets? Panel B of Figure 7 shows that the share of individuals working in sheltered sectors followed exactly similar trends in provinces with high and low exposure to posting before and after the posting shock. The absence of pre-trends is again reassuring, and suggests that provinces with low and high pre-2004 use of posting services are also comparable in terms of sheltered employment evolution before the shock. Re-estimating Equation (3), I find no statistically significant differential evolution of employment in sheltered industries following the liberalization. The large and permanent import shock in services was not followed by significant reallocation of workers to sheltered sectors within affected local labor markets.

The top panel of Table 4, column (1), summarizes the baseline estimates of the difference-in-differences model. Each coefficient is from a separate regression. The share of working age population employed in exposed sectors decreases differentially by 5.7% after 2004 in local labor markets exposed to the shock. The absolute number of jobs in exposed sectors decreases differentially by 6.8%, indicating that the employment effects are not driven by differential changes in working age population across provinces. As employment in sheltered in sectors does not experience a change in trends after the reform, total employment in exposed local labor markets decreases after the liberalization. As a result, unemployment increases by 5.1% in exposed provinces compared to local labor markets less exposed to the supply shock. The shock in posting service supply of 2004 thus had long-lasting effects, leading to permanently higher unemploy-

ment in exposed local labor markets. Other columns of Table 4, Panel A, repeats the baseline estimates with alternative specifications and selection of treatment and control groups. That the estimated coefficient is similar in magnitude across different specifications underscores the stability of the statistical relationships. The results are robust to using alternative pre-reform exposure measures, such as 2000 employment shares (column (2)), geographic distance to NMS (column (3)), region-level exposure (column (4)), or applying the leave-out correction to the baseline measure (column (5)).

The bottom panel of Table 4 finally confirms that higher exposure to the liberalization shock is systematically associated with a differential decrease in exposed domestic employment. The OLS estimated coefficient from Equation (4) is -0.028 (0.002), while employment responses to posting exposure instrumented by pre-shock posting exposure range from -.07(.02) to -.11(.03). The OLS coefficient appears to be biased upward due to unobserved demand shocks. Across all specifications, and consistent with the difference-in-differences results, higher exposure to the supply-driven component of posting inflows after 2004 is associated with lower employment growth in exposed sectors between 2003 and 2015. As in the difference-in-differences estimation, the effects of increased posting competition on domestic workers are substantial. The baseline employment elasticity means that a 10% higher posting exposure after the reform is associated with a c. 1.1 percentage point decrease in exposed employment growth over the 2003-2015 period. The estimated employment elasticities are unchanged when measuring growth of employment in levels or share of working age population, excluding industrial services that could be affected by other trade shocks (column (11)), or using alternative instruments for post-2004 exposure to posting (column (12)). To summarize, the liberalization of the posting policy causally decreased French employment in exposed sectors, leading total employment to stay permanently lower in local labor markets affected by the import shock.

4.2 Receiving-Firm Level Mechanisms Driving Market-Level Employment Effects

I explain the market-level displacement effects generated by the posting policy by two main mechanisms: posted workers are substitutes for domestic workers at receiving firms, and they are cheaper.

4.2.1 Receiving-Firm Technology: Substitutability Between Posted and Domestic Workers

Are posted workers substitutes or complements for domestic workers? Receiving firms could replace their own workers with posted workers, leading to negative employment effects at firms that purchase posting services. They could also simultaneously increase posted and domestic employment, for instance, if this novel source of labor allows them to be more competitive and gain market shares at the expense of their domestic competitors. In that case, one could observe a positive association between using posting services

and employing domestic workers at the receiving firm, while aggregate employment could still decrease at the exposed industry level. I exploit the granularity of receiving firm data to leverage variations in posting exposure at the extensive margin and explore potential substitution or complementarity between domestic and posted workers.

I use Belgium as the main laboratory for this analysis because Belgian granular data on received posting flows have the largest time span (nine years), allowing me to exploit a large set of receiving-firm-level variations in posting exposure. Belgium is one of the top importers of posting services (third country) and shares many characteristics with most of receiving countries: it is a high-wage country with relatively high labor market regulations and uses posting services to offshore mostly manual non-tradable services. I use the LIMOSA registry on the universe of posting missions purchased by Belgian firms from 2010 to 2019, which I merge with exhaustive administrative panel on Belgian firms' domestic employment. This unique dataset allows me to identify the 17,796 unique Belgian firms that used posted workers between 2010 and 2019 and to track their employment of domestic workers over the same period.

The main identification strategy asks what happens to domestic workers when their employer starts to offshore services "on site" through posting services. I thus leverage variations in posting exposure at the *extensive margin* by focusing on firms that start purchasing posting services. More specifically, I narrow down the analysis to the 11,796 firms that purchase posting services for the first time between 2014 and 2019. This sample restriction lets me select firms that never used posted workers from 2010 to 2014 so that I can precisely measure a shift from non-using to using status. I use an event study design to estimate the differential evolution of domestic employment at Belgian receiving firms before and after they first get connected to a foreign supplier of non-tradable services. More precisely, I estimate the following specification:

$$y_{it} = \alpha_i + \lambda_{st} + \sum_{k=\underline{T}}^{\bar{T}} D_{it}^k \gamma_k + \varepsilon_{it}, \quad (5)$$

where y_{it} is an outcome variable for firm i (in log) in calendar year t and α_i is a firm fixed effect. λ_{sz} are three-digit sector \times calendar year fixed effects. The event time dummies D_{it}^k are defined as $D_{it}^k = \mathbb{1}.[t = d_i + k] \forall k \in (\underline{T}, \bar{T})$, $D_{it}^{\underline{T}} = \mathbb{1}.[t \leq d_i + \underline{T}]$, and $D_{it}^{\bar{T}} = \mathbb{1}.[t \geq d_i + \bar{T}]$, where $\mathbb{1}$ is the indicator function and d_i is the first year when firm i starts using posting workers. I normalize $\theta_{-1} = 0$ and set $\underline{T} = -5$ and $\bar{T} = +5$, and I cluster standard errors at the province \times event time level to account for spatial correlation in error terms, as in [Alfaro-Ureña, Manelici, and Vasquez \[2019\]](#). The binning of event time coefficients at the ends of the event window allows me to introduce both year and firm fixed effects to circumvent the issues related to event studies in the absence of a pure control group, following the recent econometric literature on event studies ([Borusyak and Jaravel \[2017\]](#), [Schmidheiny and Siegloch \[2019\]](#)).

The sequence of coefficients γ_k describes the dynamic of receiving firms' outcomes around the event of first services being offshored to posted workers. By exclusively comparing firms that will use posted workers at some point between 2014 and 2019, the event study design rules out any selection issue related to the "importer premium."³⁹ Estimated γ_k compare the outcomes of receiving firms in event year k to the outcomes of future posting firms in the same narrowly defined sector in the year before their offshoring event. I estimate Equation (5) with both OLS two-way fixed effects and an alternative estimator that accounts for heterogeneous treatment effects and negative weighting in event-study designs developed by [Borusyak and Jaravel \[2017\]](#).

A firm's decision to purchase posting services is endogenous and plausibly correlated with time-varying unobserved shocks that are likely to also affect its domestic employment. Demand shocks experienced by the Belgian firm are particularly likely to be correlated with both decisions to hire posted workers and domestic workers. In that case, the OLS estimates of γ_k are biased upward and underestimate potential substitution between domestic and posted workers. The inspection of pre-trends will first allow me to check whether receiving firms self-select into purchasing posting services based on past domestic employment evolution. Any differential evolution will be suggestive of spurious correlation between extensive margin change in posting exposure and domestic employment evolution. I then exploit additional variations in posting exposure at the receiving firm level to make progress on the causal interpretation of the estimates.

[Figure 8](#), Panel A displays the estimates of γ_k and their 95% confidence intervals using log firm total domestic employment as the main outcome. I find that employment of Belgian workers decreases at Belgian firms that start sourcing services to posted workers. Domestic employment decreases by 2% the year firms start subcontracting services to posted workers, compared to firms in the same three-digit sector that are yet to use posting services that same year. This negative employment effect corresponds, on average, to two less domestic jobs at receiving firms for an average subcontracting of six posted worker jobs at receiving firms that year. The response of employment is amplified over time, with a 17% decrease in domestic employment four years after the first on-site offshoring event. This result suggests domestic firms substitute domestic with posted workers once they get connected to a foreign services supplier. I find no evidence of significant pre-trends. Domestic employment in firms that use and are yet to use posted workers evolve similarly before the event, conditional on firm and three-digit sector \times year fixed effects. This restricts the scope of endogeneity sources: any confounding shocks should occur simultaneously to the first purchase of the posting services event. The results are unchanged when estimating the event study model with the [Borusyak and Jaravel \[2017\]](#) estimator that corrects for negative weighting issues ([Figure A.18](#)).

³⁹Firms that use posting services tend to be larger and pay higher wages compared to firms that do not.

Do receiving firms scale-up when starting to offshore services, or do they substitute domestic for posted workers, keeping their overall activity constant? I find that receiving firms grow in terms of *overall* size once they start using posted workers, relative to their employment level in pre-event year, but this effect gradually fades-away. Figure 8, Panel B shows that total employment at receiving firms, including posted workers, increases by almost 50% after the first on-site offshoring event. However, as domestic workers get progressively displaced, the overall size of receiving firms gradually gets closer to its pre-event level. Four years after first posting use, overall employment at receiving firms is only 7% higher relative to the pre-event level, while domestic employment has decreased by 17%. Employment responses at receiving firms seem to progressively converge to full displacement of employment from domestic to posted workers.

If Belgian firms decrease domestic employment when starting to rely on posted workers, how are the wages of remaining workers affected? Figure A.16, Panel A shows the event study estimates using log average wage paid at receiving firms. There is no evidence that firms that start purchasing posting services change their domestic pay policy, suggesting that when gaining access to alternative workers, receiving firms adjust their domestic payroll through employment rather than wages, which is consistent with the presence of downward rigidities on domestic workers wages.

While Figure 8 shows striking evidence of domestic employment losses triggered by a change in posting exposure at the extensive margin, these displacement effects could be caused by unobserved shocks affecting receiving firms the year they start posting workers abroad. To make progress on this issue, I start by leveraging additional variation in posting exposure within and across firms. I first investigate whether workers who are more or less substitutable with posted workers experience similar employment losses following a posting exposure event. Posted workers are mostly blue collar and are therefore more likely to be substitutes for domestic blue collar workers. While all workers at a receiving firm should be affected by firm-level shocks, only blue collar workers should be replaced by posted workers. If the overall employment responses displayed in Figure 8, Panel A reflect the effects of a firm-level shock rather than posting use, we should, however, detect strong employment responses of non-blue collar employment around the posting event.

Figure A.12 shows that the domestic employment responses to posting exposure are driven by a decrease in receiving firms' blue collar employment. In contrast, I do not find evidence of any statistically significant differential evolution of non-blue collar workers after their employer starts purchasing posting services. This suggests that the overall displacement effects experienced by domestic workers at receiving firms are driven by substitution between domestic and posted blue collar workers rather than by simultaneous firm-level shocks that would also affect white collar employment at these firms. As a result, aggregate domestic blue collar employment at Belgian firms offshoring services to posted workers has

decreased substantially over the past 10 years. Figure A.15 shows that the share of blue collar workers at Belgian firms using posting services at least once between 2010 and 2019 started to decrease in 2010, decreasing from 58% to 54% between 2009 and 2019. At the same time, posting exposure increased dramatically: the share of posted workers in total workers hired at firms purchasing posting services once during the period increased from 5% to 16% between 2010 and 2019.

One other source of heterogeneity regarding the intensity of exposure to posting across workers lies in the proximity between the offshored service and the type of job performed by domestic workers. Two Belgian firms offshoring a construction service to a foreign firm may be affected by similar unobserved demand shocks or other factors correlated with the decision to use a foreign service. However, only receiving firms also operating in the construction industry should substitute their own workers with posted workers. I show in Figure A.17 that the domestic employment losses at receiving firms are driven by firms that offshore tasks close to their own activity. While construction firms decrease their domestic workforce once they start using construction work performed by posted workers, manufacturing firms do not significantly change their domestic employment after they start offshoring construction services to posting firms. This confirms that the estimated displacement effects at receiving are plausibly driven by substitution between domestic and posted workers rather than other simultaneous shocks.

4.2.2 Receiving-Firm Inputs Cost: Wages of Posted and Domestic Workers

Did the posting policy allow receiving firms to access cheaper inputs when substituting posted for domestic workers? While it is usually impossible to observe prices of domestic and foreign inputs at offshoring firms, my datasets allow me to compare posted and domestic workers' wages at the same workplace. I take advantage of unique matched employer-employee data on the universe of job spells in France for 2017-208 (DADS) that I match with the universe of posting contracts for the same period (DPD/SIPSI dataset).⁴⁰ I use the French-level data, rather than the Belgian receiving-firm-level data, because only the French data have information on wages paid to posted workers. I start from the universe of posting missions declared to the French authorities in 2017 and 2018 to track back the 19,138 French clients that have purchased a posting service at some point in that period and appear in the linked employer-employee dataset.⁴¹

Standard cost-saving theories would advocate that firms using posted workers are also firms that have higher domestic wage premia, as is the case for standard outsourcing ([Bilal and Lhuillier \[2020\]](#)). To test

⁴⁰The dataset is described in detail in Appendix H. I merge the DADS (matched employer-employee dataset on all job spells in France) with the SIPSI dataset that records all posting missions performed in France with information on the using French firm ID (SIREN). Since DADS allows me to follow individuals only from one year to the next, the analysis focuses on postings in 2017 and 2018.

⁴¹There are 23,332 unique French firms with a national identifier number (SIREN) that can be identified as purchasing posting services in 2017 and 2018. Of these firms, 19,138 have at least one employment spell in the linked employer-employee dataset DADS that records all job spells in France.

this hypothesis, I first estimate the importer wage premium in Table A.8: firms that offshore services “on site” pay domestic wages that are, on average, 20% higher than firms that do not use posting services in the same five-digit sector.⁴² This importer premium could, however, reflect firms’ selection into on-site offshoring rather than true differences in pay policies at receiving firms. To better understand whether pay policies differ between firms that use or do not use posting services, I estimate the firm-level wage premium based on the workhorse [Abowd et al. \[1999\]](#) (henceforth AKM) model. Formally, I estimate the following specification on the universe of domestic job spells:

$$\ln w_{it} = \alpha_i + \psi_{J_i,t} + \beta X_{it} + \epsilon_{it}, \quad (6)$$

where α_i are worker fixed effects, $\psi_{J_i,t}$ are J workplace effects, and X_{it} are worker characteristics (cubic age and number of hours worked). I estimate Equation (6) using the methodology developed by [Correia \[2017\]](#) and cluster standard errors at the worker level.⁴³ The wage changes of domestic workers moving between different workplaces identify the fixed effects in a connected set. I plot in Figure 9, Panel A the distribution of firms fixed effects separately for receiving and never-receiving firms. Pay policies at receiving firms are shifted upward, indicating firms that pay high-wage premia to their domestic workers tend to use more “on-site” foreign services, consistent with the hypothesis that high-wage firms are more likely to use posting services to save on high-wage premia. The mean receiving firm wage premium is 0.18 relative to the mean wage premium of non-receiving firms normalized to zero.

If the use of posting services is explained by cost-saving motives, receiving firms may be able to pay these workers at lower wages than their in-house workers due to lower rent-sharing associated with alternative work arrangements ([Katz and Krueger \[2019\]](#)). I then turn to the second hypothesis: workers hired through posting arrangements are cheaper than domestic workers. I begin by estimating the raw wage penalty associated with posting arrangements in the sample of receiving firms based on the following specification:

$$\ln w_{it} = \rho \times \text{Posting}_{it} + \psi_{J_i,t} + \beta X_{it} + \epsilon_{it}. \quad (7)$$

⁴²Following [Bernard et al. \[2007\]](#) for importers, I regress firms’ outcomes on a dummy equal to one if this firm is using a posting service that year, controlling for industry and province fixed effects. Compared to companies that do not use posted workers, firms sourcing their services on site through posting are larger in terms of sales and employment. They also exhibit more capital per worker and are more profitable. These findings are in line with [Bernard et al. \[2007\]](#), [Fort \[2017\]](#) or [Antras, Fort, and Tintelnot \[2017\]](#), who report that US importers exhibit a size premium. Reproducing their analyses for non-tradable imports in France, I show in Figure A.19 that the size premium of receiving firms increases with the number of countries from which a firm sources its posting services. This suggests that as for standard importing, “on-site offshoring” is constrained by important country-level fixed costs of sourcing that limit the ability of small firms to source posting services from a large number of countries.

⁴³Due to computational issues, I select a random sample of 20% of firms that are never observed as purchasing posting services between 2017 and 2020. I then run the AKM specification on the connected set of employees who worked at some point for a receiving firm or non-receiving firm included in the random sample.

Equation (7) allows me to compare wages of domestic and posted workers who perform work at the same firm. As posted workers do not transition from posting to regular work arrangements, it is not possible to separately identify the posting fixed effect when including a worker fixed effect. However, I control for work duration, age, and age squared to partially absorb potential differences in work arrangements. The results reported in Table 6 show that workers with similar age and work duration at the same workplace are paid 30% less when hired through a posting contract compared to a standard domestic contract. I take advantage of my unique dataset to further compare the wage penalty linked to foreign versus domestic alternative work arrangements. For this purpose, I augment Equation (7) with an additional indicator variable equal to one if the employee works at the receiving firm through a (domestic) temporary agency contract.⁴⁴ Estimates displayed in the last column of Table 6 show that both domestic and foreign outsourced workers face a significant wage penalty compared to incumbent domestic workers, but the wage penalty is *twice* larger for posted workers.⁴⁵ This suggests that foreign services suppliers are located even further at the bottom of the wage ladder compared to domestic contractors. To take into account permanent characteristics of workers, I follow [Drenik, Jäger, Plotkin, and Schoefer \[2020\]](#) and estimate a modified AKM model with separate workplace effects by work arrangements for the sample of receiving firms based on

$$\ln w_{it} = \alpha_i + \psi_{J_i,t}^{P_i} + \beta X_{it} + \epsilon_{it}, \quad (8)$$

where $\psi_{J_i,t}^{P_i}$ are work arrangement-specific firm fixed effects with P_i equal P if worker i has a posting contract and equals R if worker i is a incumbent domestic worker, and J_i,t is the workplace. I control for age and age squared as well as the number of hours worked. The fixed effects are identified by worker wages changes when moving between different workplaces but are now allowed to differ across work arrangements.⁴⁶ I plot the distribution of workplace effects for posted and domestic workers in Panel B of Figure 9 in the sample of receiving firms. Workplace effects for posted workers are shifted downward compared to domestic workers. The mean wage premium for posted workers is -0.43 relative to the mean of work-

⁴⁴The DADS dataset allows me to link employees hired at temporary employment agencies to the firm where the work mission is effectively performed since 2018. I use this information to observe, for a given firm purchasing posting services: (i) wages of incumbent domestic employees, (ii) wages of domestic outsourced workers (whose permanent employer is the temporary employment agency), and (iii) wages of posted workers (whose permanent employers are the foreign services suppliers).

⁴⁵Interestingly, the wage penalty estimated for domestic outsourced workers in my French dataset is very close to what has been estimated by the literature relying on similar specifications: [Drenik, Jäger, Plotkin, and Schoefer \[2020\]](#) estimate a wage penalty of -0.140 for outsourced workers in Argentina.

⁴⁶As there are no worker movement in and out of posting work arrangements, the fixed effects are therefore not identified through changes across the type of contracts for the same worker, but rather changes of workplace within the same type of work arrangement (posting or domestic employment). I estimate Equation (8) on the set of firms that are observed at least once as purchasing posting services between 2017 and 2019. Recall that posted workers cannot move across workplaces that are not using posting services, as posted workers are never observed as domestic workers.

place effects of workers normalized to zero.⁴⁷ Receiving firms thus pay lower wage premia (accounting for workers permanent characteristics) to posted workers.

The lower wage premia for posted workers compared to domestic workers is likely to reflect the degree of rent-sharing and pay differentiation for posted versus domestic workers. To finally shed light on rent-sharing between receiving firms and posted workers, I compare successively raw wages and wage premia for domestic and posted workers *at the same workplace*. The correlation between the two should mirror the amount of rent-sharing between receiving firms and posted workers: the lower this parameter, the less posted workers' pay premia are related to domestic pay policies. I start by plotting in Panel A of Figure 10 the binned scatter plot of the log average wage of posted versus incumbent domestic workers at the same workplace (red dots), absorbing five-digit sector fixed effects.⁴⁸ The figure shows a moderate and positive relationship between posted workers and incumbent domestic workers (log) wages at the same workplace, with an estimated slope of 0.21 (0.01). This means that firms that pay their domestic workers at higher wages also pay posted workers slightly higher wages, but the elasticity is small. To verify whether this effect is driven by tenure differences between posted and incumbent workers, I repeat the analysis looking at the relationship between incumbent domestic workers and newly hired domestic workers at the receiving firm (blue dots). I find that there is a much stronger relationship between newly hired workers and incumbent workers when they are hired through regular rather than posting arrangements (0.65 versus 0.21 slope).⁴⁹ I confirm this finding by estimating the elasticity of estimated premia received by posted workers (ψ_J^P) and domestic workers (ψ_J^R), following Card, Cardoso, and Kline [2016] and Drenik et al. [2020]:

$$\psi_J^P = \alpha + \rho\psi_J^R + u_J. \quad (9)$$

Panel B of Figure 10 shows the binned relationship between domestic and posted workers workplace effects.⁵⁰ The estimate of ρ is 0.11 (0.01), meaning that the pass-through of the firm-level wage premium to posted workers is essentially nil. Posted workers do not share firm's rent compared to domestic workers employed at the same workplace, suggesting receiving firms can cut labor costs by relying on on-site

⁴⁷ As what has been estimated for domestic outsourcing by Drenik, Jäger, Plotkin, and Schoefer [2020], the dispersion of wage premia is similar across work arrangements: I estimate a raw standard deviation of 0.37 for the posted worker wage premium and 0.32 for the domestic worker wage premium.

⁴⁸ Panel B of Figure A.27 presents the same correlational plot without adjusting for sectors effects.

⁴⁹ I further show in Panel A of Figure A.27 that the slope between the incumbent and domestic outsourced worker wage is higher than the one between incumbent and posted workers (0.27 versus 0.21).

⁵⁰ As noted by Card et al. [2016] and Drenik et al. [2020], a normalization of workplace effects is necessary to interpret the elasticity as the amount of workplace premia earned by domestic workers that posted workers receive at higher paying firms. I thus follow Drenik et al. [2020] and normalize workplace effects to zero in the lowest decile for each type of work contract. The normalization does not affect the estimate of ρ .

offshoring.⁵¹

5 Mobile Services Export Surplus in Sending Countries

The past section provided evidence that cross-border provision of services is associated with displacement of domestic workers in receiving labor markets. What are the counterparts of this redistribution of market shares in services for sending countries? In this section, I document the export-mobility gains created by the posting policy in sending (mostly low wage) countries. I first estimate the gains from the posting policy at the industry-level. I then focus on sending-firms scale-up once they access foreign markets through cross-border provision of services.

5.1 Industry-Level Expansion After the Posting Policy Liberalization

To shed light on economic gains created by the posting policy for sending countries, I focus on the service trade liberalization in Poland, that provides the most striking example of the European “*posting success story*”. Poland became the first supplier of posting services in Europe in 2004. Postings from Poland increased rapidly right after the end of posting restrictions in 2004, to reach an average level of 250,000 postings per year, leading the country to account for 20% of overall posting outflows while accounting for 7% of the overall European active population (Figure A.28, Panel A).

To study the effects of the 2004 export opportunity shock, I compare employment in non-tradable sectors affected and unaffected by the liberalization, before and after the 2004 accession, in Poland versus a comparable neighboring country that did not benefit from the liberalization. I use health and public sectors as controls as these are covered by licensing regulations that limit posting services provision in these sectors. To avoid picking up effects driven by simultaneous standard trade openness, I focus on construction as the only “pure” non-tradable sector treated by the liberalization reform.⁵² Panel B of Figure A.28 shows that 50% of postings from Poland occur in the construction sector, while postings in health or public administration are almost 0%.

I use Ukraine as an additional control group. Ukraine shares a border with Poland and is of similar size,

⁵¹Pay-premium sharing between receiving firms and posted workers appears to be very moderate, particularly in comparison with what has been found for domestic outsourced workers. For comparison, Drenik, Jäger, Plotkin, and Schoefer [2020] compare workplace effects of temporary agency workers and regular workers in Argentina and find a slope of 0.49(0.007) indicating rent-sharing between receiving firms and workers in alternative work arrangements is five times lower for posting than domestic outsourcing. Many qualitative studies have shown that posted workers tend to have very low bargaining power: they are not covered by most receiving firms’ work agreements, do not benefit from union representation in the receiving country, have low level of information about domestic workers due to language barriers, and have few direct interactions with receiving firms and domestic workers.

⁵²Trade tariffs were, however, abolished gradually between 1990 and 2004 in prevision of Poland accession in 2004. For instance, the trade of industrial goods with the EU-15 was almost completely liberalized in 1999 under the provisions of the Europe Agreements.

but it was not included in the first and second European enlargements: unlike Poland, the country did not gain the right to supply mobile services in 2004. Geographical and economic factors that could affect sectoral employment besides EU accession should therefore be similar in the two countries.⁵³ Ultimately, using Ukraine as a placebo hinges on the assumption that determinants of EU accession are not correlated with the *differential* evolution of postable and non-postable sectors, which seems plausible.

Panel A of Figure 14 shows the evolution of domestic employment in exposed and unexposed sectors, before and after suppliers in the treated sector gained the right to supply services abroad through posting. Before 2004, treated and control sectors experienced very similar employment trends. Domestic employment in the Polish construction sector started to boom right after the liberalization, with an increase of more than 600,000 workers between 2004 and 2007. Employment in the sector treated by the reform stayed permanently high relative to its pre-2004 level and relative to the evolution observed for control sectors in the same country. Panel B of Figure 14 shows that in the placebo country, employment trends in exposed versus sheltered sectors did not diverge in 2004, suggesting the effect detected in Poland is caused by the liberalization shock rather than sectoral-specific trends common to Ukraine and Poland. The triple differences estimates suggest that non-tradable employment in the sending country increased by 17% in the exposed sector after on-site offshoring was liberalized.

5.2 Sending-Firm-Level Mobile Services Export Gains

Figure 14 provides motivating evidence that the trade liberalization in services triggers substantial gains in sending countries' non-tradable sectors. To better characterize gains from trade in non-tradables, I leverage granular data on firms exporting posting services within the EU.

The main dataset for the analysis is an administrative tax dataset covering the universe of non-financial corporations established in Portugal merged with exhaustive information on provision of services abroad by Portuguese firms over the period 2006-2017. Portugal provides an ideal laboratory to study non-tradable service trade because it is a low-wage country, relatively well endowed in labor, and is the top exporter of posting services in main receiving countries such as France and Belgium. To identify posting flows, I use the methodology of central banks and identify five-digit sector codes where cross-border supply of services can only be provided through mobility of workers abroad.⁵⁴

I start from the universe of Portuguese firms in "non-tradable" sectors for which I can observe all ser-

⁵³Of course, differences in EU accession are partially determined by differences in countries' development and openness, which may in turn affect employment dynamics. However, the level of development in Ukraine was sufficient over the period to lead to an EU association agreement, which was later unexpectedly canceled due to the election of a pro-Russian leader.

⁵⁴The analysis is thus restricted to non-tradable sectors that can only export their services through mobile workers, listed in Figure ???. The dataset and methodology are described in detail in the Appendix G.

vices provided abroad reported by each firm to the tax administration for the period 2006-2017.⁵⁵ Of these firms, I use the exhaustive information on provision of services to an EU country to identify the 4,151 firms that started posting workers to another member state between 2010 and 2015.⁵⁶ The average (and median) posting firm is small, employing a mean of 16 (7) workers in 2009 and operating in the construction of residential buildings (39%), road transportation (19%), electrical installation (5.2%), temporary employment provision (2.5%), and plumbing installation (2.4%). The posting export represents an average (median) of 40% (22%) of the posting firms' turnover in the first year when they start posting abroad (Figure A.34).

5.2.1 Identification Strategy

To uncover the effects triggered by posting in sending firms, I use an event study framework that investigates the effects for suppliers to provide their non-tradable services abroad for the first time.⁵⁷ Between 2010 and 2015, 4,151 events occur in Portugal among the 27 sectors in which non-tradable services exports can be identified in my administrative tax dataset. The empirical specification is

$$y_{it} = \alpha_i + \lambda_{sptz} + \sum_{k=\underline{T}}^{\bar{T}} D_{it}^k \theta_k + \varepsilon_{it}, \quad (10)$$

where y_{it} is an outcome variable (in log) for firm i in calendar year t and α_i is a firm fixed effect. λ_{sptz} are five-digit sector \times district \times calendar year fixed effects. The event time dummies D_{it}^k are defined as $D_{it}^k = \mathbb{1}.[t = d_i + k] \forall k \in (\underline{T}, \bar{T})$, $D_{it}^{\underline{T}} = \mathbb{1}.[t \leq d_i + \underline{T}]$, and $D_{it}^{\bar{T}} = \mathbb{1}.[t \geq d_i + \bar{T}]$, where $\mathbb{1}$ is the indicator function and d_i is the first year when firm i starts posting workers abroad. I normalize $\theta_{-1} = 0$ and set $\underline{T} = -5$ and $\bar{T} = +5$. I cluster standard errors at the province \times event time level to account for spatial correlation in error terms as in [Alfaro-Ureña et al. \[2019\]](#).

The sequence of coefficients θ_k describes the dynamic of firms' outcomes around the event of the first service performed abroad. By comparing exclusively firms that export their services at some point between 2010 and 2015, the event study design conveniently rules out any selection issue related to the "exporter premium."⁵⁸ Formally, estimated θ_k compare the outcomes of posting firms in event year k to the outcomes

⁵⁵I focus on those who have at least a median of three workers across all years of activities. I also drop a minor number of firms that performed services in a country outside the EU, as these services provisions are not covered by the European posting regulation but by the restricted posting policy for non-EU member states.

⁵⁶I restrict the treatment definition to firms that start providing services abroad for the first time in 2010 such that I can observe treated firms at least four years before the event and two years after. This allows me to define correctly their first "export event time" and to verify that firms that export services in 2010 were effectively not posting workers from 2006 to 2010. I further follow [Alfaro-Ureña et al. \[2019\]](#) by focusing only on firms with a median of three employees over the period. Appendix G provides descriptive statistics on all posting firms as well as an estimation sample coverage.

⁵⁷In spirit the exercise is similar to studies that investigate the effects of exporting or joining a global value chains on firms' performances such as [Alfaro-Ureña, Manelici, and Vasquez \[2019\]](#).

⁵⁸Table A.5 shows the exporter premium and reports differences between firms that export or do not export non-tradable services. Following what has been found in the literature, exporting firms tend to be systematically different from non-exporting firms. The exporter premium is, however, lower in non-tradable services than in standard manufacturing, suggesting lower entry

of future posting firms in the same narrowly defined sector and province in the year before their event. As in Equation (5), the binning of event time coefficients at the ends of the event window allows me to introduce both year and firm fixed effects ([Borusyak and Jaravel \[2017\]](#), [Schmidheiny and Siegloch \[2019\]](#)).

The main question addressed by my event study design is how services suppliers outcomes would evolve in the absence of the export opportunity opened by the posting policy. My identification strategy relies on the assumption that firms that will post workers in the future form a credible counterfactual for firms that start posting workers after accounting for time-invariant differences between firms and common sector-district-year shocks. Interpreting the sequence of estimated θ_k as the causal effects of the mobility-related export opportunity requires that firms do not select into posting based on firm-specific shocks that would be correlated with firms' outcomes *in the absence of the posting policy*. What matters for identification is not that the timing of posting is random but rather the observed changes in posting firms' outcomes after the event require that firms have the ability to use posting mobility to access foreign markets. The counterfactual I am interested in is not what would happen to exporters if they had not chosen to take up the posting opportunity but instead what would happen to exporters in a world where they are constrained to provide services solely in the domestic market (no posting mobility). The only threat to identification lies in firm-specific shocks that (i) affect the timing of posting of workers, (ii) affect firms' outcomes after the event of first services exports, (iii) do not affect firms' outcomes before the event, and (iv) would affect firms' outcomes after the event even in the absence of the service export opportunity.⁵⁹

Ultimately, it is difficult to identify these unobserved factors without additional data on firm-specific shocks. The results from the event studies regressions will allow me to evaluate whether the timing of first posting is driven by the past differential evolution of outcomes between the treated and the control group. Focusing on non-tradable sectors further restricts potential unobserved shocks caused by automation or innovation events that could affect firms' performances in domestic markets even in the absence of exporting opportunities. To gauge whether firm-level shocks simultaneous to the posting event affect firms' activity at home, in Section 5.1.2 I investigate what happens to a firm's domestic sales when it starts providing services abroad. In Section 5.1.3, I then exploit differences in posting missions across treated firms to show that the posting export event is the prime driver of the estimated θ_k . Finally, in Section 5.1.4 I compare

costs into exporting in service trade.

⁵⁹If a services supplier experiences a productivity shock in a given year, and if this productivity shock leads the firms to post workers this given year and this productivity shock would boost firms' activity even without the possibility of providing services abroad, then the interpretation of θ_k as the effects of the posting opportunity are biased. If a services supplier starts posting workers abroad because of an information shock or a demand shock from a foreign customer, the identifying assumption is not violated. Similarly, if a services supplier innovates in a given year, and if this innovation allows this firm to provide services abroad but would not affect firms' sales at home in the absence of the posting opportunity, the estimated coefficients can still be interpreted as the gains created by the posting opportunity for firms.

posting firms' outcomes to those of similar firms operating in sectors shielded from posting opportunities.

5.2.2 Baseline Results on Sending-Firms Scale

In a world where companies are allowed to provide services abroad through posted workers, how much do they gain in doing so? Figure 11 plots the event study coefficients estimates for firms' total employment, turnover, assets, total hours worked, cash deposit, and wage bill, with corresponding estimates displayed in Table 7. The results show that providing non-tradable services abroad is associated with a large and permanent expansion of services supplier activity. The second year after the first posting export, total employment in sending firms increases by 30%, turnover and hours of work increase by 56%, and total wage bill increases by 72%, compared to firms that have not yet posted workers that year. The increase in sending firms' sales triggered by the mobile services export opportunity is not purely driven by a price effect, as services suppliers significantly scale up their use of labor inputs. In addition to increasing total hours of work, sending firms also grow at the extensive margin and hire significantly more employees. I find no evidence of selection into posting based on past firm growth in terms of economic activity, suggesting the timing of the first posting is not correlated with past differential evolution in outcomes across firms. It is only after sending firms start providing non-tradable services abroad that they experience strong growth.

To prove that posting is driving these gains, rather than unobserved firm-level shocks, I exploit heterogeneities in duration of posting missions across firms. I run Equation (10) separately for each of treatment duration groups in order to show heterogeneities in export gains depending on posting take-up duration.⁶⁰ Figure 12 shows that firm-level scale-up effects are simultaneous to the posting mission but do not last after the firm stops providing services abroad. For firms that post workers for three years consecutively, wage rates, profits, and employment start to significantly increase the year of the event relative to the pre-posting event but return to their pre-posting level in fourth year, e.g., when the posting mission ends. By contrast, the treatment effects are larger and last for firms that keep posting workers abroad permanently after their first non-tradable export. Figure 12 shows clear evidence that the posting opportunity is driving the large changes in firm-level outcomes, rather than other shocks.

5.2.3 Distribution of Posting Gains: Capitalists, Workers and Government

How is this increase in firms' activity triggered by the mobile services export opportunity shared between workers, firms and government in sending countries? I plot in Figure A.30 social security contributions and

⁶⁰I divide my baseline group of treated firms into five groups: firms that are only posting during one year, firms posting for two consecutive years, firms posting for three consecutive years, firms posting for four consecutive years, and firms that keep posting workers for the entire period of observation after their first posting. Table G.13 describes the distribution of first posting events and their duration over time.

income taxes paid by sending firms around the event of the first services export. As sending firms' expand their wage bill after posting, social security contributions paid by sending companies start to increase right after they start supplying non-tradable services abroad. Sending firms also increase their corporate income tax payments once they start providing services abroad. These results emphasize the radically different fiscal implications of trade-related mobility compared to standard migration: while emigration leads to tax losses, posted workers generate additional (substantial) tax revenues for sending governments.

I then investigate the effects of non-tradables exports on sending firms' profit and wages. Panel A of Figure 13 plots the event study coefficients with 95% confidence intervals for firms' hourly wage rates estimated from Equation (10) on the restricted sample of treated firms, with corresponding estimates displayed in Table 8. Wages of workers in firms that have yet to post workers evolve similarly before the event. The wage rate in sending firms starts to increase the year of the first posting provision compared to firms that do not yet export non-tradables this year and are in the same five-digit sector and province. Wage rate increases by 14% in treated firms two years after they start providing services abroad relative to the pre-posting year and relative to wages in firms that do not post workers yet. The increase in posting firms' hourly wages is persistent, stable, and statistically significant at the 1% level for the five-plus years after the event. Panel B of Figure 13 shows similar estimates for sending firms' profits. Firms that post workers and firms that are yet to post workers thus face similar profits evolution before the event, while earnings of sending firms compared to control firms increase by 9% the year of the first posting. Profits then increase by 37% in treated firms two years after they start providing services abroad relative to the pre-posting year and to profits in firms that do not post workers yet. These results outline that capital owners derive profit gains from non-tradable services exports that are twice larger than wage gains redistributed to employees. It is even clearer focusing on the sample of permanent exporters of posting services, limiting noise in the measure of sending firms' profits. figure A.13 shows the large differences in wages and profits gains split at sending firms.

The Role of the Posting Policy in Explaining Posted Workers' Wage Gains Are posted workers' wage gains explained by the service trade policy? Posted workers cannot be paid under the destination-level minimum legal wage, forcing sending firms to pay an additional posting allowance to their workers in some cases. I provide suggestive evidence of this mechanism in two successive steps.

While the firm-level data do not contain information on destination countries linked to each posting mission, I observe the decomposition of aggregate exports of posting services from Portugal in the EU-wide dataset on bilateral posting flows. Figure A.46, panel A, shows that most of posting services supplied by Portuguese firms are performed in high-wage countries. The average destination minimum legal wage faced by Portuguese firms is much higher than the level of wages paid by these firms before the posting

mission (Figure A.46, panel B). This suggests that sending firms may indeed be constrained to pay higher wages due to posting policy. To verify this assumption, I re-estimate my baseline specification separately on the sample of sending firms with pre-posting wages below or above the average destination-level minimum wage index. Figure A.47 confirms that only firms with wages below the destination-level minimum legal wage increase their workers' wages during the posting mission. This provides suggestive evidence that wage gains are driven by the trade policy, rather than surplus-sharing.

The ideal test for this assumption requires to access similar data in a country that is not constrained by destination-level minimum wage policies. I use an additional administrative dataset on postings with heterogeneities in prevailing wage bindingness across sending countries. Luxembourg has the highest minimum legal wage in the EU,⁶¹ and therefore posting firms in Luxembourg are not constrained by the prevailing wage policy, while Portuguese firms are.⁶² I use administrative exhaustive data on posting firms in Luxembourg to repeat my baseline analysis.⁶³ If wage gains are explained by the destination-specific minimum wage rules, workers posted from Luxembourg should not benefit from wage gains when posted abroad. To ensure posting wage gains in Portugal and Luxembourg are comparable, I first show that posting firms located in Luxembourg exhibit a remarkably similar scale-up in terms of labor inputs (employment, hours of work) when they start exporting non-tradable services abroad compared to similar firms in Portugal. More specifically, I re-estimate Equation (10) for sending firms located in Luxembourg to compare these estimates with the baseline results for Portugal displayed in Figure 13. Results are displayed in Figure A.14. Remarkably, I find a strikingly similar growth in firms' employment and hours of work after that they start posting workers abroad, despite these estimates being performed in two different datasets and two different countries. I then investigate how this similar scale-up in posting firms' activity translates into potentially different posted worker wage increases in Luxembourg and Portugal. Panel C compares the evolution of (log) wage in posting companies before and after they start providing services abroad, for firms located in Portugal (red line) or Luxembourg (black line). While Portuguese employees experience a substantial increase in wages after their employer starts to provide non-tradable services abroad, employees of services suppliers based in Luxembourg do not benefit from wages increases when the posting mission starts. A similar scale-up in posting firms' activity after they start providing services abroad thus translates into important wage gains in the sending country constrained to pay a minimum allowance to its workers and no wage gains in the sending country not constrained by the destination-

⁶¹1,921 euros per month in 2015 versus 589 euros in Portugal

⁶²This is exemplified by Figure A.56, which displays the distribution of wages paid to workers posted to France by location of services suppliers. No workers posted from Luxembourg are paid at the French-level minimum wage, while almost 40% of Portuguese posted workers' exhibit a bunching at the minimum wage, suggesting that for these workers, the prevailing receiving country's minimum wage is binding.

⁶³The dataset is described in Appendix I and consists of linked employer-employee data merged with information on E101/A1 form issued by all firms in Luxembourg.

level policy. This provides support for interpreting the 10%-15% posting gains in the worker wage rate in Portugal as the result of destination-specific regulation rather than bargaining over surplus sharing between firms and workers.

5.2.4 Robustness

I run several alternative specifications to check the robustness of the baseline estimates. The estimates are robust to using an additional control group of (i) firms shielded from the opportunity to provide services abroad even through mobile workers (Figure A.40) and (ii) never-posting firms matched with posting firms on pre-event variables (Figure A.45). I follow the rule-of-thumb tests suggested by [Borusyak and Jaravel \[2017\]](#) and [Schmidheiny and Siegloch \[2019\]](#) by showing that the estimates are not drastically changed when omitting unit fixed effects or estimating the model in semi-dynamic rather than fully dynamic form (Figure 13).⁶⁴ Therefore, the estimates accounting for heterogeneous treatment effects and negative weighting using the estimator developed in [De Chaisemartin and d'Haultfoeuille \[2019\]](#) are similar (Figure A.42). To prove my results are not driven by biases due to the composition of the estimation sample, I also show that the estimates are robust to balancing the panel around the event time (Figure A.44). Finally, I run a placebo analysis by estimating Equation (10) on event times randomly assigned to my baseline estimation sample of 4,151 treated firms. Reassuringly, the estimates displayed in Figure A.43 show that no significant treatment effect of the placebo export event times can be detected

5.2.5 Magnitude and Incidence of Gains from Non-Tradable Trade for Sending Countries

To gauge the size of the gains from non-tradable trade compared to more standard globalization channel, I benchmark the posting gains with comparable estimates for manufacturing trade, repeating the baseline event study of Equation (10) on the sample of manufacturing exporters.⁶⁵ I show in Figure A.31 that manufacturing exporters experience a similar scale-up in their activity after they start exporting goods in foreign markets. The estimated gains from non-tradable services' exports are also close in magnitude to those of [Alfaro-Ureña et al. \[2019\]](#) that focus on the effects for firms to start supplying to multinationals in Costa-Rica. The posting policy generates gains in sending countries of similar magnitude than standard exports, or standard FDI, the usual focus of industrial policies in low-wage countries. Given the size of the export-mobility opportunities opened by the posting policy, countries with competitive advantage in services have large incentives to lift barriers to cross-border provision of services.

⁶⁴When the estimates are largely affected by the omission of unit fixed effects, this could also indicate that negative weighting across treatment groups can represent a significant bias.

⁶⁵Table A.5 provides descriptive statistics on manufacturing exporters and compares them to posting firms.

The incidence of these gains, however, appears to be different. Companies that benefit from these alternative trade instruments are younger, smaller, less capital intensive and pay lower wages than standard exporters (Table A.5). The redistributive implications of liberalizing cross-border provision of services may thus be different as compared to standard trade policies focused on manufacturing.

While this novel class of trade instruments benefit novel firms, the nature of these export gains is also different. Figure 12 showed that firms do not grow permanently after the posting mission ends, suggesting that firms operating in non-tradable sectors exhibit little learning by exporting, which is consistent with manual services being characterized by weaker scope for productivity gains.⁶⁶ This finding is also consistent with weaker scope for investments and technological changes in services compared to standard manufacturing sectors. While sending firms exhibit a larger stock of assets after exporting non-tradable services, this effect is driven by cash holdings rather than tangible assets due to low capital intensity of services supply (Figure A.39). The (large) estimated export surplus opened by the posting policy thus appears to be driven by increased market shares abroad rather than structural changes at the sending company.

6 Consumer Gains From the Posting Policy

The liberalization of cross-border provision of services displaced low-paid workers in receiving countries, while allowing sending-firms in low wage countries to experience substantial growth. What is the magnitude of the efficiency gains from such reallocation of market shares in services? I close the paper by turning to the consumer gains created by the liberalization in Europe, building on a standard conceptual framework for the cross-border sourcing of services.

6.1 A Model of Cross-Border Provision of Services

I use a model of service trade drawing on standard [Eaton and Kortum \[2002\]](#). I consider a world with a finite number of countries $i \in S$ and a continuum of services Ω_n that every country can produce. In this world, services can be supplied by foreign countries through the geographical mobility of workers.

6.1.1 Demand of Services

A representative consumer in country j with CES preferences consumes services:

⁶⁶I also test how TFP evolved in sending firms after they start posting workers abroad. I measure TFP assuming a standard Cobb-Douglas technology, using a simple OLS framework where sales are the dependent variable and where employment, net assets and material costs, are used as time-varying controls. To take into account potential endogeneity in input choices at the services supplier level, I also use methods proposed by [Ackerberg, Caves, and Frazer \[2015\]](#). The results in Figure A.32 show that sending firms exhibit limited TFP changes after they start posting workers abroad. These TFP changes could be further driven by changes in margins or prices when providing services abroad.

$$U_j = \left(\int_{\Omega_n} S_j(n) dn \right)^{\frac{\sigma}{\sigma-1}},$$

where Ω_n is the set of non-tradable services and $S_j(n)$ is the quantity of services n consumed by country j . The CES preference yields a Dixit-Stiglitz price index:

$$P_j = \left(\int_{\Omega_n} p_j(n)^{1-\sigma} dn \right)^{\frac{1}{1-\sigma}}. \quad (11)$$

6.1.2 Supply of Services

Services are produced by combining hours of labor with country i 's efficiency in producing services n $a_i(n)$. Unit labor costs in sending countries are wages paid to workers divided by productivity w_i/a_i . Services suppliers must pay payroll taxes τ_i . To supply services from one country i to another country j , there are mobility costs and frictions m_{ij} that resemble the standard iceberg trade cost and capture destination-level entry requirements.

Foreign services suppliers may be subject to additional destination-level rules. Prevailing wage and tax policies imply that suppliers located in some countries must top up their sending country's wage level with an additional posting allowance to post workers to country j , which is captured by the general term a_{ij} . In the current posting policy, a posting allowance tops up the sending country's wage level to reach the minimum legal wage of the receiving country. This term is zero if the receiving country does not have a minimum legal wage, if the sending country's wage level is higher than the prevailing wage, or if the service is produced at home.⁶⁷ The unit labor cost for services performed by workers posted from i to j is

$$C_{ij}(n) = \frac{w_i}{a_i(n)} (1 + \tau_i + a_{ij}) (m_{ij}) = \frac{c_{ij}}{a_i(n)}. \quad (12)$$

There is perfect competition across service suppliers. Each service is purchased from the country that offers the service at the lowest unit labor cost, including posting bilateral cost. Using the assumption of Fréchet distributed productivity such as $F_i(a) = \exp\left\{-(T_i a)^{-\theta}\right\}$, I can derive for each service n the probability that i provides the lowest price service in country j . The share of services in country j performed by workers posted from country i is given by

$$\lambda_{ij} = \frac{T_i (c_{ij})^{-\theta}}{\sum_{k \in S} T_k (c_{kj})^{-\theta}} = T_i (w_i (1 + \tau_i + a_{ij}) (m_{ij}))^{-\theta} \Phi_j^{-1}, \quad (13)$$

where $\Phi_j = \left[\sum_{k \in S} T_k (w_k (1 + \tau_k + a_{kj}) (m_{kj}))^{-\theta} \right]$. Denoting S_j the number of non-tradable services

⁶⁷Formally, to post a worker from i to country j where the destination-level minimum legal wage applicable to posted workers is \bar{w}_j , the supplier pays $w_i + w_i \tau_i + \mathbb{1}_{w_i < \bar{w}_j} (\bar{w}_j - w_i)$, which I write as $w_i (1 + \tau_i + a_{ij})$.

demanded in country j , the number of services performed in j by workers posted from i is

$$S_{ij} = \lambda_{ij} S_j = S_j T_i w_i^{-\theta} (1 + \tau_i + a_{ij})^{-\theta} (m_{ij})^{-\theta} \Phi_j^{-1}. \quad (14)$$

Responsiveness of posting flows to labor cost policies is captured by the structural parameter θ . Despite the absence of trade tariffs in the EU, receiving countries have two types of instruments at their disposal to restrict or incentivize on-site offshoring: (i) entry restrictions applied to posted workers (m_{ij}) and (ii) destination-level labor cost policies (payroll tax exemptions or minimum wages).

6.1.3 Equilibrium, Welfare and Counterfactual Analysis

I use market clearing conditions to close the model. I denote X_{ij} the expenditure of country j on services produced by workers posted from country i and $X_j = \sum_i X_{ij}$ is country j 's total spending in services, and $X_{ij} = \lambda_{ij} X_j$.⁶⁸ From Equation (13) we can write $X_{ij} = T_i w_i^{-\theta} (1 + \tau_i + a_{ij})^{-\theta} (m_{ij})^{-\theta} \Phi_j^{-1} X_j$. In equilibrium, total income in country i must be equal to total spending on services from country i such that

$$Y_i = \sum_j \frac{T_i w_i^{-\theta} (1 + \tau_i + a_{ij})^{-\theta} (m_{ij})^{-\theta}}{\sum_k T_k w_k^{-\theta} (1 + \tau_k + m_{kj})^{-\theta} (m_{kj})^{-\theta}} Y_j. \quad (15)$$

From the CES preferences of the final consumer, the welfare of individuals is given by a combination of their income and the price index they face. One question when thinking about consumer welfare in this paper's context is whether the price index is one of receiving or sending countries. Most of the time, the posting of workers describes a temporary work mission abroad where most of the workers' consumption is paid off by employers.⁶⁹ I thus use the simplifying assumption that a representative consumer of country i earns consumes in his sending country. Welfare of the representative consumer in country i can be written as

$$W_i = \frac{w_i (1 + \tau_i + a_{ij})}{P_i}. \quad (16)$$

From Equation (13) and the price equilibrium, we have $\lambda_{ij} = T_i C^{-\theta} w_i^{-\theta} (1 + \tau_i + a_{ij})^{-\theta} (m_{ij})^{-\theta} P_j^\theta$. As in [Arkolakis, Costinot, and Rodríguez-Clare \[2012\]](#), using the fact that $m_{ii} = 1$, welfare can be expressed as a function of domestic non-tradable services share λ_{ii} and the structural posting elasticity parameter:

⁶⁸It follows from the Fréchet assumption that the fraction of services purchased from a particular sending country λ_{ij} is equal to the fraction of country j 's income spent on services produced by country i , which I denote Π_{ij} . Closing the model with equilibrium conditions follows standard derivations and is detailed in Appendix ??

⁶⁹For instance, micro administrative data from France show that for 80% of posting missions, workers' housing, food, and trip were paid by firms and not by the workers themselves.

$$W_i = \lambda_{ii}^{-\frac{1}{\theta}} C^{-1} T_i^{\frac{1}{\theta}} \quad (17)$$

A change in the representative consumer welfare of country i after a given posting policy shock can be inferred from changes in equilibrium changes in posting shares ($\hat{\lambda}_{ij}$) and the posting elasticity (θ). In the range class of trade models resembling Equation (13), one can rely on “exact hat algebra” (Dekle et al. [2008]) to express the counterfactual trade flows after a policy shock. Denoting the ratio of the variables in the new and old equilibrium following a change in posting frictions as $\hat{x} = x' / x$, the consumption shares after the policy change are given by

$$\hat{\lambda}_{ij} = \frac{\hat{T}_i (\hat{w}_i (1 + \hat{\tau}_i + \hat{a}_{ij}) (\hat{m}_{ij}))^{-\theta}}{\sum_k \lambda_{kj} \hat{T}_k (\hat{w}_k (1 + \hat{\tau}_k + \hat{a}_{kj}) (\hat{m}_{kj}))^{-\theta}}. \quad (18)$$

On the other hand, using Equation (15) and Equation (19),

$$\hat{Y}_i Y_i = \sum_j \frac{\lambda_{ij} \hat{T}_i (\hat{w}_i (1 + \hat{\tau}_i + \hat{a}_{ij}) (\hat{m}_{ij}))^{-\theta}}{\sum_k \lambda_{kj} \hat{T}_k (\hat{w}_k (1 + \hat{\tau}_k + \hat{a}_{ik}) (\hat{m}_{kj}))^{-\theta}} \hat{Y}_j Y_j. \quad (19)$$

This forms a system of equations from which I can get \hat{Y}_i as a function of policy shocks and initial observables. Equation (18) allows me to combine posting shares observed before the changes λ_{kj} with estimates of the posting elasticity θ to simulate counterfactual posting flows in the presence of shocks to posting determinants, accounting for all general equilibrium changes induced by the change in posting cost.

6.2 Estimates of the Posting Elasticity

A central parameter to gauge the efficiency effects of the posting policy is the structural elasticity θ . To shed light on cross-border services responsiveness, I start by documenting the empirical relationship between posting flows and labor cost at the aggregate level. The “origin-based” tax treatment of posted workers generates origin-specific labor cost variations within a receiving country: workers posted from low-tax countries are cheaper to hire than domestic workers at the same workplace. Figure A.48 shows that a tight aggregate relationship holds between posting flows and labor cost differentials: workers tend to be posted from low to high labor cost countries, with a cross-sectional correlation between (log) posting flows and (log) destination-origin payroll tax ratios of 0.52. If this cross-sectional relationship is informative of the steady-state impact of payroll taxes on posting flows, many factors could be simultaneously correlated with employers’ labor costs and the magnitude of mobility-dependent trade. To properly estimate the causal effect of labor cost policies on posting flows, it is crucial to exploit exogenous variations in labor costs

while controlling for these simultaneous factors. I thus estimate the model-based Equation (14), using as a dependent variable S_{ijt} the number of postings from country i to j at time t and controlling for all structural determinants of supply and demand of services' flows

$$S_{ijt} = \exp \{ -\theta \ln(w_{it}(1 + \tau_{it} + a_{ijt})) - \theta \ln(m_{ij}) - \ln(\Phi_{jt} S_{jt}) + \theta \ln T_i \}. \quad (20)$$

The main challenge in recovering the posting elasticity θ is to exploit exogenous variations in the posting cost, accounting for simultaneous shocks that affect demand and supply of cross-border services within a given country pair. I use payroll tax and minimum wage reforms in place of standard "trade tariffs" to identify the posting elasticity. I follow the best-practice methods for theory-consistent structural gravity estimations that are summarized in [Head and Mayer \[2014\]](#).

The results of the estimation of Equation (20) are displayed in Panel A of Table 9, using alternatively variations in payroll tax employers' labor cost alone (top panel) and total wage cost (middle panel) to identify the posting elasticity parameter θ . All specifications include destination-origin fixed effects (filtering-out m_{ij}), destination-year fixed effects (filtering-out $\Phi_{jt} S_{jt}$), and a free posting agreement dummy (filtering-out a_{ijt}) and cluster standard errors at the destination-year level. The structural parameter θ is identified by *origin-specific* payroll tax variations *within* receiving countries (workers posted from different countries pay different taxes in the same receiving country) as well as *origin-destination* minimum wage variations (workers posted from different countries are affected differentially by destination-level changes in minimum wage).

I find evidence of large and significant responses of bilateral posting flows to changes in labor costs. Across all specifications, I find that the coefficient estimate of θ is significant at the 1% level, with a median point estimate that lies above one. The lower bound 0.66 (0.21) is close to the steady-state correlation between labor cost differentials and posting flows observed in Figure A.48, while the upper bound of 2.4 (0.28) is closer to the posting elasticities estimated in quasi-natural experiments. The median elasticity estimate based on the theory-consistent gravity equation is 1.1 and is reassuringly close to the reduced-form estimates displayed in Panel B of Table 9.

It has been well documented that the log-linearization of the multiplicative gravity equation can be biased by zero flows and heteroskedastic error terms ([Silva and Tenreyro \[2006\]](#)).⁷⁰ Following the rule of thumb in the literature, I estimate Equation (20) with both log-linear OLS and Poisson pseudo-maximum likelihood (PPML) estimators: estimates from OLS (Columns (2), (5), (9), and (12)) and PPML (Columns (3), (6), (10), and (13)) are reassuringly close. I also repeat the estimation with a Poisson regression using

⁷⁰Data on bilateral posting flows are, however, less likely to be affected by zero flows compared to standard goods and services export flows, as there is no minimum reporting threshold for postings.

posting shares λ_{ijt} as the dependent variable, as suggested by [Eaton, Kortum, and Sotelo \[2012\]](#). Estimated elasticities displayed in Columns (7) and (14) show very similar effects when using this estimator.

As in standard trade models, my theoretical framework features a world where producers choose among and consume services supplied by domestic and foreign suppliers. To be fully consistent with theory, Equation (20) should therefore also reflect the differential use of domestic versus posted services. Columns (1), (4), (8), and (11) in Table 9 show the estimates of θ including the domestic services $S_{j,jt}$ in the estimation.⁷¹ The magnitude and statistical significance of the estimates is unchanged when including domestic services supply in the structural gravity estimation. Columns (4)-(7) and (11)-(14) of Table 9 further present estimates of θ from regressions weighted by the sending country's population to adjust for countries' size heterogeneities. The point estimates are slightly larger when using weights but lie in the same ballpark as estimates from unweighted regressions.

All specifications include a destination-year fixed effect absorbing all time-varying shocks from receiving countries that could affect demand for posting services in that country. The only source of confounding factors remains in origin-specific shocks that would be correlated with changes in labor cost and posting flows. I control for origin-year fixed effects in Column (15), thus filtering out all origin-year and destination-year shifters of posting flows demand and supply. With these controls, the identification rests on bilateral variations driven by origin-specific exposure to changes in the destination-level minimum wage implementation. I find that the posting elasticity is again remarkably stable, with a point estimate of 1.1 (0.3).

Complementary Reduced Form Evidence In Section §D, I provide additional evidence of the causal effect of labor tax reforms on posting flows, focusing on the reduced form effects of country-level reforms. Exploiting three quasi-natural labor costs shocks induced by payroll tax reforms (in Belgium and Slovenia) and the introduction of a minimum wage (in Germany), and using a difference-in-differences approach, I find that posting flows significantly respond to policy-induced labor cost differentials. Remarkably, the three quasi-natural experiments, while affecting distinct components of posted labor costs in different countries and periods, yield close estimates of the posting elasticity, lying between 1.3 (0.27) and 1.6 (0.33). I finally show that 1) a reform limiting labor tax exemptions granted to workers posted from some countries and sectors significantly decreased treated flows (Figure A.52, Figure A.53) and 2) the posting duration exhibits a substantial bunching at payroll tax exemption thresholds (Figure A.54). There is a striking similarity between the theory-consistent structural estimates and the three reduced-form estimates from

⁷¹To measure $S_{j,jt}$, the yearly number of domestic workers performing work for domestic producers established in j , I use total domestic employment in country j at time t minus the total number of workers posted from j at time t to work for other EU countries. This methodology is the counterpart for mobile services supply of the standard approach in the literature that uses domestic production minus total exports.

quasi-experimental reforms, hinging on the credibility of these estimates.

Using alternative estimation methods and controlling for destination and origin shifters, estimates of the posting elasticity with respect to labor cost reforms θ are extremely stable across all specifications, statistically significant at the 1% level with a median point estimate of 1.1, and an upper-bound of 2.4. Interestingly, the posting elasticity is lower than the standard “trade in goods” elasticity, which is around 4 ([Head and Mayer \[2014\]](#)), and closer to the international migration elasticity, which is usually closer to unity ([Caliendo, Opronolla, Parro, and Sforza \[2017\]](#); [Kleven, Landais, Munoz, and Stantcheva \[2020\]](#)). This is fully consistent with posting being simultaneously a trade and migration flow. Non-tradables trade is thus not only affected by different policies compared to standard trade but also characterized by different responsiveness to these different policies. The estimates presented in Table 9 thus provide key parameters to inform discussions on the trade liberalization of services.

6.3 Model-Based Welfare Calibration

I use my model’s structure to assess the welfare effects of the service trade liberalization in Europe, accounting for general equilibrium changes in countries’ income. I consider the liberalization of the posting policy for NMS as my main experiment. I combine my estimated reduced-form coefficient β (1.8) on a dummy for the NMS liberalization in equation (1) with the estimates of θ to compute the change in posting cost following the reform.

Using the initial value of production of each member state (Y_i) and the original posting shares (λ_{ij}), I can plug the estimated change in posting cost \hat{m}_{ij} into Equation (19), which defines a system of equations determining \hat{Y}_i for each member state. Using my structural estimates of θ , I can substitute the change in posting frictions \hat{m}_{ij} and in income \hat{Y}_i into Equation (18) to obtain the matrix of posting shares change $\hat{\lambda}_{ij}$. I iterate this procedure using a dampening factor until $\hat{\lambda}_{ij}$ stops changing, and can finally express the change in welfare induced by posting restrictions by $\hat{\lambda}_{ij}^{-\frac{1}{\theta}}$.

Figure 15 shows the distribution of welfare gains derived from the lifting of mobility restrictions for NMS studied in Figure 4. The liberalization shock, or decrease in trade costs of services for NMS, acts as a positive productivity shock in the model, allowing all countries to source services from newly available suppliers. While the removing of posting barriers had large implications in terms of service trade flows, the overall welfare gains appear to be small. The liberalization of the posting policy to NMS countries has increased the average consumer gains by 0.3%. The average welfare gains from posting openness masks heterogeneities across member states. Small countries that tend to be more open, and therefore consume more non-tradable services produced by foreign entities, have larger gains from the liberalization. NMS that gained the right to provide services abroad had the largest welfare improvements, with top winners

being Slovenia, Croatia, Slovakia, and Hungary. Southern European countries such as Portugal, Italy, and Spain appear to derive the smallest gains from the expansion of the posting policy to Eastern Europe, as they are the direct competitors of NMS for the cross-border provision of services. Countries like France and Belgium, where large displacement effects have been triggered by increased exposure to posting inflows from NMS countries, appear to also derive very moderate welfare gains from this increase in posting exposure, which are below 0.2%.

While the finding of small aggregate efficiency gains from “non-tradable” trade is close to what has been found for manufacturing, the underlying forces differ in some dimensions. The consumption shares of services performed by posted workers (λ_{ij}) are small, and much smaller than the consumption shares of imported goods. This standard “small number effect” is however counterbalanced by much lower substitutability of foreign and domestic services as compared to standard traded goods.

7 Concluding Remarks

This paper demonstrates that novel trade instruments lead formerly “non-tradable” services to become effectively traded across borders. Using novel administrative data on a continent-wide experiment of trade liberalization in services, I show that the policy choices made in Europe had important distributional implications, within and between countries. The European posting policy generated permanent import and export exposure in sending (low-wage) and receiving (high-wage) countries, exposing previously sheltered workers and firms to globalization. I show that by expanding the range of tradable jobs, the policy displaced low-paid workers in high wage countries, benefited sending firms in low wage countries, and had small efficiency effects for consumers. These results have important implications for the future of trade policies. As the share of manufacturing in advanced economies is shrinking, trade policies expanding the range of tradable jobs may appear as a tempting alternative to pursue international integration. My paper proposes the first quantitative assessment of such trade instruments, for both exporters, importers, and consumers.

My paper further opens novel questions related to labor regulations in exporting countries. When people are traded, rather than standard goods, or standard services, trade policy has a much broader scope than previously thought. In Europe, trade tariffs between member states are prohibited. However, because cross-border services are performed in their territory, receiving (importing) countries have the right to impose part of their fiscal and social standards to workers performing these exported services. Could (should) we extend this logic to other trade flows, for instance, by imposing a set of core labor rights to all imports, adding “responsible sourcing” dispositions in trade agreements? Such an “anti-dumping” clause has, for instance, been recently proposed in a report commanded by President Macron on the future of

economic challenges ([Blanchard and Tirole \[2021\]](#)). While I leave the answer to this question for future research, I have shown that posting represents a unique experiment where such policies have already been tested continent-wide.

Finally, the novel and numerous datasets leveraged in my analysis could allow us to overcome two major measurement challenges faced by the trade and labor literature. First, the paucity of empirical studies on trade in services, its determinants, and its consequences can be traced to the lack of reliable micro data on these transactions, as services are intangible and therefore absent from usual customs-based measures of trade flows. Identifying service trade through payroll tax information on posted workers helps reconstruct administrative records of service trade and could provide a trove of information for future research on the topic. Second, it is often impossible to track workers before and after they immigrate since no administrative data from any one country jointly observe individual labor market situations before and after a move. Following posted workers across borders could allow researchers to recover this usually truncated information around the mobility event and could thus provide novel answers on the dynamic path of earnings and employment for international migrants.

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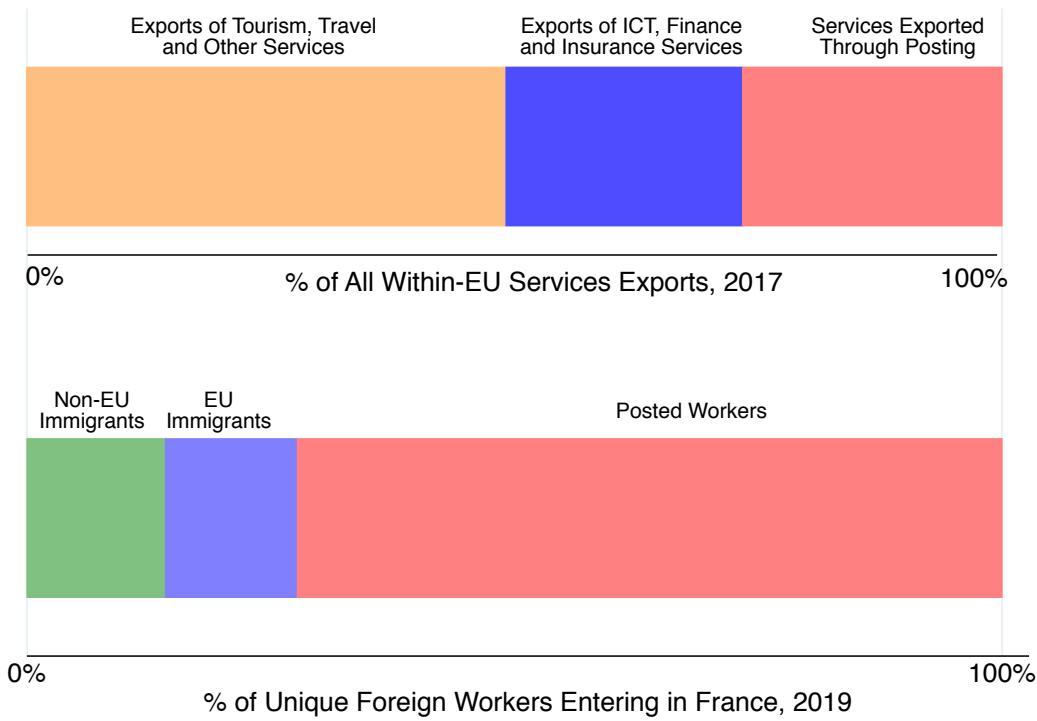
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8 Figures

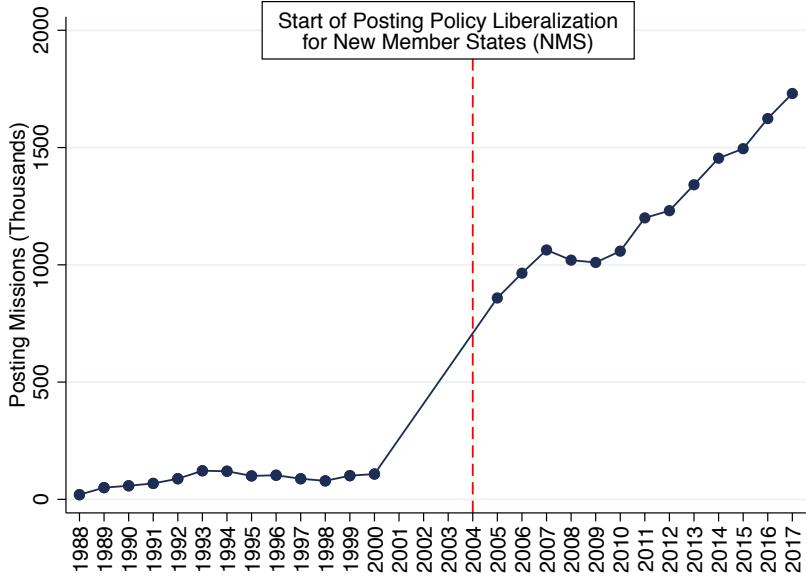
Figure 1: Posting Flows and Globalization in the European Union



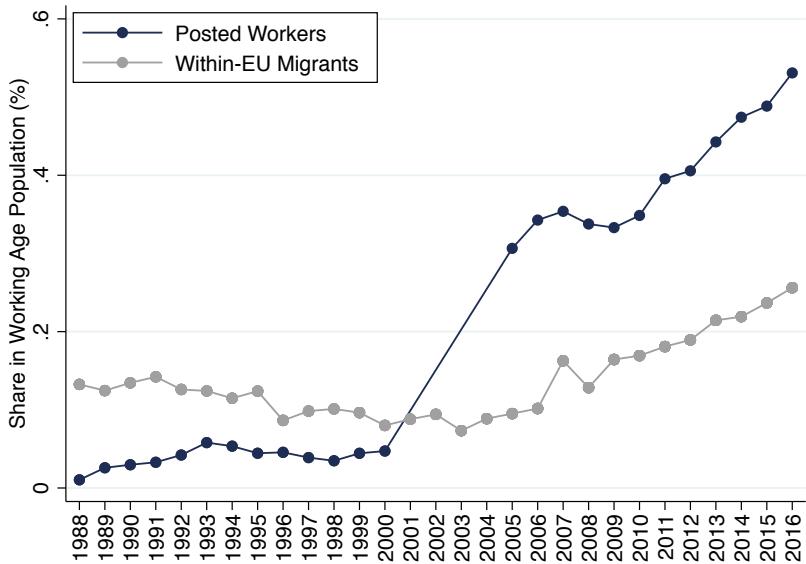
Notes: This figure shows the importance of posting flows in EU measures of globalization. The top panel of the graph decomposes within-EU trade in service flows by type of transactions, using data on services' trade by mode of supply. Services exported through posting are services that are performed by workers posted abroad (mode 4 services supply of WTO). The bottom panel decomposes the incoming flows of workers in France in 2019. Posted workers are sent temporarily by their employer to France but do not appear in standard migration statistics. Data on workers posted to France come from administrative registries of workers posted to France described in Appendix H.

Figure 2: Within-EU Services Offshoring Through Posted Workers

A. Cross-Border Provision of Services Within-EU



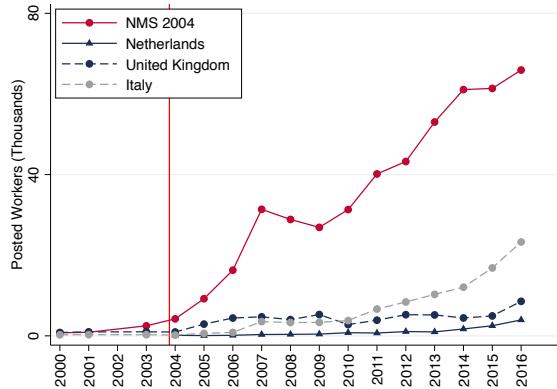
B. Trade-Related Mobility Is Larger Than Migration



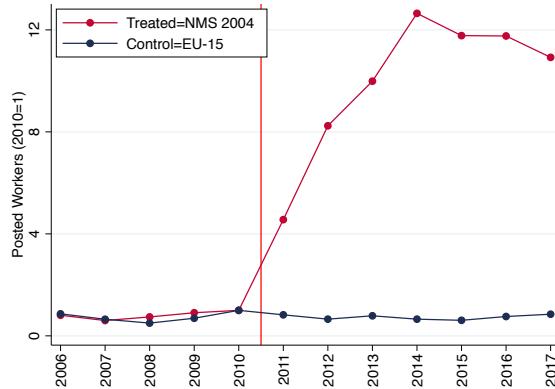
Notes: This figure describes the evolution of posting flows within the EU since 1988. Provision of services through posted workers was substantially expanded in 2004. Within the EU, posted workers must hold a E101/A1 mandatory certificate while performing a service mission in another member state. The yearly number of issued posting forms has been collected each year by the European Commission, with a break in data collection between 2000 and 2005. The top panel shows the yearly number of posting missions between EU member states based on the universe of E101/A1 social security posting forms issued each year in the EU. A worker may be posted several times during the year: posting forms relate to posting missions rather than unique workers. Panel B compares trade-related mobility flows (posting missions/population) to standard migration flows (migrants/population) within the EU. Migration flows are computed from the EU-LFS survey and measure the number of individuals who change, for at least 12 months, their residence country each year within the EU. By contrast to standard migration, the average duration of posting is around four months. Figure A.21, Panel B shows the increase of postings to France during the same period without a break in data collection. Table ?? compares the number of unique posted workers and migrants. Data on posting forms are described in detail in the Appendix F.

Figure 3: Lifting Entry Restrictions for Posted Workers: Raw Events

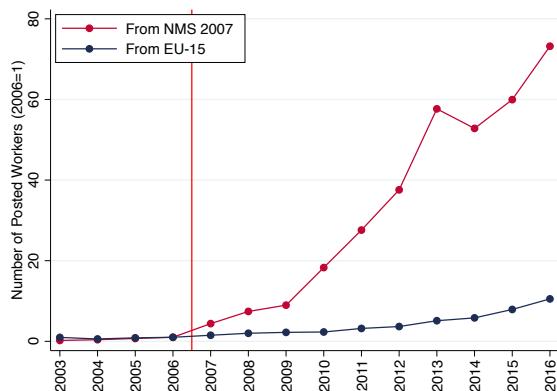
A. New Member States 2004 to France



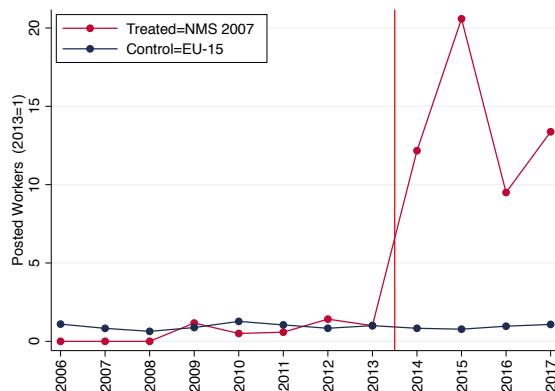
B. New Member States 2004 to Austria



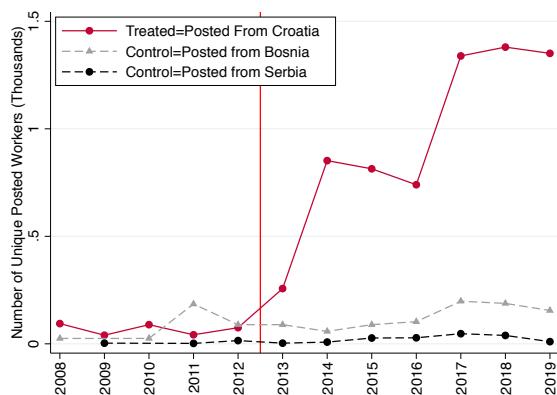
C. New Member States 2007 to France



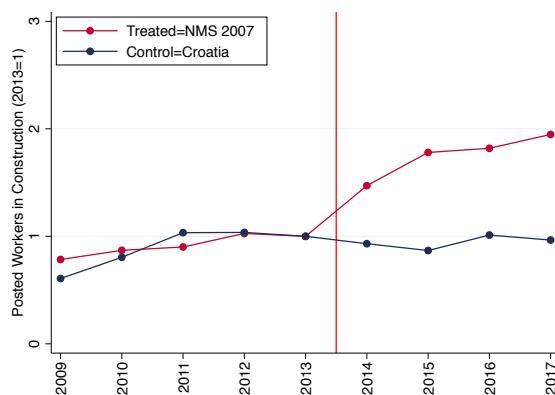
D. New Member States 2007 to Austria



E. New Member States 2013 to Belgium

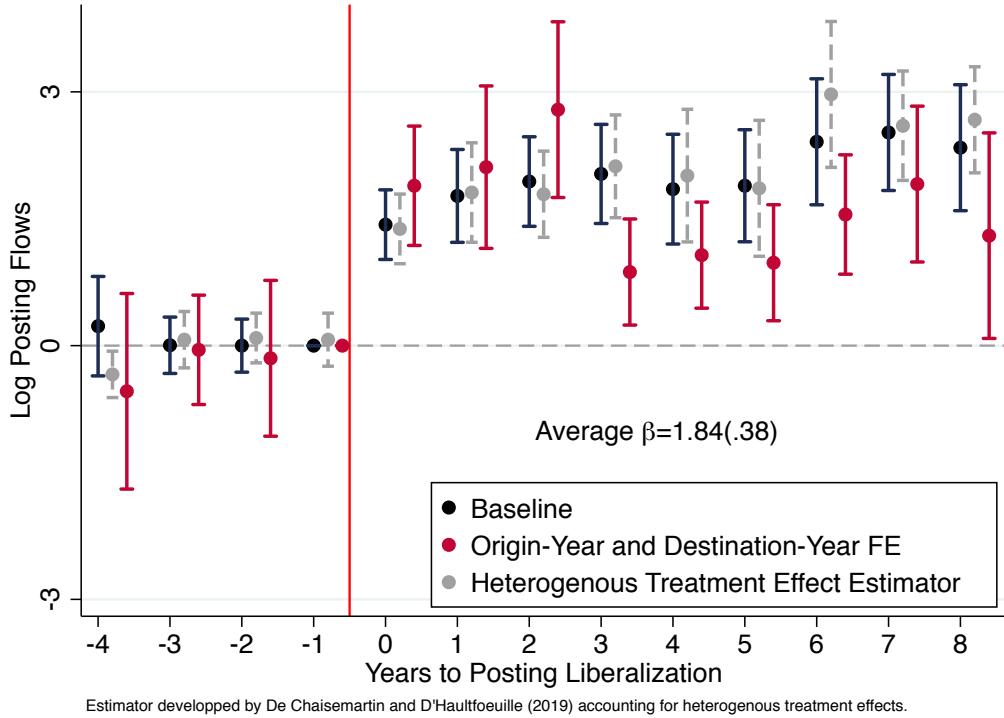


F. New Member States 2007 to Germany



Notes: This figure plots raw series of posting inflows around the end of mobility restrictions in receiving countries. The liberalization events are defined as a receiving country lifting all entry restrictions for workers posted from a given sending country. Panels A and C are based on exhaustive administrative declarations of posting missions performed by foreign suppliers to France for 2000-2016 recorded in the DPD/SIPSI dataset. Panels B and D are based on exhaustive administrative declarations of posting missions performed by foreign services suppliers to Austria between 2006 and 2017 recorded by the BUAK dataset. Panel E is based on exhaustive administrative declarations on postings to Belgium from 2008 to 2019 recorded in the LIMOSA dataset. Panel F is based on exhaustive administrative posting declarations on postings to Germany from 2000 to 2017 recorded by SOKA-BAU. Each figure compares postings from treated (red series) to control (dark series) sending countries to a given receiving country, before and after this receiving country lifted entry restrictions for treated countries (event depicted by vertical red line). The timing of these events is described in Figure A.3, Panel B.

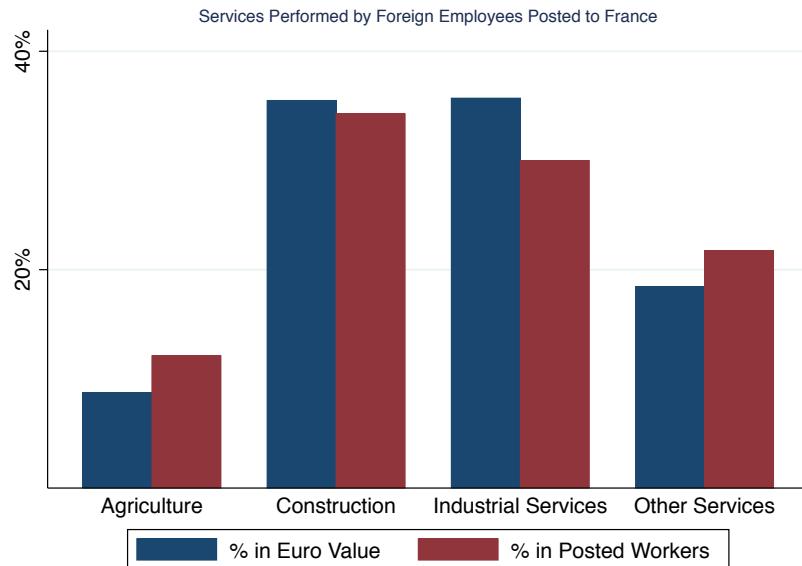
Figure 4: Causal Effect of The Liberalization on Cross-Border Supply of Services



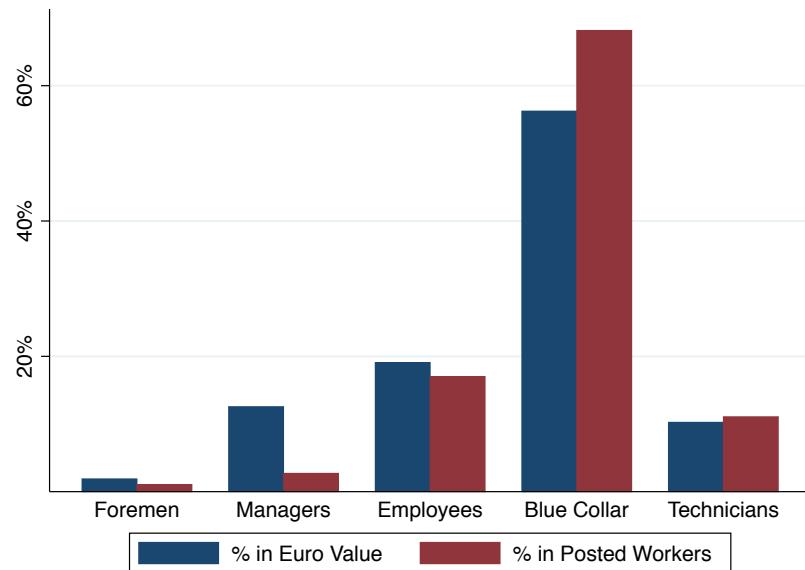
Notes: This figure reports the causal dynamic effects of posting liberalization in receiving countries on the volume of services performed by foreign suppliers' employees in that country. The event study is restricted to the four main receiving countries for which flows of posted workers can be observed before liberalization in country-level posting registries: Germany, France, Belgium, and Austria. The datasets pooled for the estimation are exhaustive administrative declarations of postings performed in (i) France (DPD/SIPSI dataset, Appendix H), (ii) Belgium (LIMOSA dataset, Appendix J), (iii) Austria (BUAK dataset), and (iv) Germany (SOKA-BAU dataset). The graph plots β_k coefficients and their 95% confidence interval from the dynamic staggered difference-in-differences Equation (1) that pools events and raw variations presented in Figure 3. The dependent variable is log posting flows from country i to j at time t . The treatment is defined as country i gaining the right to post workers without restrictions in country j at time t . The identifying variation is the liberalization from low- to high-wage countries within the EU, with staggered timing across origin-destination country pairs as described in Figure A.4. The coefficient of the year before liberalization β_{-1} is normalized to zero, and standard errors are clustered at the origin-destination level. A control country i is such that posting regulations from i to j never changes over the estimation period, e.g., is never or yet to be treated by the end of posting restrictions event.

Figure 5: “Non-Tradable” Jobs Are Offshored On-Site Through Posting of Workers

A. Sectors of Work Mission Performed by Posted Workers



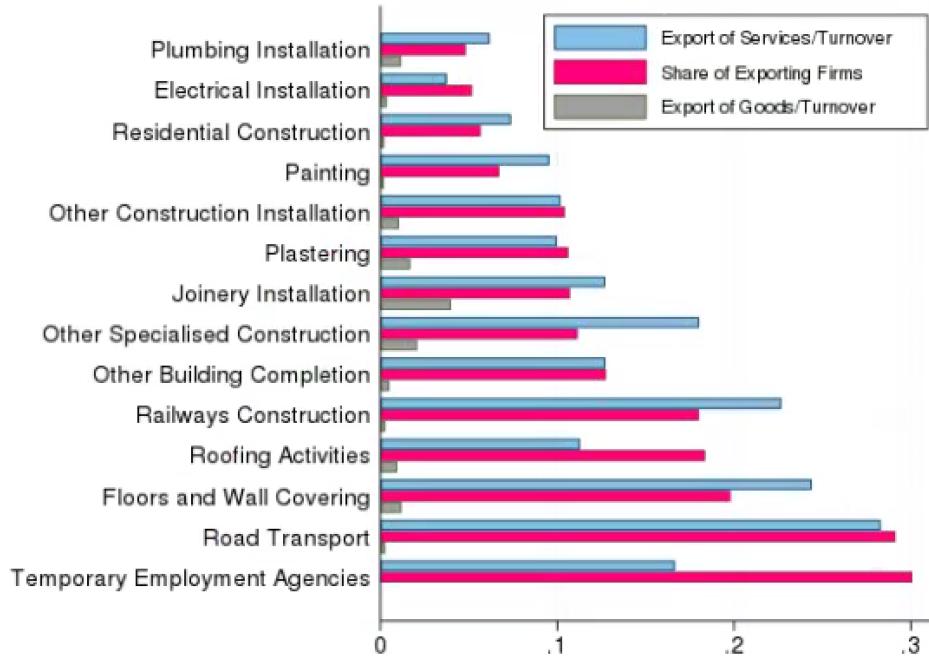
B. Qualification of Posted Workers



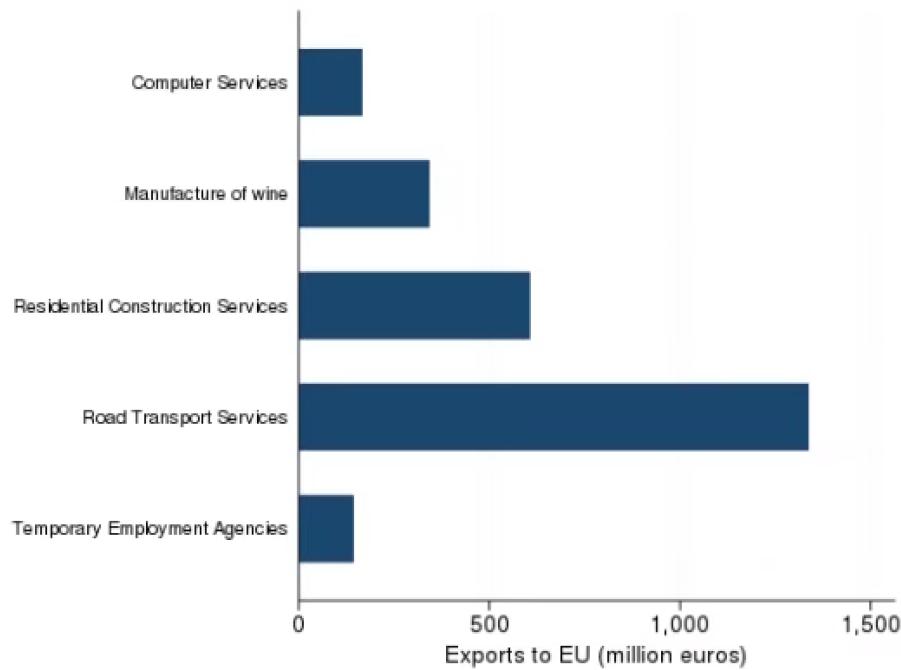
Notes: This figure shows the decomposition of posting missions performed by mobile (foreign) employees in 2019 in France, the second importing country of posting services in Europe. It is based on the DPD/SIPSI dataset that records all posting missions performed by foreign services suppliers in France’s territory, with detailed information on posted workers’ wage, posting mission duration, and type of job performed in France. In 2019, 657,216 posting missions performed by 227,991 unique posted workers were declared in the country. To compute the euro value of posting contracts, each posting mission is weighted by its duration and the wage paid to the foreign suppliers’ employee. Panel A shows the decomposition of posting missions performed in France in 2019 by sector of that mission. The decomposition is computed with respect to the total number of posting missions (red bar) or total amount of posting missions (blue bar). Panel B shows the decomposition of posting missions by qualification level of the foreign employee performing that mission. Top jobs performed by posted workers are builder, welder, mechanic, cleaner, driver, and farm worker. The sector of the posting mission offshored “on-site” through posted workers is not necessarily the same as the sector of the receiving firm (see Figure A.8 and Table A.9). The equivalent of Panel A for all European countries is available in Figure F.64. Data are described in Appendix H.

Figure 6: Non-Tradable Sectors Are In Fact Internationally Integrated In Sending Countries

A. Exposure to Exports Opportunities in “Non-Tradable” Sectors



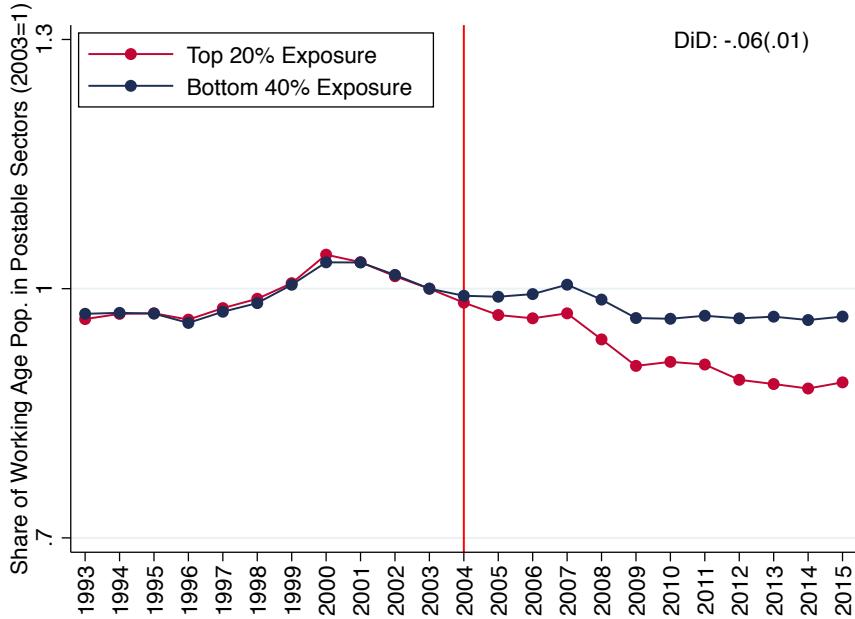
B. Portuguese Exports by Sectors



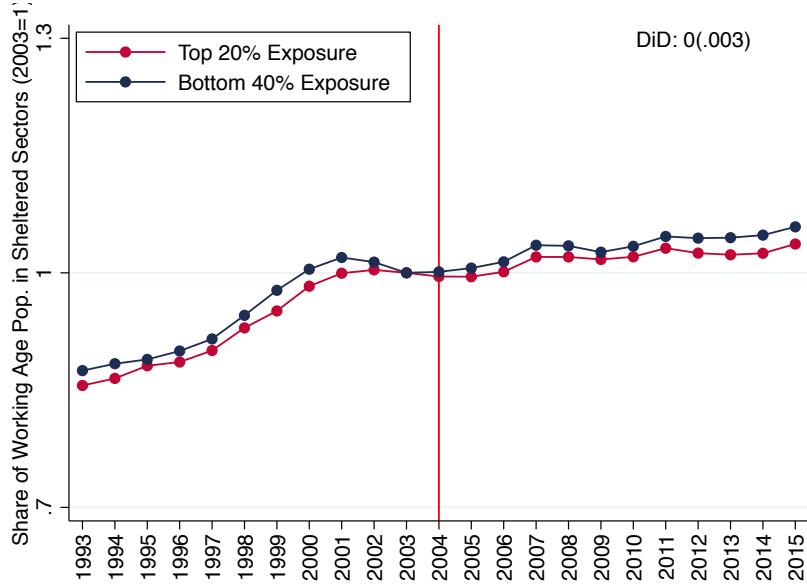
Notes: The Figure shows the amount of services and goods exports in non-tradable sectors in one of the main sending countries: Portugal. I use exhaustive administrative tax records of Portuguese firms merged with administrative records of services performed in another EU country, as well as exported goods and materials, from 2006 to 2017, described in Appendix G. The histogram shows for non-tradable sectors where trade in mobility-dependent, the total amount of services provided in EU (red) and total amount of goods exported to EU (blue) divided by total sales in that sector.

Figure 7: Causal Effect of the Posting Liberalization on Domestic Employment

A. Domestic Employment in Exposed Sectors and Provinces



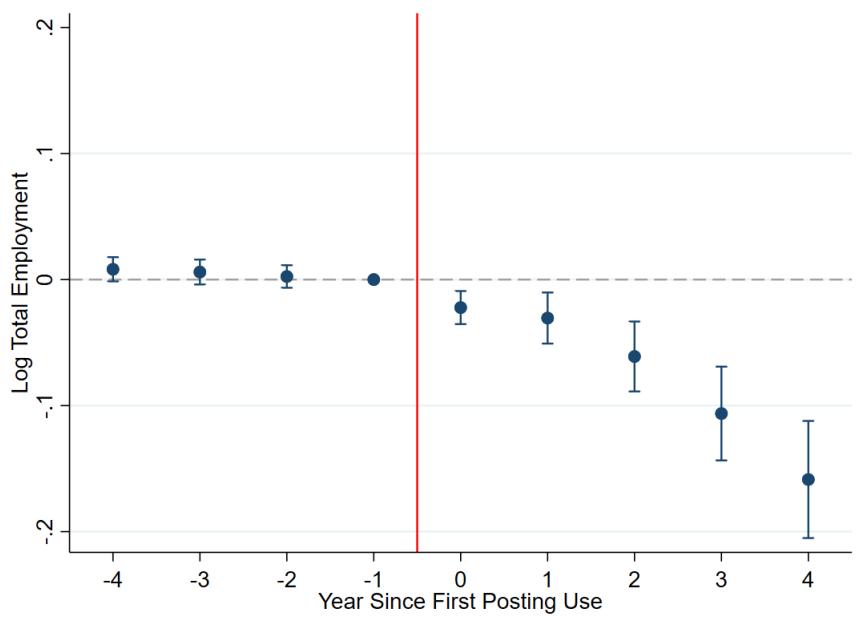
B. Domestic Employment in Sheltered Sectors



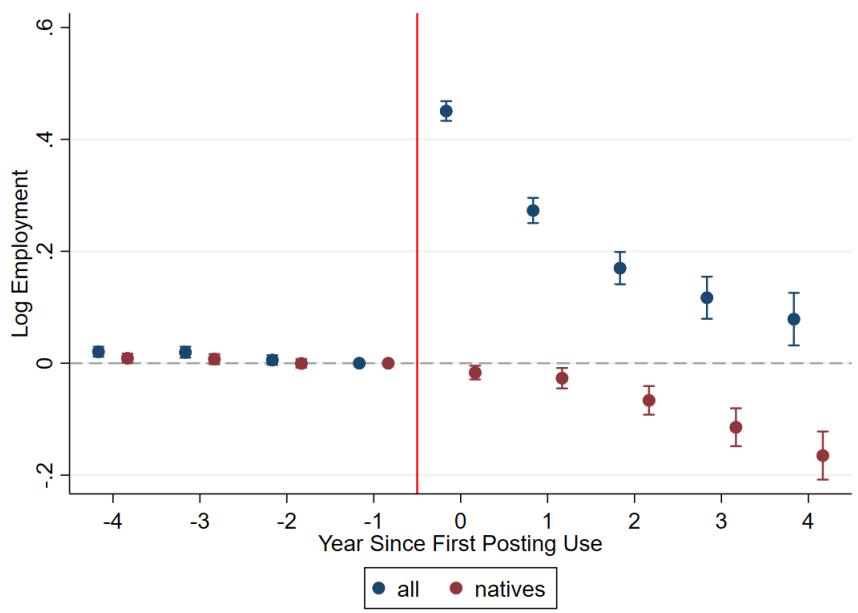
Notes: The figure studies the effect of posting on domestic employment in the second largest importer of posting services: France. I use the dataset on all posting declarations filed by foreign suppliers sending posted workers to France aggregated at the province-year-sector from 2000 to 2015 (DPD/SIPSI), merged with administrative data on French domestic employment and working age population at the province-year-sector from 1990 to 2015 from INSEE. The aggregate DPD/SIPSI dataset builds on yearly province-level administration (DIRECCTE) reports to the French ministry of labor of the number of received posting declarations each year. In 2004, France lifted entry restrictions for workers posted from 10 Eastern European countries, leading to permanent increased import exposure in some sectors through posting (Figure A.21). Province-level exposure to the 2004 shock is defined by exposure to the shock before the reform, in 2003. Panel A shows the evolution of the share of domestic workers in exposed sectors, before and after 2004, in provinces with low and high exposure to the shock. Panel B shows the counterparts for the share of domestic workers in sheltered sectors, such as administrative support, retail or skilled services. Prediction power of initial exposure shares (first stage) are showed in XX.

Figure 8: Receiving Firms Substitute Posted for Domestic Workers

A. Domestic Employment At Receiving Firms After the Offshoring Event



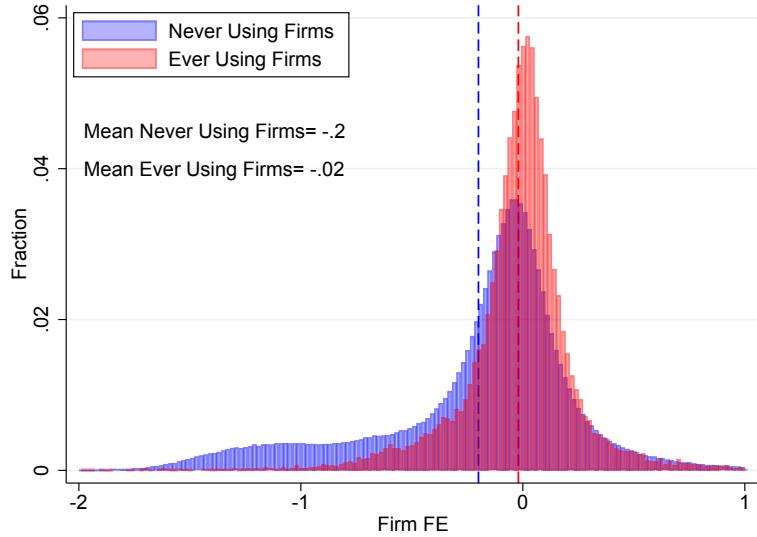
B. Employment Evolution At Receiving Firms Including Posted Workers



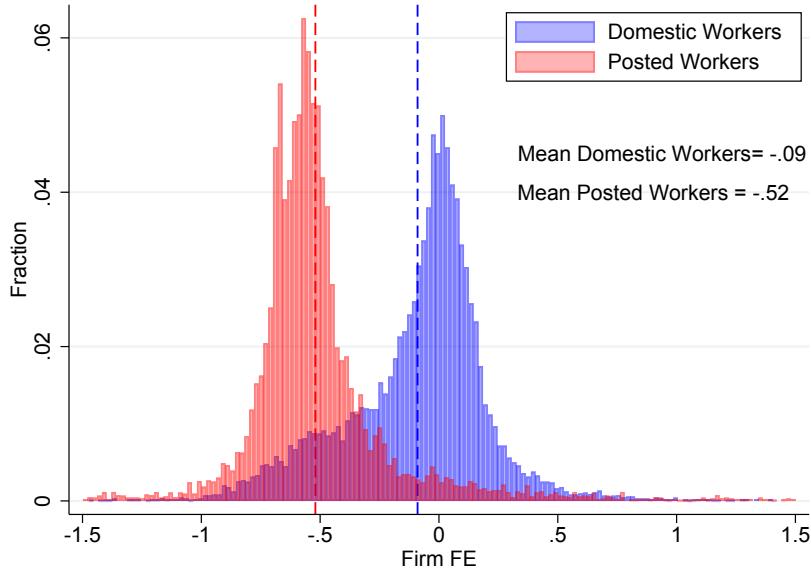
Notes: This figure studies how posting affects receiving firms and domestic workers in Belgium, one of the main receiving countries for posted workers. I use exhaustive administrative posting records of Belgian firms merged with administrative employment data to select the 11,796 firms that started using posted workers for the first time between 2014 and 2019. The figure plots the estimated event study coefficients γ_k from Equation (5) for the period 2008-2019, where the dependent variable is log employment (Panel A). Panel B compares the evolution of log overall employment (domestic and posted workers, blue series) and log domestic employment (red series) at receiving firms before and after the event. The event is defined as the first time a Belgian firm sources services to foreign posted employees. The coefficient of the year before the first posting use γ_{-1} is normalized to zero. The regressions include firm and three-digit sector \times calendar year. γ_k compares the outcomes of receiving firms in event year k to the outcomes of future posting firms in the same narrowly defined sector in the year before their event. The vertical line represents 95% confidence intervals computed from robust standard errors clustered at the calendar year \times province level.

Figure 9: Are Posted Workers Cheaper Than Domestic Workers?

A. Firms Purchasing Posting Services Face Higher Domestic Labor Cost



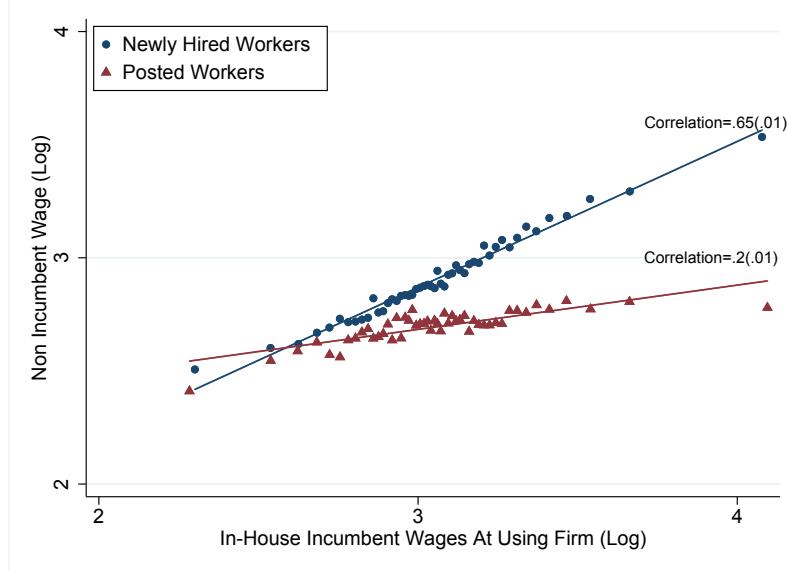
B. Posted Workers Receive Lower Workplace Wage Premia at Receiving Firms



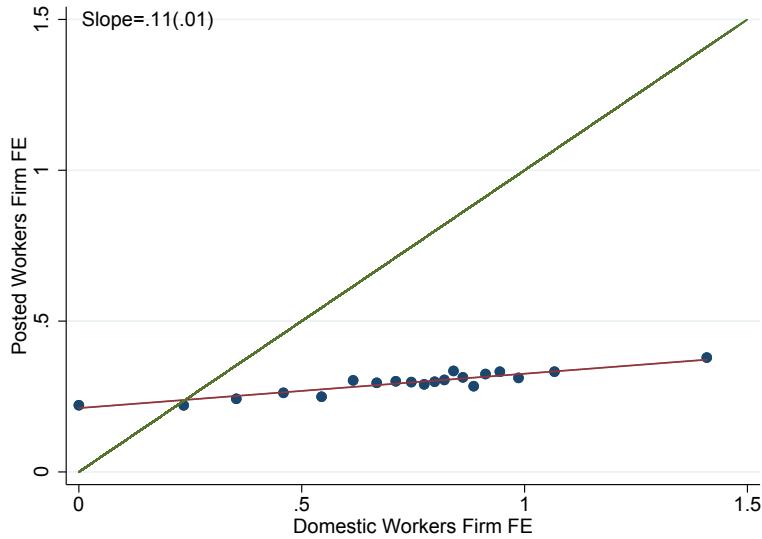
Notes: This figure compares posted workers' and domestic workers' wages in the second largest importer of posting services: France. I use the universe of mandatory posting declarations filed by foreign suppliers that send posted workers in the French territory (DPD/SIPSI dataset) to identify all posting contracts that started in 2017 and 2018, and to track the 23,332 French companies that have purchased a posting service in those years. For each posting contract, I observe, among other rich characteristics, the wage paid to the posted worker by their foreign employer, the hours of work linked to the posting mission, and the identifier of the French firm that purchased that mission. To obtain employment information on domestic workers, I use the linked employer-employee administrative dataset "DADS postes 2018" that covers all job spells of French employees in 2017 and 2018. I use the unique receiving firm identifier (SIREN) to link posted workers to French employees and end up with 19,138 French firms that purchased a posting contract at some point in 2017-2018 and for which at least one domestic job record exists in the 2017-2018 DADS postes. Panel A plots the histogram of workplace AKM effects for domestic workers, separately for firms that use or never use posting, based on Equation (6). Panel B plots workplace pay premia for domestic and posted workers estimated *within the sample of receiving firms only*, based on Equation (7). The mean wage premium for posted workers is -0.43 compared to the mean wage premium of domestic workers normalized to zero, suggesting a substantial wage penalty borne by posted workers.

Figure 10: Surplus-Sharing Between Posted Workers and Receiving Firms

A. Relationship Between Domestic Workers' and Posted Workers' Wages

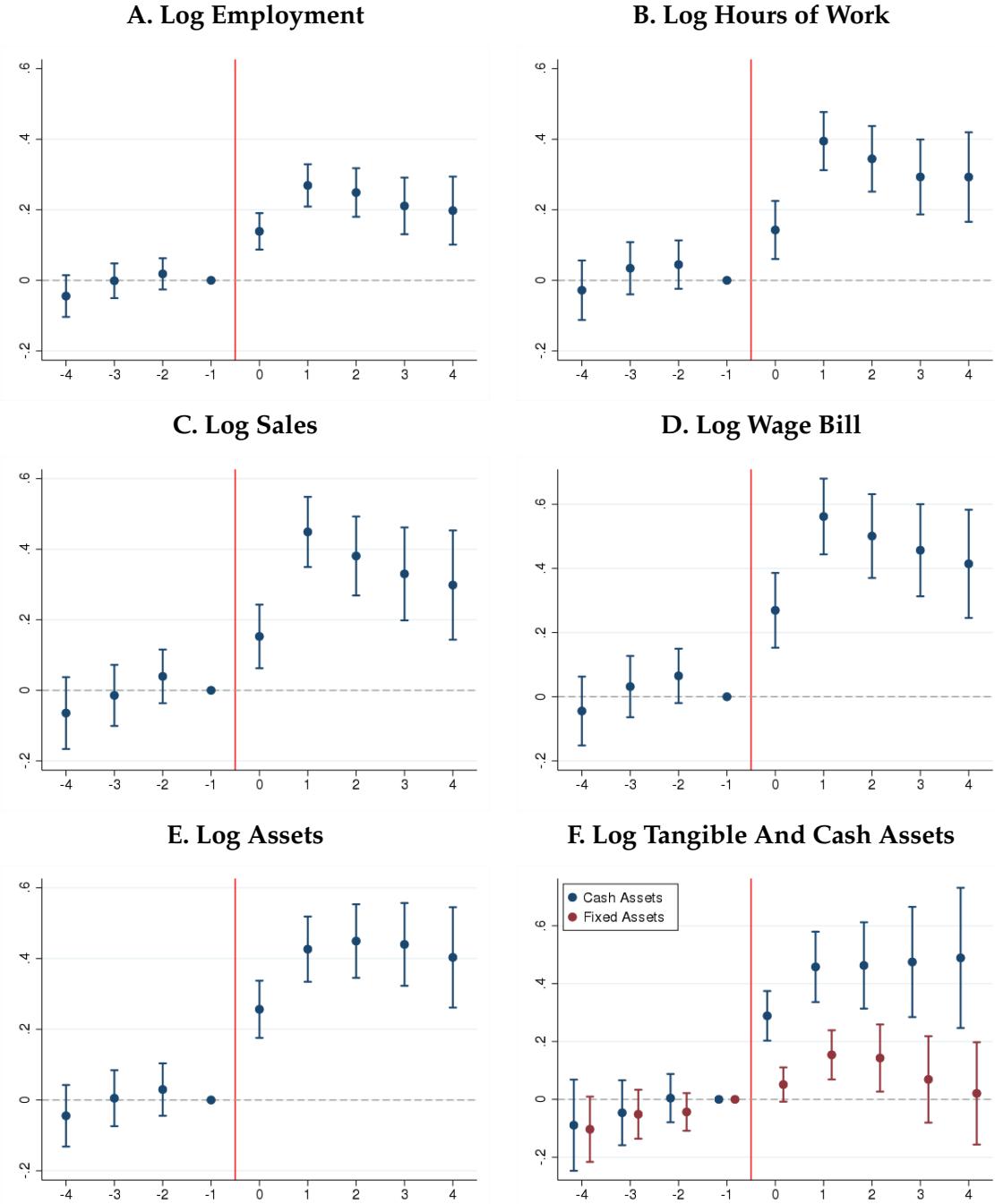


B. Firm-Level Pay Premia Sharing with Posted Workers



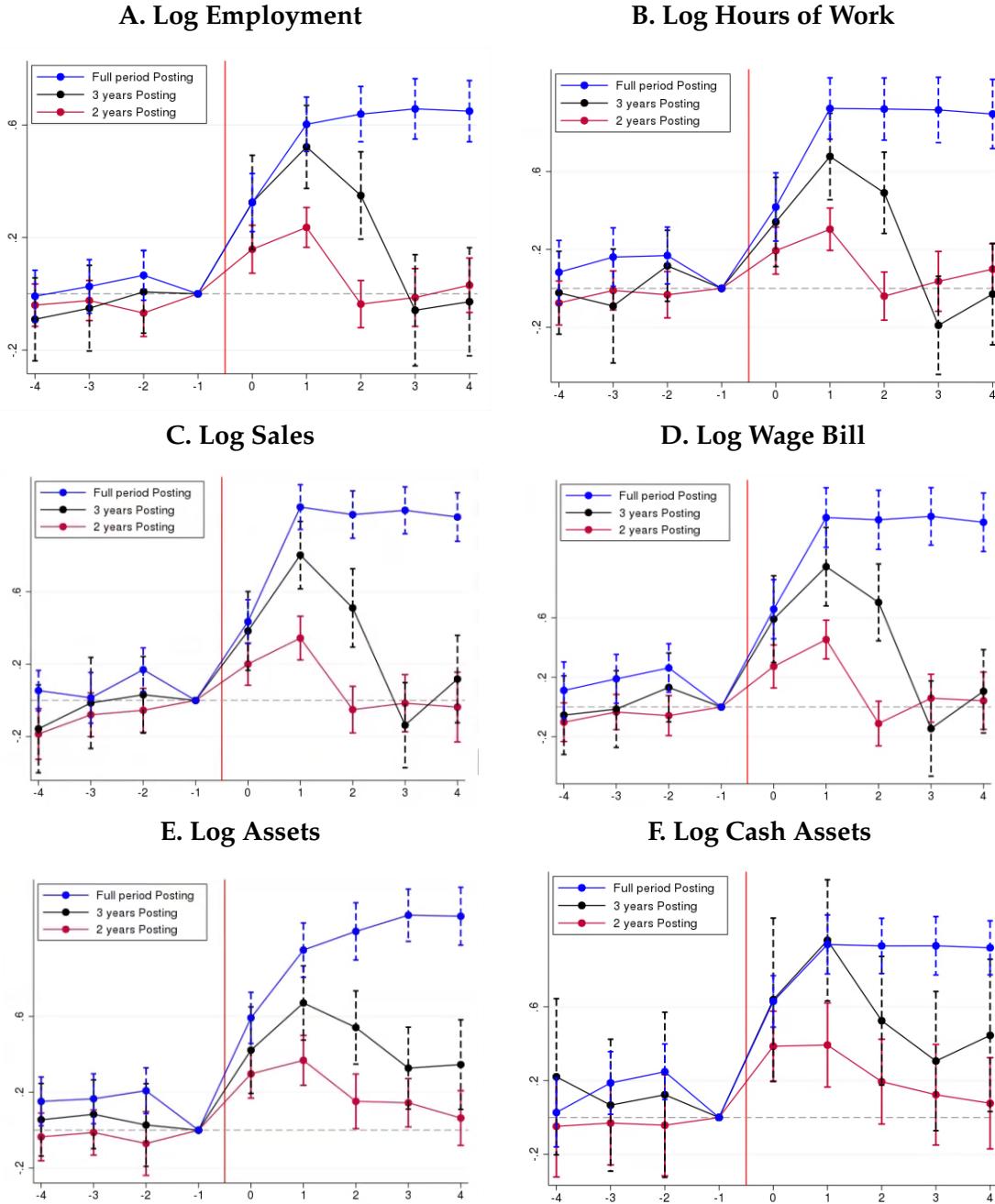
Notes: This figure compares posted and domestic workers' wage *within a workplace* in the second largest importer of posting services: France. I use the universe of mandatory posting declarations filed by foreign suppliers that send posted workers in the French territory (DPD/SIPSI dataset) to identify the 19,138 French firms that purchased a posting contract in 2017-2018 and for which at least one domestic job record exist in the 2017-2018 DADS postes dataset, a linked employer-employee dataset covering all job spells in France during that period. I can observe wages paid to French workers and posted workers at the same workplace in France. Panel A shows the relationship between incumbent, newly hired domestic, and posted workers' wages at the same workplace in 2018. It shows the binned scatterplot of log domestic incumbent workers' wage (x axis) against log domestic newly hired workers' wage (blue dots) and posted workers' wage (red dots) for receiving firms, residualized on five-digit sector fixed effects. Figure A.27 shows similar pattern adding domestic temporary agency workers' wage in the comparison. Table 6 reports estimates of the raw wage penalty within a workplace borne by posted workers. Panel B shows the binned scatter plot of estimated AKM workplace effects for posted workers against estimated AKM workplace effects for incumbent domestic workers. For visualization, the fixed effects are normalized to zero in the lowest respective deciles, but the normalization does not affect the estimates of the slope. The red line in bottom panel corresponds to the regression described in Equation (8), while the green line depicts the 45-degree line.

Figure 11: Sending Firms Expand When Starting to Provide Services Abroad



Notes: This figure studies how posting affects sending firms located in Portugal, one of the main suppliers of posting services in Europe. I use exhaustive administrative tax records of Portuguese firms merged with administrative records of services performed in another EU country from 2006 to 2017 to select the 4,151 firms (with a median of more than three employees over the period) that start posting workers abroad for the first time between 2010 and 2015. The figure plots the estimated event study coefficients θ_k from Equation (10) for the period 2006-2017 where the dependent variable is log number of paid employees (Panel A), log total hours worked by employees (Panel B), log total sales (Panel C), log domestic sales (Panel D), log total assets (Panel E), and log wage bill (Panel F). The event is defined as the first time a Portuguese firm provides non-tradable services in another EU country. The coefficient of the year before the first posting θ_{-1} is normalized to zero. The regressions include firm and five-digit sector \times calendar year \times province fixed effects. θ_k compares the outcomes of posting firms in event year k to the outcomes of future posting firms in the same narrowly defined sector and province in the year before their event. The vertical line represents 95% confidence intervals computed from robust standard errors clustered at the calendar year \times province level. The event study coefficients are reported in Table 7. The dataset and estimation sample are described in Appendix G.

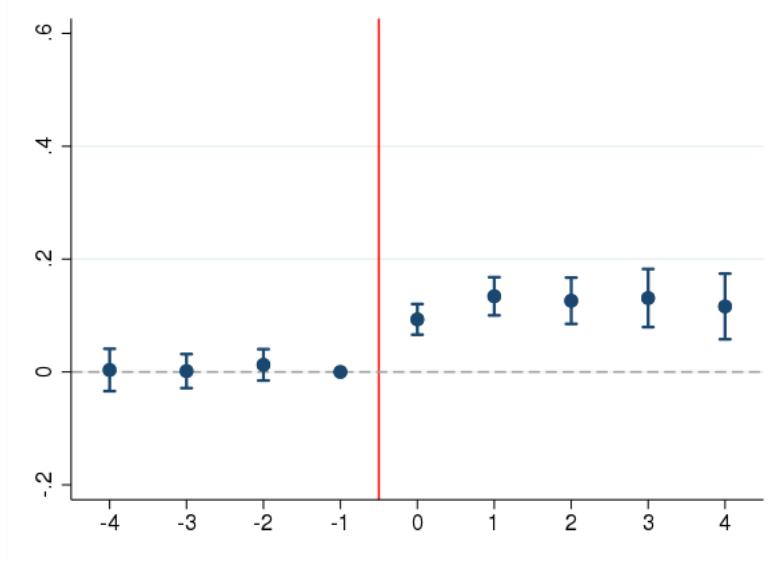
Figure 12: Export-Mobility Gains Start and End With the Posting Mission



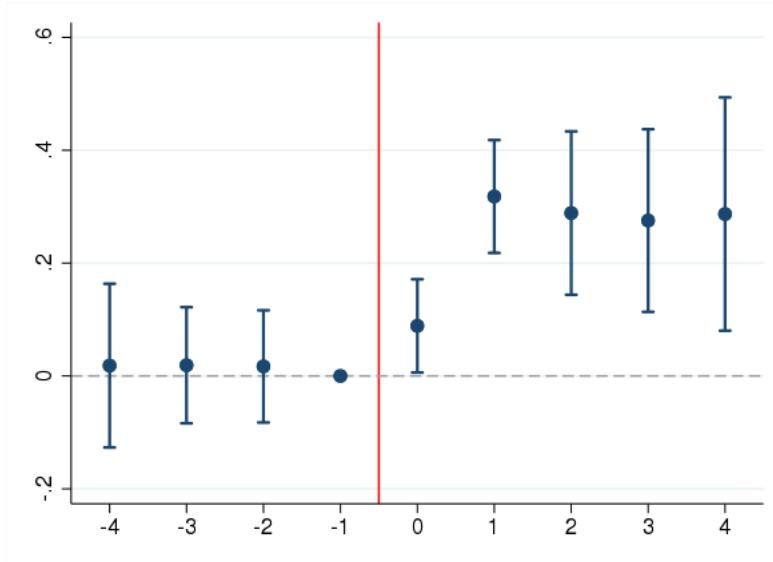
Notes: This figure studies how posting affects sending firms located in Portugal, one of the main suppliers of posting services in Europe. I use exhaustive administrative tax records of Portuguese firms merged with administrative records of services performed in another EU country from 2006 to 2017 to select the 4,151 firms (with a median of more than three employees over the period) that start posting workers abroad for the first time between 2010 and 2015. The figure plots the estimated event study coefficients θ_k from Equation (10) for the period 2006-2017 where the dependent variable is log number of paid employees (Panel A), log total hours worked by employees (Panel B), log total sales (Panel C), log domestic sales (Panel D), log total assets (Panel E), and log wage bill (Panel F). The event is defined as the first time a Portuguese firm provides non-tradable services in another EU country. The coefficient of the year before the first posting θ_{-1} is normalized to zero. The regressions include firm and five-digit sector \times calendar year \times province fixed effects. θ_k compares the outcomes of posting firms in event year k to the outcomes of future posting firms in the same narrowly defined sector and province in the year before their event. The vertical line represents 95% confidence intervals computed from robust standard errors clustered at the calendar year \times province level. The event study coefficients are reported in Table 7. The dataset and estimation sample are described in Appendix G.

Figure 13: Surplus-Sharing Between Sending Firms and Posted Workers

A. Wage Rate After Provision of Services Abroad

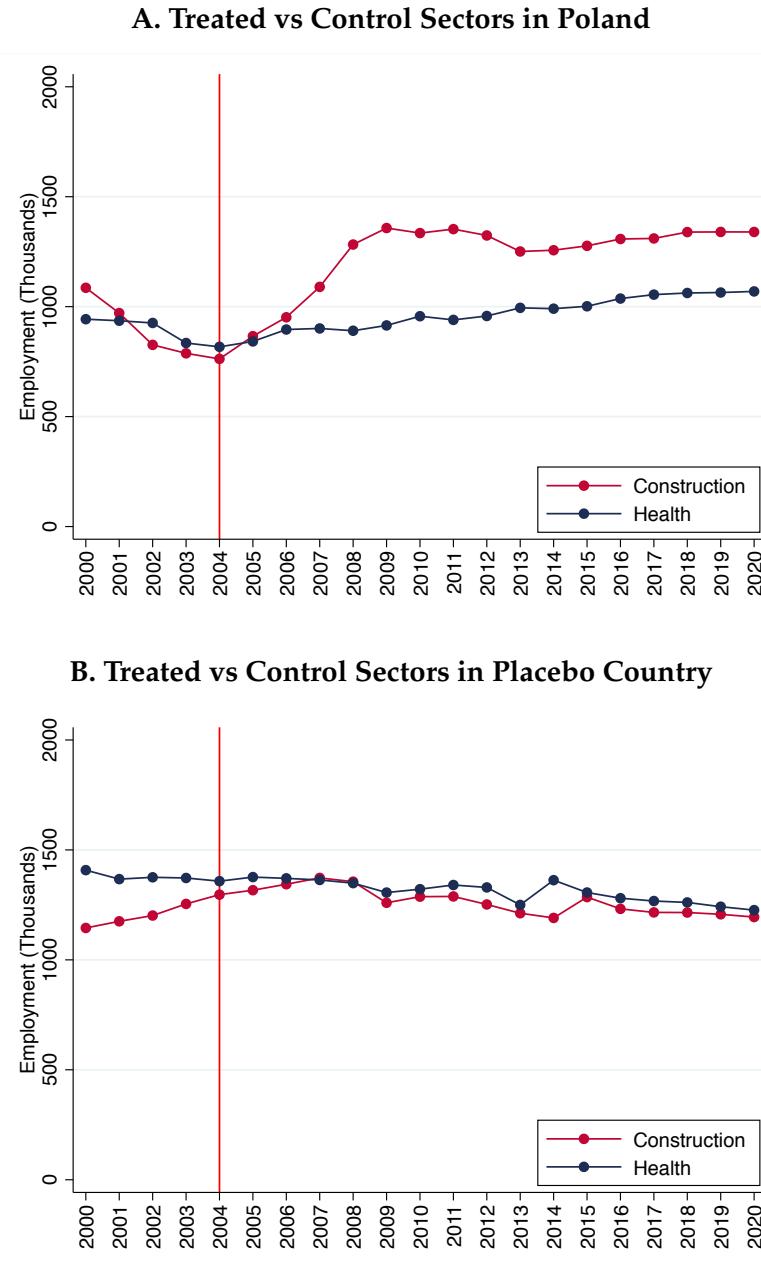


B. Profits After Provision of Services Abroad



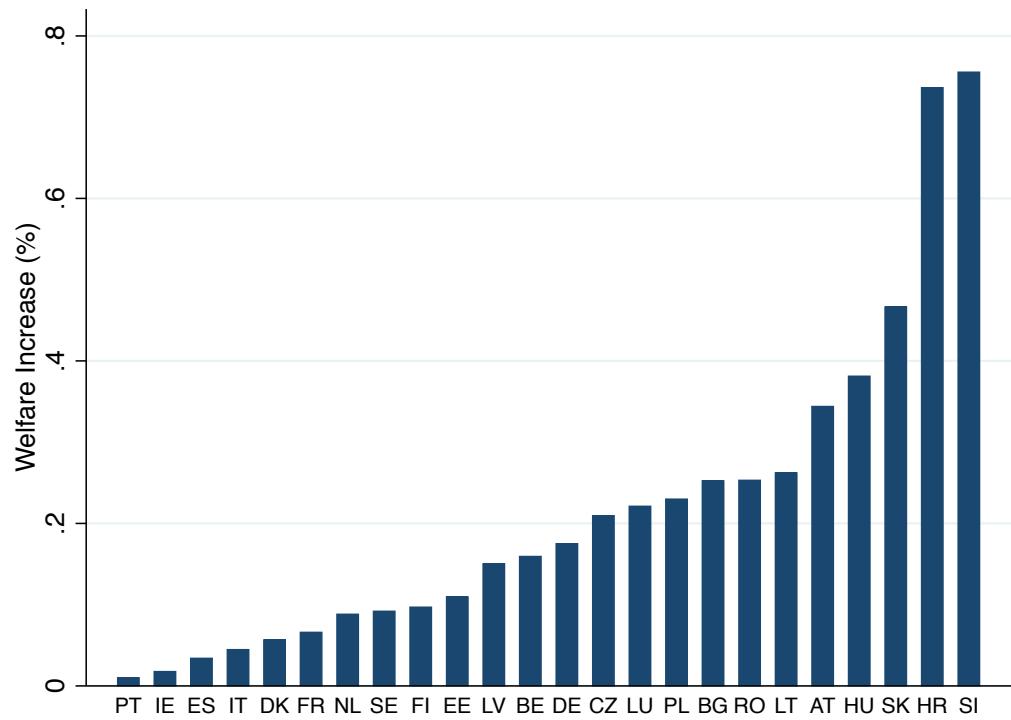
Notes: This figure studies how posting affects sending firms located in Portugal, one of the main suppliers of posting services in Europe. I use exhaustive administrative tax records of Portuguese firms merged with administrative records of services performed in another EU country from 2006 to 2017 to select the 4,151 firms (with a median of more than three employees over the period) that start posting workers abroad for the first time between 2010 and 2015. The figure plots the estimated event study coefficients θ_k from Equation (10) for the period 2006–2017 where the dependent variable is log wage rate (Panel A) and log earnings before taxes (Panel B). The event is defined as the first time a Portuguese firm provides non-tradable services in another EU country. The coefficient of the year before the first posting θ_{-1} is normalized to zero. The regressions include firm and five-digit sector \times calendar year \times province fixed effects. θ_k compares the outcomes of posting firms in event year k to the outcomes of future posting firms in the same narrowly defined sector and province in the year before their event. The vertical line represents 95% confidence intervals computed from robust standard errors clustered at the calendar year \times province level. The event study coefficients plotted in the figure are reported in Columns (1)-(2) of Table 8. The dataset and estimation sample are described in Appendix G. Estimates accounting for heterogeneous treatment effects are presented in Figure A.42, and estimates using never-posting firms as an additional control group are similar and presented in Table 8 and Figure A.41.

Figure 14: Effects of the Liberalization Reform on Sending Country Employment



Notes: This figure shows the aggregate employment effects of posting openness for Poland, the first supplier of posting services since 2005. The analysis is a triple differences approach that compares employment in exposed versus unexposed sectors before and after an exogenous posting openness shock in countries affected and not affected by the shock. Poland became a EU member state in 2004. That year, all mobility restrictions for employees posted by Polish suppliers were lifted, except for postings from Poland to Austria and Germany that were deregulated in 2011 (the first-stage effects of these mobility reforms are analyzed in Figure 4). Most of the postings from Poland occur in the construction sector, while regulated sectors like health, education, or public administration are covered by licensing regulations that prevent them from being performed abroad. Construction services can only be exported through posted workers: construction sectors should be directly affected by the liberalization but not by other trade tariff liberalizations that could occur simultaneously with the EU accession event. Panel A shows the differential evolution of Polish employment in exposed (red series) versus non-exposed sectors (blue series) before and after the posting openness shock of 2004 (red vertical line). Panel B repeats the analysis for a neighboring country, Ukraine, that never gained access to EU membership and therefore to free posting in the EU.

Figure 15: Consumer Gains from Removing Posting Mobility Restrictions Since 2004



Notes: This figure plots the distribution of aggregate consumer welfare gains following the lifting of mobility restrictions for employees posted for firms located in new member states, for each country in the European Union. The welfare effects of the change in posting policy accounts for general equilibrium effects and is based on equation (18) and equation (19).

9 Tables

Table 1: Magnitude of Provision of Services Through Posted Workers in the EU

| A- Overall Internationally Mobile Service Trade Within-EU (2017) | | | | | |
|---|------------------------------|----------------------------------|--|--|--|
| | Posting forms (thousands) | Posting flows (billion euros) | | | |
| Within-EU | 1,730 | 314 | | | |

| B- Worker and Firm Level Exposure | | | | | |
|--|---------------------------|-----------------------|--|---------------------------------|-----------|
| | Sending firms per year | Ever sending firms | Employees at sending firms per year | Sent posted workers per year | Period |
| Portugal | 5,938 | 19,437 | 181,549 | - | 2006-2017 |
| Luxembourg | 1,884 | 6,891 | 137,272 | 11,433 | 2004-2019 |
| | Using firms per year | Ever using firms | Employees at using firms per year | Posted workers per year | Period |
| France | 12,780 | - | 3,358,236 | 227,991 | 2017-2019 |
| Belgium | 9,300 | 23,305 | - | 236,791 | 2014-2019 |

Notes: The table summarizes descriptive statistics on the magnitude of posting of workers in the European Union. The top panel describes posting flows at the EU level. The number of posting forms issued in 2017 is based on mandatory social security forms that posted workers must hold when providing services abroad. The monetary value associated with these flows is computed by applying the standard balance of payment methodology (MSITS 2010) to service trade flows in the entire EU by BPM6 sectors, which allows me to recover provision of services through the movement of natural persons (mode 4). The bottom panel is based on country-level micro registries on postings. Data for postings from Portugal are based on exhaustive firm-level tax declarations merged with information on services provided in another EU country from 2006 to 2017 (Appendix G). Data on postings from Luxembourg are based on exhaustive firm-level payroll declarations covering all job spells in Luxembourg merged with information on services provided in another EU country from 2004 to 2020 (Appendix I). Data for postings to France are based on exhaustive posting declarations filed by foreign suppliers performing services in France merged with French-linked employer-employee data (Appendix H). Data for postings to Belgium are based on exhaustive posting declarations filed by foreign suppliers performing services in Belgium merged with Belgian-linked employer-employee data (Appendix H). The number of sending (using) firms relates to the number of firms that export (import) posting each year, while the number of never-sending (using) firms relate to the unique number of firms that exported (purchased) posting services during the period of observation.

Table 2: Causal Effect of the Liberalization on Posting service flows

| | Europe-Wide Event-Study | | |
|---|-------------------------|------------------|-----------------|
| | (1) | (2) | (3) |
| 4 years before liberalization | -.53 (.58) | | |
| 3 years before liberalization | -.05 (.31) | | |
| 2 years before liberalization | -.15 (.47) | | |
| Year of liberalization | 1.89*** (.35) | | |
| 1 year after liberalization | 2.11*** (.49) | | |
| 2 years after liberalization | 2.79*** (.53) | | |
| 3 years after liberalization | .88*** (.32) | | |
| 4 years after liberalization | 1.08*** (.32) | | |
| 5 years after liberalization | .99*** (.35) | | |
| 6 years after liberalization | 1.55*** (.37) | | |
| 7 years after liberalization | 1.91*** (.47) | | |
| 8 years after liberalization | 1.3*** (.63) | | |
| Average Mobility Effect (β) | | 1.83*** (.37) | .75*** (.13) |
| Observations | 853 | 853 | 953 |
| Origin-Destination FE | Yes | Yes | Yes |
| Destination \times Year FE | Yes | Yes | Yes |
| Origin \times Year FE | Yes | Yes | Yes |
| Estimation | Log | Log | PPML |

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table summarizes the effects of lifting entry barriers for foreign suppliers' employees on within-EU posting flows. The dependent variable is the number of posting services from country i to country j at time t in log (Log) or levels (PPML). The identification strategy exploits the staggered timing of the exogenous liberalization reform across sending and receiving countries within the EU as exemplified in Figure 3. The treatment is defined as country i gaining the right to post workers without reentry restrictions in country j at time t . The event study is restricted to receiving countries for which flows of posted workers can be observed before the liberalization in country-level datasets (Austria, Belgium, Germany, and France). Column (1) shows the dynamic effects following Equation (1) and shown in Figure 4. Columns (2) and (3) estimate average effects of liberalizing services exports mobility following Equation (??). In parentheses are robust standard errors clustered at the origin-destination level. Figure ?? shows the estimates accounting for heterogeneous treatment effects.

Table 3: Pre-Reform Exposure to Posting: First-Stage

| Dependent variable | Exposure in 2015 | | | | | Exposure 2005-2015 |
|--------------------|----------------------------------|--------------------------------|---------------------------|-----------------------------|------------------------------|----------------------------------|
| | Baseline 2003 Exposure (1) | 2000 Industry Shares (2) | Distance to NMS (3) | Regional Exposure (4) | Exposure Leave-Out (5) | Baseline 2003 Exposure (6) |
| Rank-Rank | 0.32*** (.04) | 0.20*** (.09) | -0.23*** (.10) | 0.29*** (.10) | .32*** (.09) | .47*** (.09) |
| Observations | 94 | 94 | 94 | 94 | 94 | 94 |
| Log-Log | .20*** (.05) | .24*** (.05) | -1.3*** (.54) | .23*** (.05) | .15** (.07) | .29*** (.05) |
| F stat | 14.7 | 15.2 | 6 | 16.7 | 4 | 26.6 |
| Observations | 94 | 94 | 94 | 94 | 94 | 94 |

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. Robust standard errors in parentheses. This table summarizes the predictive power of measures of French provinces' exposure to the nation-wide 2004 reform. The dependent variable is province-level exposure to posting after the liberalization (in 2015), measured as province-level posting flows in 2015 divided by total employment in that province in 2015. The number of posting flows to France in 2003 was 11,200, this number was 280,000 in 2015. The baseline measure of pre-reform exposure is based on 2003 posting flows in each French province, computed by interacting province-level industry shares in exposed sectors and region-sectoral-level posting flows in 2003 (Equation (2)). The pre-reform level of posting inflows is normalized by total employment in that province in 2003, as for the post-reform exposure measure, to capture pre-reform intensity of posting use rather than province's size. Column (2) uses industry shares from 2000 to compute the pre-reform exposure. Column (3) uses geographic distance to NMS countries as an alternative predictor for post-reform posting exposure. Column (4) only uses observed information on region-level posting flows, and measures province-level exposure to posting in 2003 as the share of posting flows in total regional employment in 2003 for all provinces in the same region.

Table 4: Effect of Posting Exposure on Receiving Country Employment

| Dependent Variable (log) | Difference-in-Differences: Estimates of ζ Top vs Bottom Exposure, Before and After 2004 | | | | | |
|--------------------------|--|-----------------------------|------------------------|--------------------------|---------------------------|-----------------------|
| | Baseline (1) | 2000 Industry Shares (2) | Distance to NMS (3) | Regional Exposure (4) | Exposure Leave-Out (5) | Top20 Bottom20 (6) |
| | | | | | | |
| Postable Employment/pop | -.057*** (.007) | -.053*** (.011) | -.072*** (.008) | -.047*** (.007) | -.041*** (.008) | -.049*** (.009) |
| Observations | 46 | 46 | 46 | 46 | 46 | 46 |
| Postable Employment | | | | | | |
| | -.068*** (0.010) | -.044*** (.009) | -.090*** (.011) | -.048*** (.007) | -.030*** (.007) | -.057*** (.01) |
| Observations | 46 | 46 | 46 | 46 | 46 | 46 |
| Total Unemployment | .051*** (.013) | .10*** (.018) | .073*** (.014) | .054*** (.015) | .053*** (.015) | .067*** (.013) |
| Observations | 46 | 46 | 46 | 46 | 46 | 46 |

| Panel B | First difference: $\Delta(Emp_{pt})$, 2003-2015 | | | | | |
|----------------------|--|-------------------|--------------------|--------------------|-------------------|--------------------|
| | OLS (7) | IV (8) | IV (9) | IV (10) | IV (11) | IV (12) |
| β | -.024*** (.005) | -.11*** (.035) | -.075*** (.020) | -.087*** (.030) | -.043** (.123) | -.109*** (.035) |
| FStat | | 14.73 | 26.62 | 26.62 | 20.1 | 15.2 |
| Observations | 94 | 94 | 94 | 94 | 94 | 94 |
| Instrument | | Baseline | Baseline | Baseline | Baseline | 2000 Shares |
| $\Delta(Emp_{pt})$ | In pop | In pop | In pop | In level | Excl. Industry | In pop |
| Post-reform Exposure | | 2015 | 2005-2015 | 2005-2015 | 2005-2015 | 2015 |
| | | | Average | Average | Average | |

Notes: *p<0.10, **p<0.05, ***p<0.01. The top panel shows the estimates of the difference-in-differences model described by Equation (3). Provinces are grouped by top or bottom exposure, and one observation is at the year-exposure level, from 1989 to 2015. The dependent variable is the log employment of French workers in sectors exposed to posting, in level or in share of the working age population. Sectors exposed to posting are sectors for which non-zero posting exposure can be observed before the 2004 shock. The coefficient η captures the differential evolution of domestic employment in French provinces with high and low exposure to posting, before and after the exogenous supply shock of 2004. The bottom panel shows the estimates of the IV model where local posting exposure in 2015 is instrumented by the initial posting exposure. More details are provided in the text.

Table 5: Dynamic of Receiving Firms Employment and Wages After First Posting Use Event

| Dependent Variable (in log) | (1) Total Employment | (2) Wage Rate | (3) Blue Collar Workers | (4) Other Workers |
|-----------------------------|-------------------------|-------------------|----------------------------|----------------------|
| 4 years before event | .0081* (.00490) | .0011 (.0018) | .0059 (.0054) | -.0257 (.2080) |
| 3 years before event | .0059 (.0050) | .00104 (.0018) | .0038 (.0058) | -.0697 (.1941) |
| 2 years before event | .0024 (.0045) | .0007 (.0019) | .0071 (.0055) | .2889 (.4657) |
| Year of event | -.0222*** (.0066) | .0001 (.0022) | -.0223*** (.0076) | -.2210 (.3087) |
| 1 year after event | -.03054*** (.0103) | -.0015 (.0031) | -.0393*** (.0116) | -.5621 (.5307) |
| 2 years after event | -.0610*** (.0141) | -.0045 (.0040) | -.0533*** (.0154) | -.7750 (.7603) |
| 3 years after event | -.1062*** (.0189) | -.0026 (.0479) | -.0935*** (.0202) | -1.362 (1.012) |
| 4 years after event | -.1586*** (.0236) | -.0018 (.0066) | -.1208*** (.0258) | -.9746 (1.291) |
| Firm FE | Yes | Yes | Yes | Yes |
| Year×3DSect | Yes | Yes | Yes | Yes |
| Never Using Firms | No | No | No | No |
| # of Observations | 90,146 | 90,146 | 68,718 | 90,146 |

Notes: *p<0.10, **p<0.05, ***p<0.01. This table reports the estimates of domestic employment responses to the use of posting services by Belgian firms. The estimates are based on Equation (5).

Table 6: Posting Employment Pay Penalty

| | Outcome: Log Wage | | | |
|-----------------------------|-------------------|-------------------|-------------------|-------------------|
| | (1) | (2) | (3) | (4) |
| Posting Arrangement | -.32*** (.002) | -.30*** (.004) | -.30*** (.004) | -.34*** (.003) |
| Temp Employment Arrangement | | | | -.12*** (.001) |
| Firm FE | Yes | Yes | Yes | Yes |
| Polynomial Age | No | Yes | Yes | Yes |
| Log Hours of Work | No | Yes | Yes | Yes |
| Year Fe | Yes | Yes | No | Yes |
| Observations | 13,144,061 | 13,144,045 | 13,144,045 | 13,144,045 |

Notes: The table compares posted and domestic workers' wage *within a workplace* in the second largest importer of posting services: France. I use the universe of mandatory posting declarations filed by foreign suppliers that send posted workers in the French territory (DPD/SIPSI dataset) to identify the 19,138 French firms that purchased a posting contract at some point in 2017-2018 and for which at least one domestic job record exist in the 2017-2018 DADS postes dataset, a linked employer-employee dataset covering all job spells in France during that period. Merging the DADS with the posting registry, I can observe wages paid to French workers (reported in DADS by French employer) and posted workers (reported in DPD/SIPSI by foreign supplier) at the same workplace in France. For the sample of receiving firms in 2017-2018, I regress workers' log wage on an indicator equal to one if the workers is in a posting arrangement, controlling for firm fix effects, cubic age, and number of hours worked.

Table 7: Sending Firms' Expansion Around the First Posting Event

| Dependent Variable (in log) | (1) Turnover | (2) Wage Bill | (3) Hours Worked | (4) Employees | (5) Total Assets |
|---------------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| 4 years before event | -0.0644 (.0518) | -0.0446 (.0546) | -0.0280 (.0428) | -0.0446 (.0301) | -0.0446 (.0442) |
| 3 years before event | -0.0144 (.0440) | .0316 (.0486) | .0343 (.0376) | -0.00121 (.0250) | .00508 (.0402) |
| 2 years before event | .0395 (.0387) | .0649 (.0431) | .0447 (.0349) | .0184 (.0225) | .0296 (.0377) |
| Year of event | .153*** (.0458) | .269*** (.0593) | .143*** (.0419) | .139*** (.0263) | .256*** (.0411) |
| 1 year after event | .449*** (.0506) | .562*** (.0600) | .395*** (.0419) | .269*** (.0305) | .426*** (.0469) |
| 2 years after event | .381*** (.0569) | .501*** (.0664) | .344*** (.0473) | .249*** (.0350) | .449*** (.0529) |
| 3 years after event | .330*** (.0670) | .457*** (.0730) | 0.293*** (.0540) | .211*** (.0408) | .440*** (.0595) |
| 4 years after event | 0.298*** (.0787) | 0.414*** (.0858) | .293*** (.0645) | .198*** (.0490) | .403*** (.0722) |
| Firm FE | Yes | Yes | Yes | Yes | Yes |
| Year \times 5DSect \times Prov FE | Yes | Yes | Yes | Yes | Yes |
| Never Posting Firms | No | No | No | No | No |
| # of Observations | 29,754 | 29,971 | 29,880 | 29,972 | 30,851 |

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports the event study estimates from the empirical specification described by Equation (10) for the period 2006-2017, focusing on the 4,151 firms that post workers for the first time between 2010 and 2015. The regressions include firms and five-digit industry \times province \times year fixed effects. Robust standard errors are clustered at the event year \times province level to account for spatial autocorrelation of errors terms. The estimation sample is described in detail in Section §G.

Table 8: Dynamic Effects of First Posting on Firms' Wages and Profits

| Dependent Variable (in log) | (1) Wage Rate | (2) Profits | (3) Wage Rate | (4) Profit |
|---------------------------------------|---------------------|--------------------|---------------------|--------------------|
| 4 years before event | .00996 (.0161) | -0.0183 (.0545) | .00354 (.0191) | .0184 (.0737) |
| 3 years before event | .00455 (.0154) | .0231 (.0411) | .00154 (.0153) | .0190 (.0523) |
| 2 years before event | .0129 (.0156) | .0284 (.0379) | .0126 (.0141) | .0169 (.0506) |
| Year of event | .0834*** (.0200) | .0932** (.0429) | .0932*** (.0138) | .0887** (.0420) |
| 1 year after event | .119*** (.0213) | .304*** (.0478) | .134*** (.0172) | .318*** (.0508) |
| 2 years after event | .102*** (.0201) | .266*** (.0438) | .126*** (.0208) | .289*** (.0736) |
| 3 years after event | .106*** (.0198) | .256*** (.0479) | .131*** (.0262) | .275*** (.0823) |
| 4 years after event | .0835*** (.0185) | .255*** (.0465) | .116*** (.0296) | .287*** (.105) |
| Firm FE | Yes | Yes | Yes | Yes |
| Year \times 5DSect \times Prov FE | Yes | Yes | Yes | Yes |
| Never Posting Firms | Yes | Yes | No | No |
| # of Observations | 235,471 | 167,496 | 29,880 | 23,118 |

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports the event study estimates from the empirical specification described by Equation (10) for the period 2006-2017. The estimation sample is restricted to the 4,151 firms that post workers for the first time between 2010 and 2015 in Columns (3)-(4), while Columns (1)-(2) use the 28,803 firms that never post workers over the period as an additional control group. The regressions include firms and five-digit industry \times province \times year fixed effects. Robust standard errors are clustered at the event-year \times province level to account for spatial autocorrelation of errors terms. The estimation sample is described in detail in Section §G.

Table 9: Elasticity of Posting Flows to Policy-Induced Labor Cost Changes

| Panel A: Full Gravity Estimation | | | | | | | | |
|--|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Regressor: Log Payroll Taxes | (1) | (2) | (3) | (4) | (5) | (6) | (7) | |
| Posting Elasticity ($-\theta$) | -.71*** (.20) | -.75*** (.21) | -.66*** (.21) | -1.2*** (.20) | -1.2*** (.21) | -.75** (.33) | -1.1*** (.38) | |
| Regressor: Log Total Wage Cost | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) |
| Posting Elasticity ($-\theta$) | -.78*** (.23) | -.82*** (.24) | -1.2*** (.15) | -1.4*** (.25) | -1.4*** (.27) | -.97*** (.27) | -2.4*** (.47) | -1.1*** (.19) |
| Observations | 4,665 | 4,455 | 4,723 | 4,665 | 4,455 | 4,723 | 4,723 | 4,667 |
| Origin-Destination FE | Yes |
| Destination \times Year FE | Yes |
| Origin \times Year FE | No | Yes |
| Weighted | No | No | No | Yes | Yes | Yes | No | No |
| Estimator | OLS | OLS | PPML | OLS | OLS | PPML | MPPML | MPPML |
| Internal Flows | Yes | No | No | Yes | No | No | No | No |

Panel B: Quasi-Natural Experiment Estimates

| | Slovenian Posted Bonus ($\Delta\tau_{it}$) | Belgian Tax Shift ($\Delta\Phi_{jt}$) | German Min Wage (Δa_{ijt}) |
|--|---|--|---|
| Posting Elasticity ($-\theta$) | -1.6*** (.33) | -1.4*** (.42) | -1.3*** (.27) |

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. Posted workers are exempt from labor taxes in the receiving country: all payroll taxes during the posting mission are paid in the sending country. Posted workers cannot be paid less than destination-level minimum wage: they must receive an additional posting allowance to match that “prevailing regulatory wage.” I exploit within destination-year or within country-pair-year-level variation generated by payroll tax exemptions or differentially binding minimum wages to identify the elasticity of posting flows with respect to labor cost. Panel A estimates the structural gravity Equation (20) on the full matrix of bilateral posting flows within the EU merged with data on employers’ labor cost for each country pair (origin-specific wage and payroll taxes combined with destination-specific posting allowance) for 2009-2017. Each column is from a separate regression. The dependent variable is the number of postings from i to j at time t (S_{ijt}); in log for specifications relying on a log-linear version of Equation (20) (OLS estimation); in levels for specifications relying on the multiplicative form of Equation (20) following Silva and Tenreyro [2006] (“PPML” Poisson pseudo maximum likelihood estimator); and in shares λ_{ijt} following Eaton et al. [2012] (“MPML” Poisson pseudo maximum likelihood estimator with trade shares as dependent variable). All specifications include destination-origin fixed effects, a dummy equal to one if mobility rules between country i and j changes at time t , and a destination-year fixed effect to control for the multilateral resistance structural term (Φ_{ijt}). Columns (1) to (7) exploit variations in (log) employers’ payroll taxes only, while Columns (8)-(14) exploit variations in (log) total employers’ labor cost. Weighted regressions use total population in sending countries to weight observations. Robust standard errors are clustered at destination-year level and are displayed in parentheses. Panel B displays the reduced-form posting elasticity estimates from difference-in-differences designs applied to three quasi-natural labor costs shocks induced by payroll tax reforms (in Belgium and Slovenia) and the introduction of minimum wage (Germany). Appendix D further documents bunching (Figure A.54) and difference-in-differences (Figure A.52) responses to two reforms in labor cost exemptions granted to posted workers in receiving countries.

Table 10: Model-Based Welfare Gains

| | All Mobility Restrictions | Mobility Restrictions Lifted since 2004 |
|-----------------------|---------------------------|---|
| Average Welfare Gains | +0.9% | +0.3% |
| Median Welfare Gains | 0.5% | 0.17% |

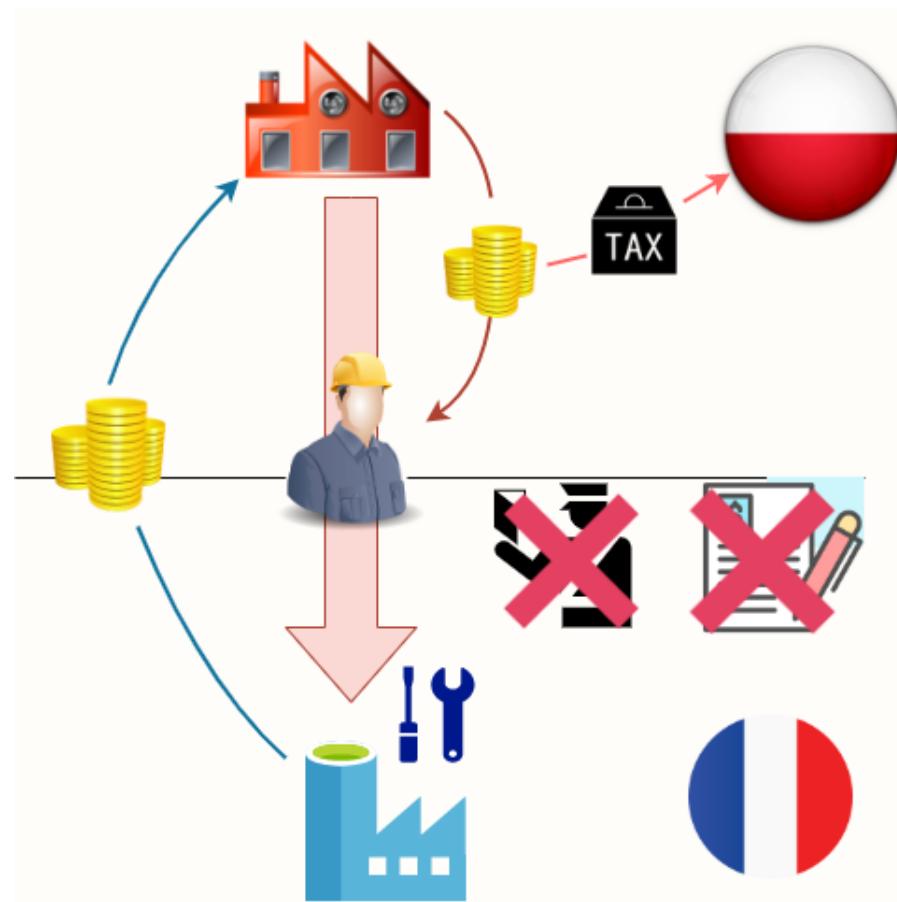
Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. This table summarizes the average and median welfare gains from lifting posting restrictions, as explained in the text. The calibration accounts for general equilibrium effects and is based on equation (18) and equation (19), and it uses estimates of the posting elasticity from theory-consistent estimations as presented in Table 9.

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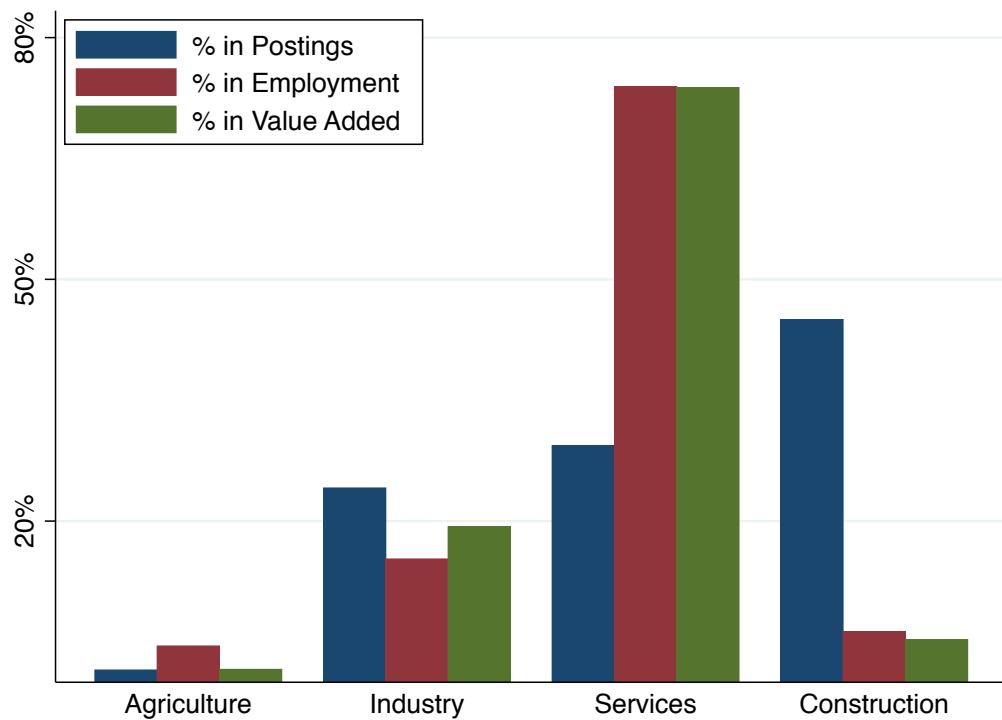
A Additional Figures and Tables

Figure A.1: Non-Tradable Services Export from Poland (PL) to Germany (DE)



Notes: This diagram summarizes the European posting policy that allows firms established in one member state to send their workers in another member state in order to perform a service. Sending firms do not need to request a work authorization in the receiving country. Employees sent abroad are hired in the sending country and never integrate the labor market where the service is provided while performing their activity in the receiving country. Posted workers are exempted from the receiving country's social security contributions and labor taxes, and they keep paying payroll taxes in the country where the sending firm is established. The exemption cannot exceed 12 or 24 months and can be repeated after a two-month break. Posted workers benefit from destination-level minimum wage. If their usual wage in the sending country is below the "prevailing wage," the sending firm must pay its workers an additional allowance to match the destination-level minimum legal wage. The posting policy only concerns the within-EU services provision. Firms located outside the EU must request a work and entry authorization in the receiving country.

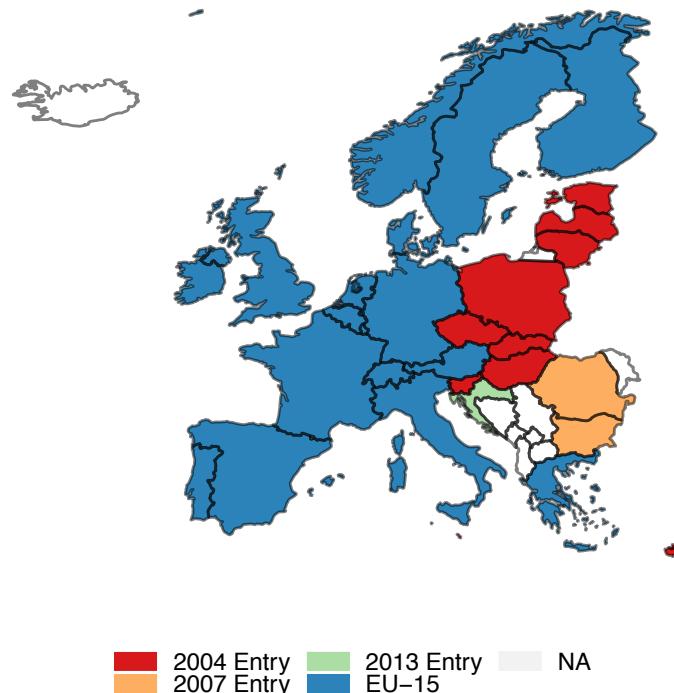
Figure A.2: Sectoral Decomposition of Overall Economic Activity and Postings Within EU



Notes: The Figure shows the sectoral decomposition of posting missions within the EU as well as the share of European value added and employment of each of these sectors. The Figure is based on mandatory social security forms E101/A1 that foreign employees must hold when they provide a service in another EU member state, this dataset is described in Appendix F. Statistics from EU-level employment and value added are from Eurostat economic indicators.

Figure A.3: Timing of Posting Liberalization

A. Three Waves of EU Accession Events

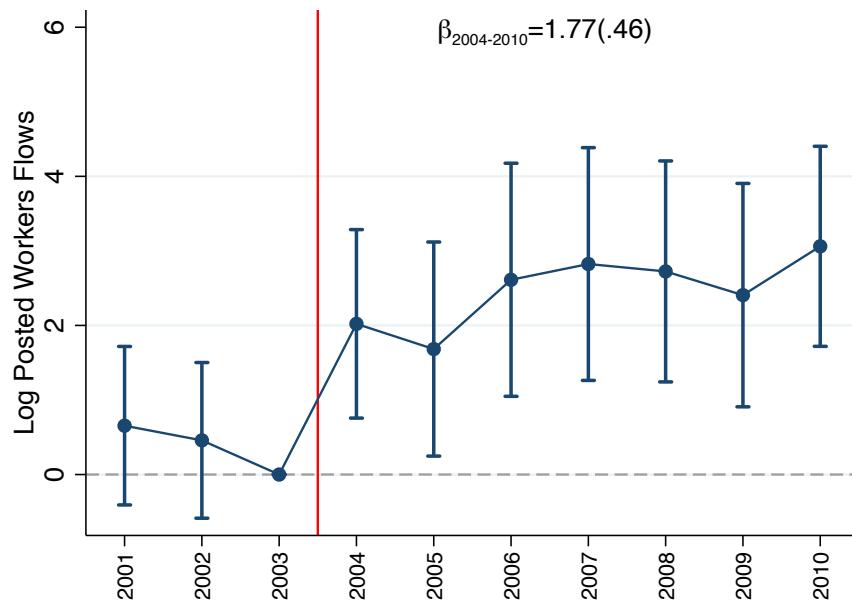


B. Staggered Timing Across Origin-Destination Set by the EC



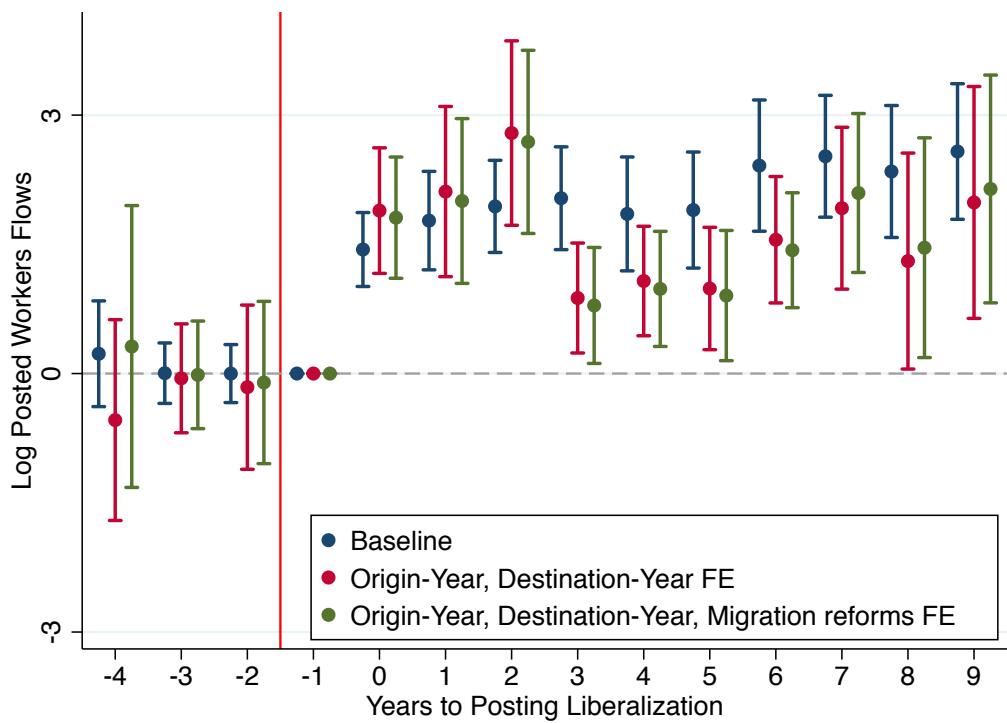
Notes: This Figure shows the timing of EU accession for new member states (NMS) located in Eastern European countries from 2004 to 2013. The EU enlargements of 2004, 2007 and 2013 triggered posting liberalization for successively 10 (Poland, Lithuania, Hungary, Estonia, Latvia, Slovakia, Slovenia, Czech Republic, Malta and Cyprus), 2 (Bulgaria and Romania) and 1 (Croatia) countries located in Eastern Europe. The bottom figure summarizes the differential timing posting mobility liberalization for some country pairs. Before EU accession, employees sent from these new member states to an EU member state had to request a work and entry authorization in the destination country. As detailed in the text, all destination countries lifted posting mobility restrictions at EU accession, while Germany and Austria were allowed by the European Commission to keep pre-existing entry barriers for 7 additional years following each EU accession events. After the lifting of mobility restrictions, destination countries have no right to refuse the foreign intervention performed by another EU member state in their territory.

Figure A.4: Robustness to Excluding Simultaneous Migration and Posting Reform Events



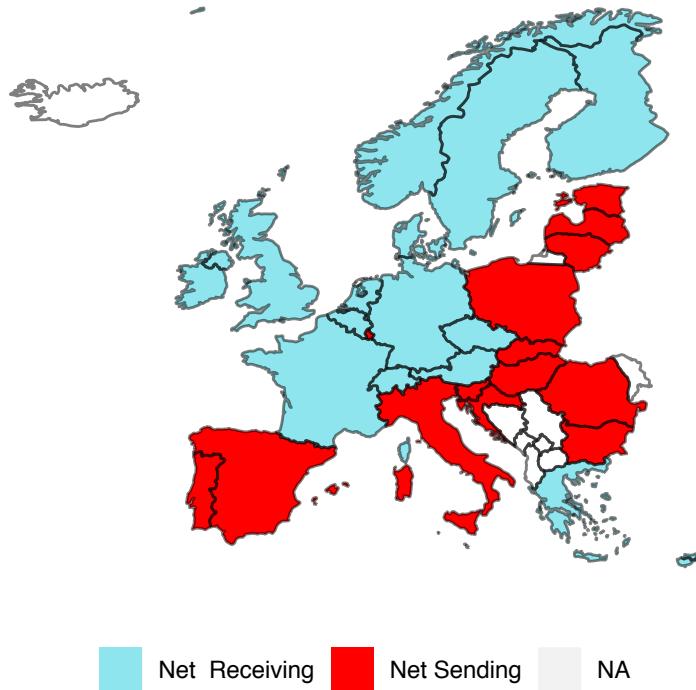
Notes: The Figure shows the effects of an origin-specific posting liberalization shocks on posted workers flows to France. In 2004, posting restrictions for countries that became EU members in 2004 (NMS 2004: Poland, Lithuania, Latvia, Estonia, Slovakia, Slovenia, Hungary, Czech Republic, Malta and Cyprus) were lifted. Posting restrictions for workers posted from NMS2004 were kept until 2011 in the German construction sector. In a triple differences design, Panel B compares the differential evolution of postings from countries treated and not treated by the 2004 enlargement, to France versus Germany where NMS 2004 were not granted the end of posting restrictions, controlling for destination and origin-year fixed effects.

Figure A.5: Robustness to Controlling for Bilateral Migration Reforms



Notes: The Figure repeats the baseline estimation Equation (1) adding as a control a dummy for bilateral migration reforms occurring at different timings than posting liberalization reforms.

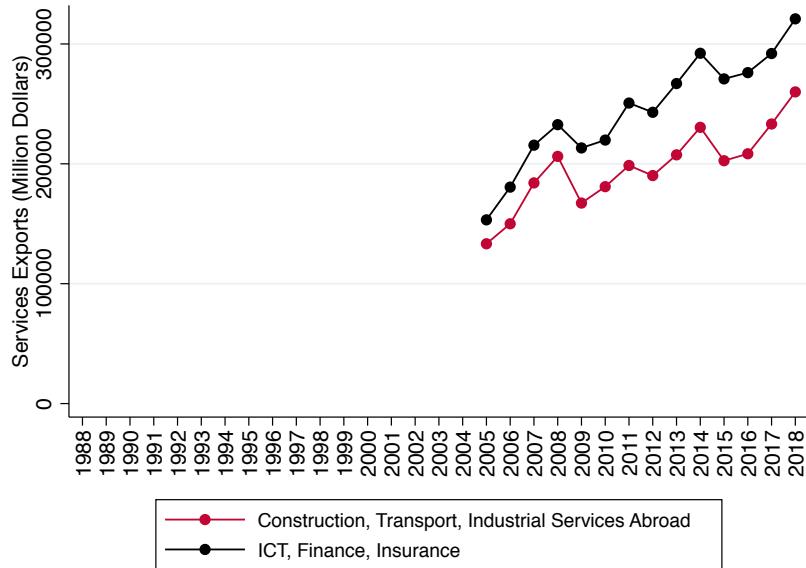
Figure A.6: The Geography of Services Offshored Through Posting of Workers



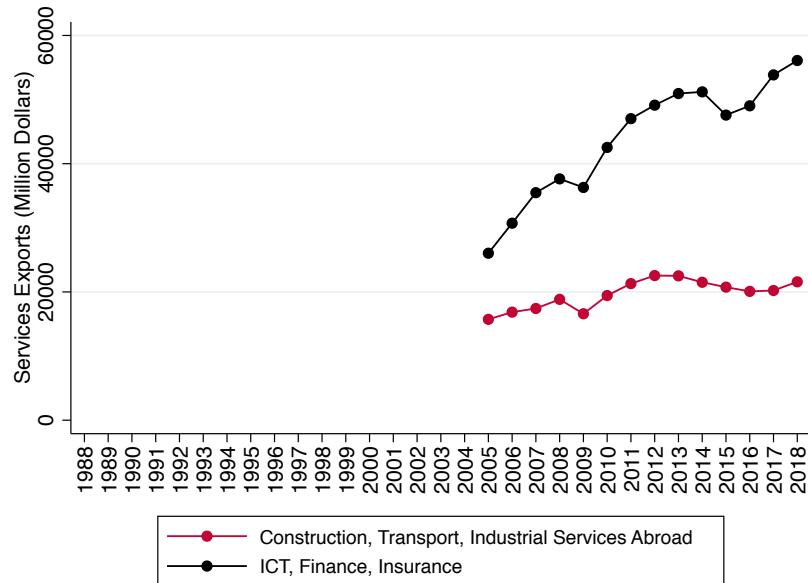
Notes: This Figure shows the location of consumers and providers of cross-border services performed through posting in Europe. The Figure is based on mandatory social security forms E101/A1 that foreign employees must hold when they provide a service in another EU member state, this dataset is described in Appendix F. Net sending countries (in red) are countries that performed more services in the EU by sending workers abroad compared to the number of services performed by workers posted to their territory. Net receiving countries (in blue) are countries that consumed more services performed by foreign workers posted to their territory compared to the number of services their domestic workers performed abroad.

Figure A.7: International Exposure of Non-Tradable Sectors: EU vs NAFTA

A. Within-EU service trade

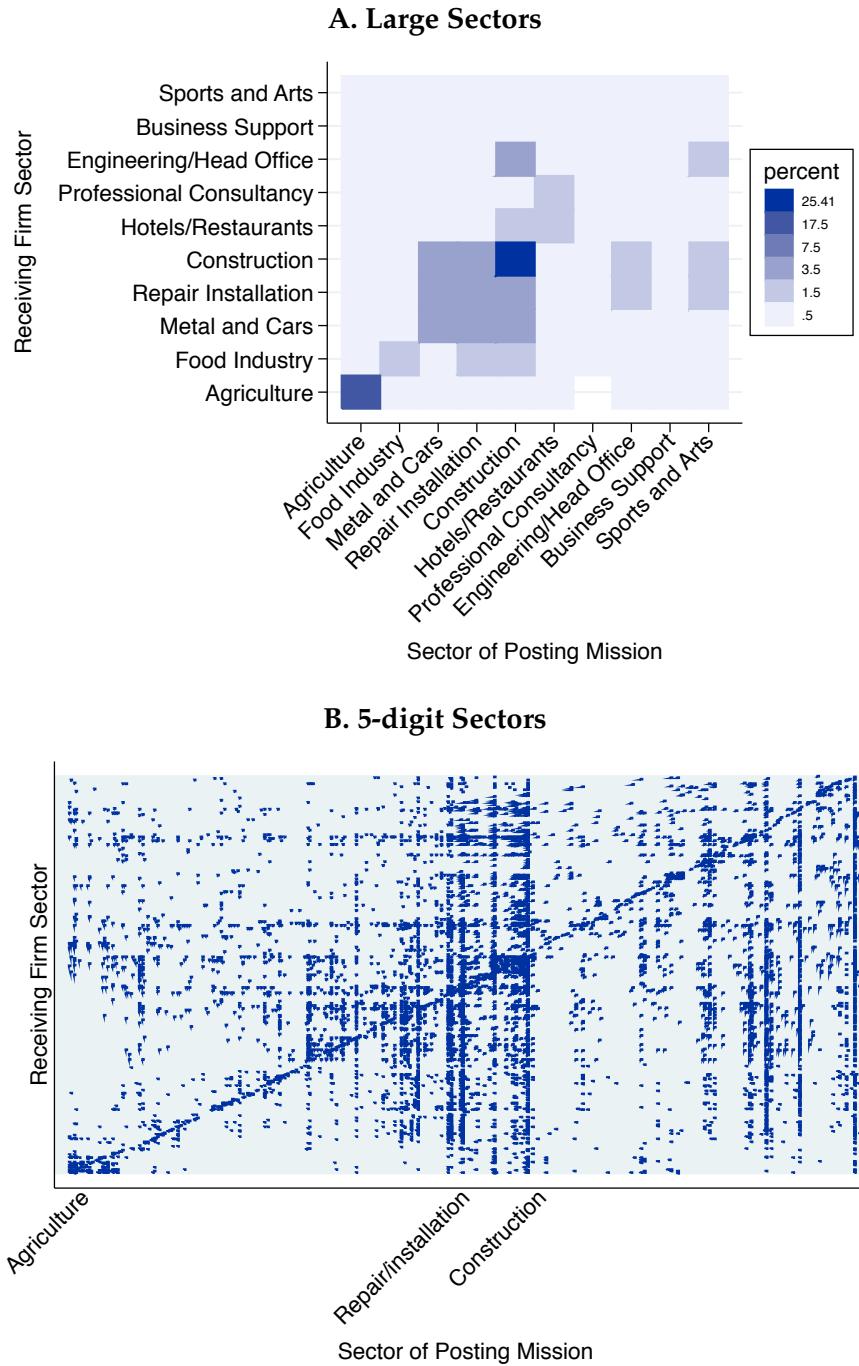


B. Within-NAFTA service trade



Notes: This figure compares non-tradable service trade within the EU and within the NAFTA since 2005. The figure is based on international data on service trade from the WTO for 12 sectors. I select sectors where trade is purely mobility dependent, e.g., services that must be produced locally: construction, transport, and manufacturing services performed on inputs owned by others. To measure trade in services in sectors that are less mobility dependent, I select sectors where services can be produced remotely and exchanged easily through electronic means: information and communications technology (ICT), finance, and insurance. This measure of provision of services through posted workers is a lower bound of mobility-dependent trade, as services in ICT, finance, and insurance can also be performed through posted workers. The quantification of total cross-border services within the EU is provided in Panel A of Table 1 and is described in Appendix ??: mobile service trade flows are worth 314 billion euros in 2017 and represented 1.7 million of posting missions.

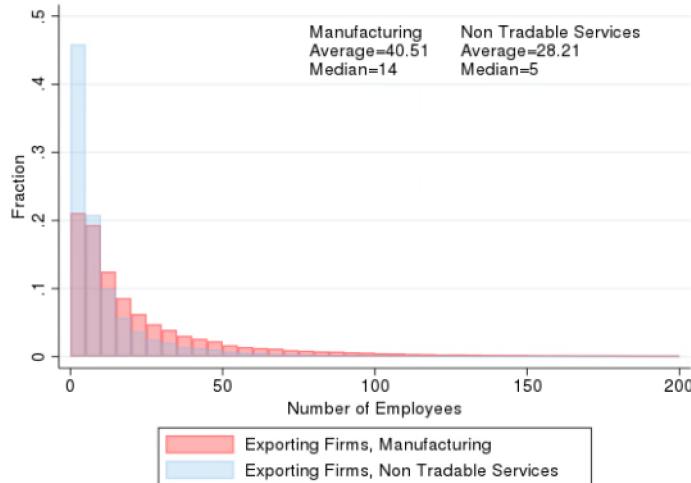
Figure A.8: Sector of Using Firm and Offshored Task



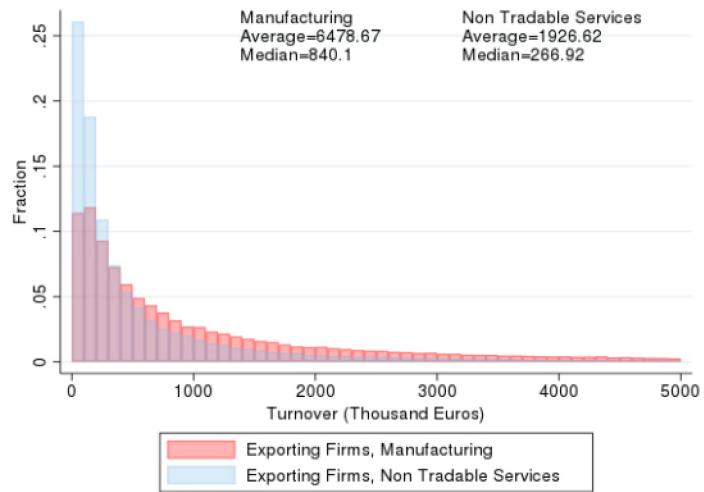
Notes: This Figure shows the sectoral decomposition of posting missions performed in the second largest importer of posting services: France. I use the universe of mandatory posting declarations filed by foreign suppliers that send posted workers in the French territory (DPD/SIPSI dataset) from 2016 to 2020. Since 2019, it is mandatory for foreign suppliers to report the 5-digit NACE code of the mission performed by foreign employees in France's territory. The identifier number of the using firm reported in the posting declaration further allows to recover the 5-digit NACE code of using firms' activity. I use these two informations to show the relationship between using firms' activity and type of activity offshored through posted workers, aggregated at the 2-digit level in top panel, and 5-digit level for bottom panel. Table A.9 and Table A.10 shows the underlying numbers for top posting sectors.

Figure A.9: Firms Exporting Through Posting Differ from Standard Exporters

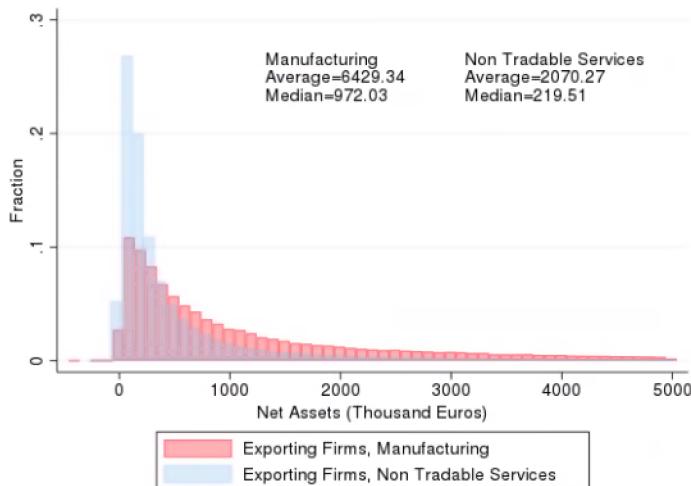
A. Number of Employees



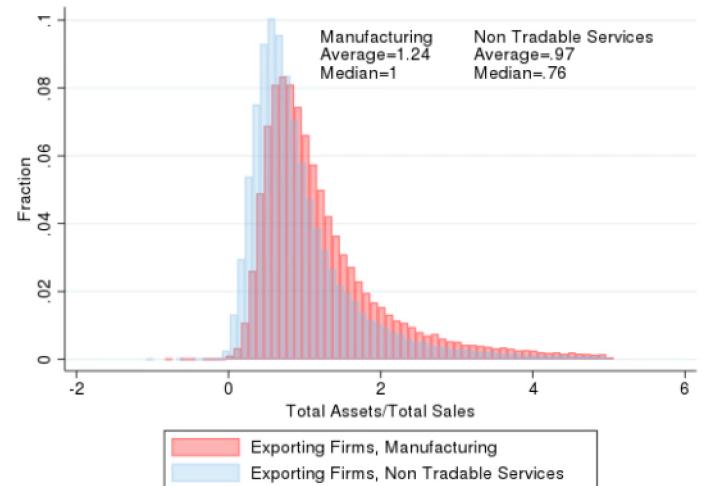
B. Turnover



C. Total Assets

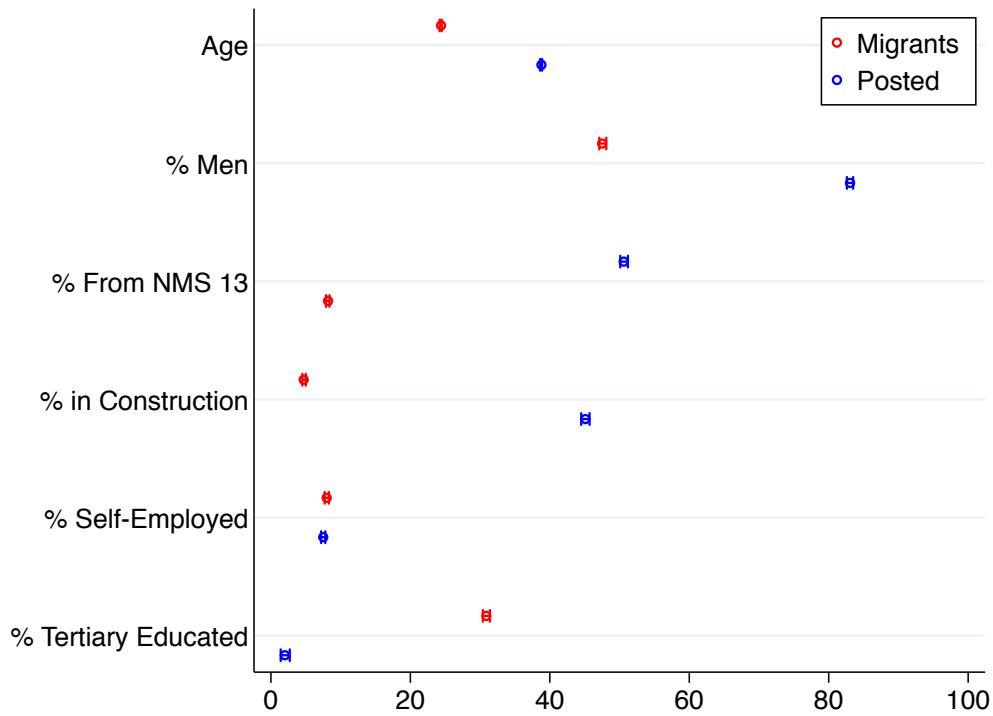


D. Capital Intensity



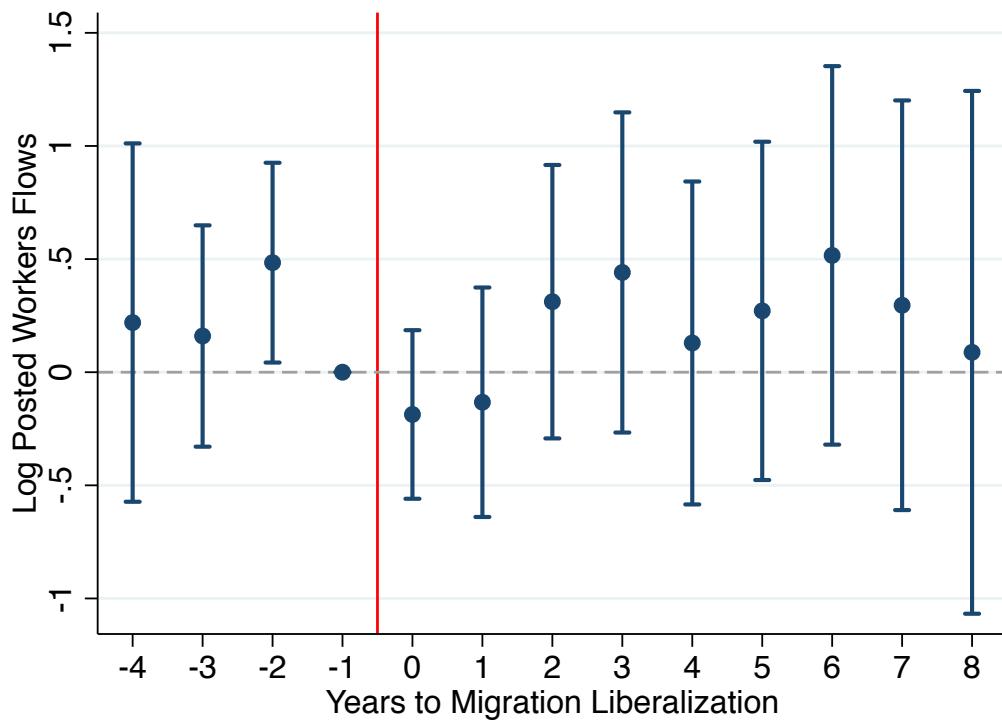
Notes: This figure compares characteristics of firms exporting standard manufacturing goods and non-tradable services in one of the main sending country in Europe, Portugal. It is based on exhaustive firm-level tax data covering all non-financial corporations operating in Portugal merged with exhaustive information on trade in goods and services transactions from 2006 to 2017. I use this information to track the 5,938 (11%) services suppliers that performed their activity in another EU country each year during this period and the 19,437 firms that exported a service through posted workers in EU at least once. Exporters of non-tradables operate in sectors listed in Table A.3. The graph shows the distribution of employees (Panel A), turnover (Panel B), assets (Panel C), and capital intensity (Panel D) for firms in manufacturing sectors (red) against firms in non-tradable sectors (blue), in the year in which these firms export manufacturing goods or non-tradable services. Table A.5 presents the regression equivalent of these graphs as well as exporter premium estimates. Data are described in Appendix G.

Figure A.10: Posted Workers Differ from Standard Migrants



Notes: The figure shows demographics of posted workers versus standard migrants for the second and third importer of posting services in Europe: France and Belgium. The LIMOSA dataset records all posting missions performed by foreign suppliers in Belgium from 2010 to 2020, with detailed information on posted workers' demographics (Appendix J). The SIPS dataset records all posting missions performed by foreign suppliers in France from 2016 to 2019 with detailed information on posted workers' demographics (Appendix H). In 2019, 227,991 unique posted workers were in France and 269,235 to Belgium. For posted workers, being tertiary educated is proxied by having a managerial job, and this information is only available for workers posted to France. Self-employed posted workers are only recorded in Belgium. Demographics for migrants come from the EU-LFS dataset, a continent-wide European survey. Migrants are defined as working-age foreigners who live permanently in France or Belgium. For posted workers, all demographics are measured in the year of the posting mission. For migrants, all characteristics are measured at the time of the survey, but age is the age at which they arrived in the receiving country (France or Belgium). NMS 13 refers to the 13 new member states that entered in the EU since 2004 and are located in Eastern Europe (figure A.3). More on posted workers and migrants comparison are in Appendix E.

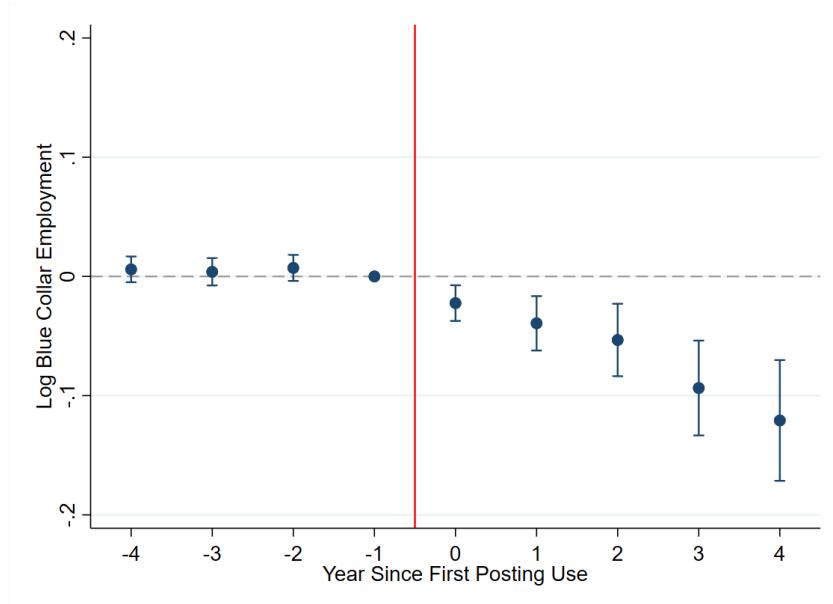
Figure A.11: Posted Workers Flows Responses to Standard Migration Reforms



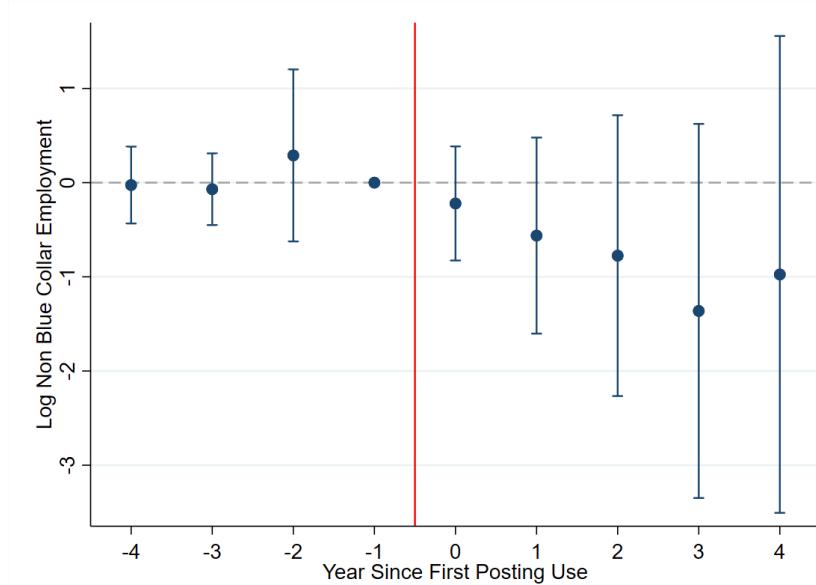
Notes: The figure shows posting flows responses to a change in standard migration reforms, when posting and standard migration are liberalized in different years.

Figure A.12: Firm-Level Displacement: Heterogenous Workers Exposure Within-Firm

A. Blue Collar Employment at Receiving Firms

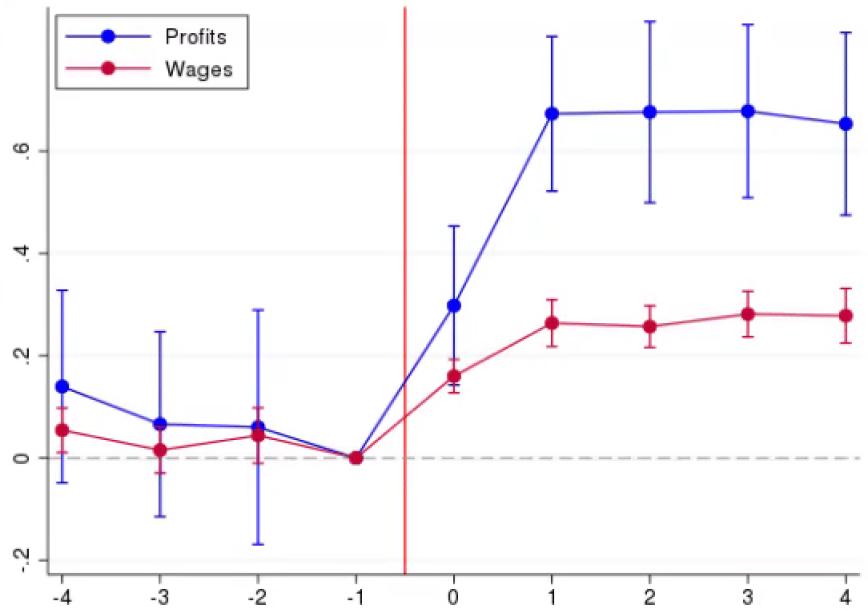


B. Other Employment At Receiving Firms



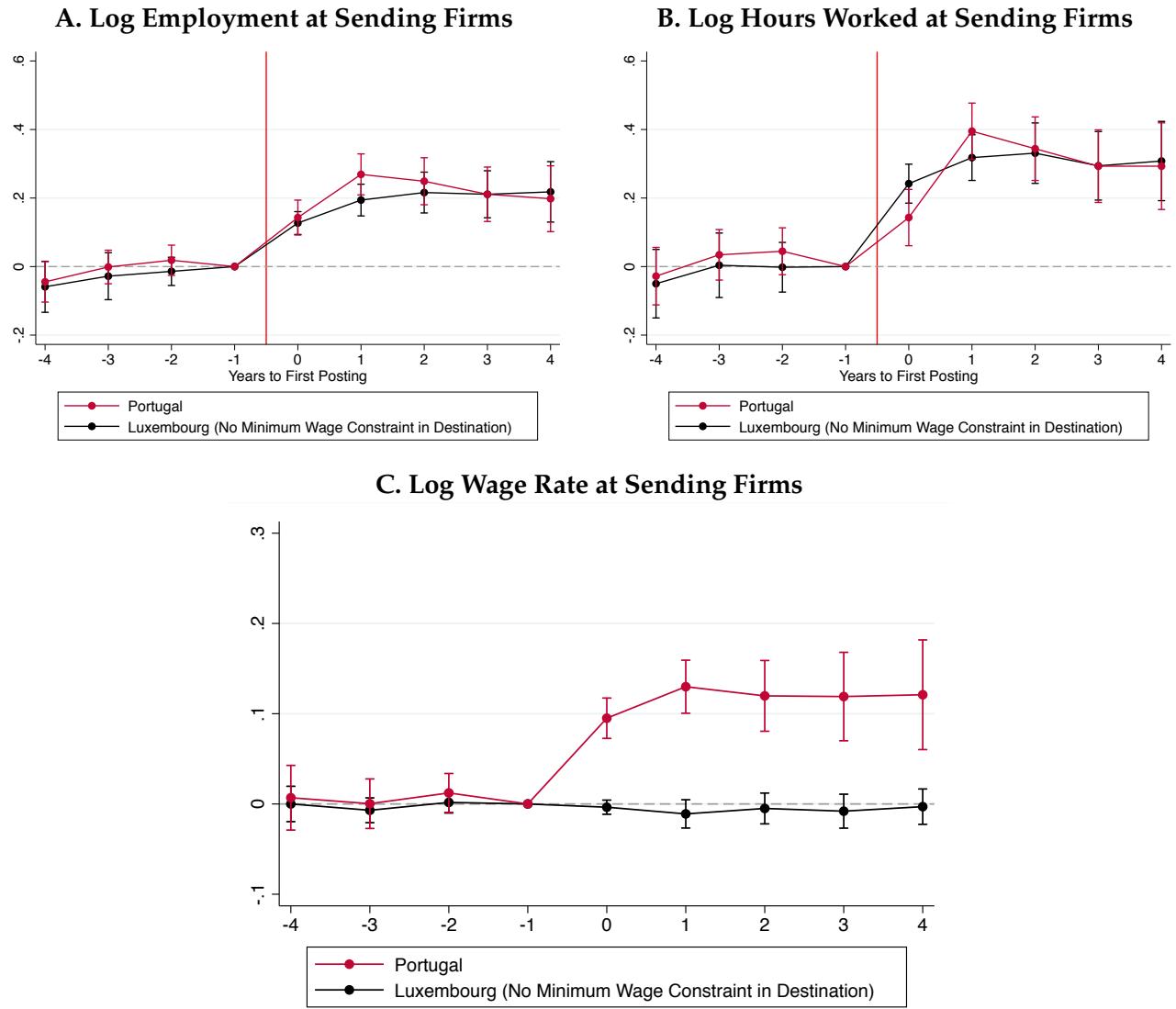
Notes: This figure uses exhaustive administrative posting records of Belgian firms merged with administrative employment data to select the 11,796 firms that started using posted workers for the first time between 2014 and 2019. The figure plots the estimated event study coefficients γ_k from Equation (5) for the period 2008-2019, where the dependent variable is log blue collar employment (Panel A) and log employment of other workers (Panel B). The event is defined as the first time a Belgian firm sources services to foreign posted employees. The coefficient of the year before the first posting use γ_{-1} is normalized to zero. The regressions include firm and three-digit sector \times calendar year. γ_k compares the outcomes of receiving firms in event year k to the outcomes of future posting firms in the same narrowly defined sector in the year before their event. The vertical line represents 95% confidence intervals computed from robust standard errors clustered at the calendar year \times province level.

Figure A.13: Profits-Wage Split At Permanent Sending Firms



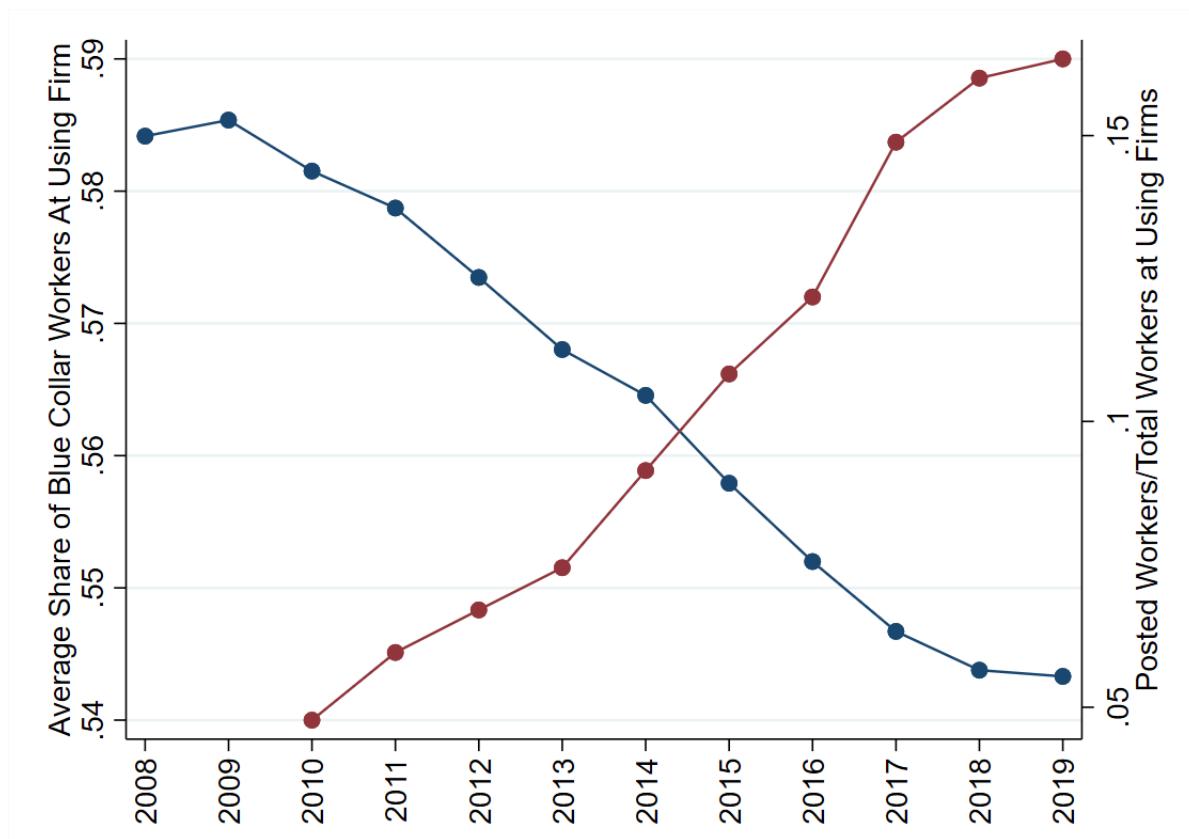
Notes: This figure studies how posting affects sending firms located in Portugal, one of the main suppliers of posting services in Europe. I use exhaustive administrative tax records of Portuguese firms merged with administrative records of services performed in another EU country from 2006 to 2017 to select the 4,151 firms (with a median of more than three employees over the period) that start posting workers abroad for the first time between 2010 and 2015. This figure restricts the analysis to sending firms that permanently provide services abroad after their first posting event. The figure plots the estimated event study coefficients θ_k from Equation (10) for the period 2006-2017 where the dependent variable is log wage rate (pink series) and log earnings before taxes (blue series). The event is defined as the first time a Portuguese firm provides non-tradable services in another EU country. The coefficient of the year before the first posting θ_{-1} is normalized to zero. The regressions include firm and five-digit sector \times calendar year \times province fixed effects. θ_k compares the outcomes of posting firms in event year k to the outcomes of future posting firms in the same narrowly defined sector and province in the year before their event. The vertical line represents 95% confidence intervals computed from robust standard errors clustered at the calendar year \times province level. The dataset and estimation sample are described in Appendix G.

Figure A.14: Posted Workers' Wage Gains Come From Regulation Rather Than Surplus-Sharing



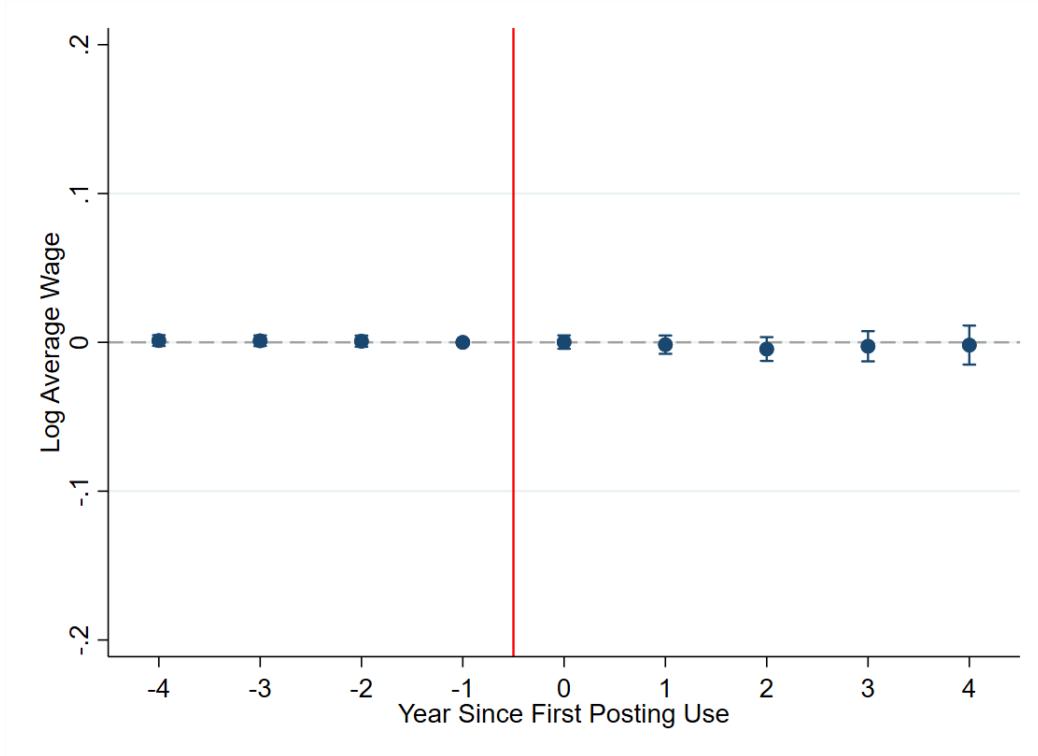
Notes: This figure compares sending firms' outcomes after a first posting event for firms located in two different countries affected differentially by destination-country minimum wages: Portugal and Luxembourg. I use exhaustive administrative tax records of Portuguese firms merged with administrative records of services performed in another EU country from 2006 to 2017. I use exhaustive administrative employment registries of Luxembourgish firms merged with administrative records of services performed in another EU country from 2002 to 2020. To ensure comparability of these two samples, I focus on Luxembourgish firms operating in the same sectors than posting firms in Portugal, which are listed in figure ?? and represent 70% of postings from Luxembourg. My two samples are: (i) the 4,151 Portuguese firms that start posting workers abroad for the first time between 2010 and 2015 and (ii) the 1,286 Luxembourgish firms that start posting workers for the first time between 2007 and 2017. The figure juxtaposes the estimated event study coefficients θ_k from Equation (10) estimated separately on posting firms in Portugal (red) and posting firms in Luxembourg (black). The event is defined as the first time a firm posts workers to another European member states, and the dependent variable is the log number employees (Panel A), log hours of work (Panel B), and log average wage at sending firm (Panel C). The coefficient of the year before the first posting θ_{-1} is normalized to zero. All regressions include firm fixed effects, five-digit sector \times calendar year \times province fixed effects for Portugal, and five-digit sector \times calendar year for Luxembourg (no provinces). The vertical line represents 95% confidence intervals computed from robust standard errors clustered at the event time \times province level for Portugal and at the event time \times five-digit sector for Luxembourg.

Figure A.15: Aggregate Domestic Blue Collar Employment and Exposure to Posting Flows



Notes: This figure uses exhaustive administrative posting records of Belgian firms merged with administrative employment data to observe the 23,380 Belgian firms that purchased a posting service at some point between 2010 and 2019. For these firms, the graph displays the evolution of the share of domestic blue collar workers in total employment (blue line, left axis) and the evolution of posted workers in total employment (red line, right axis).

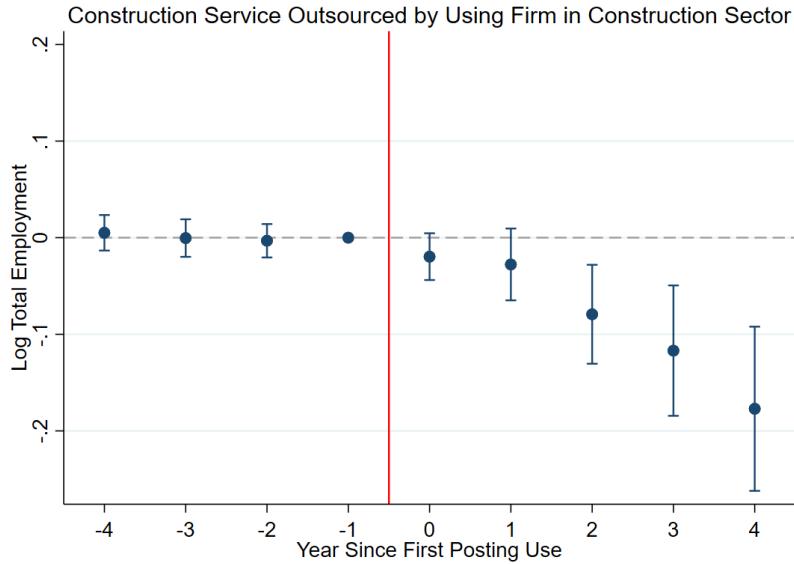
Figure A.16: Receiving-Firm Level Wage Rate After Using Posted Workers



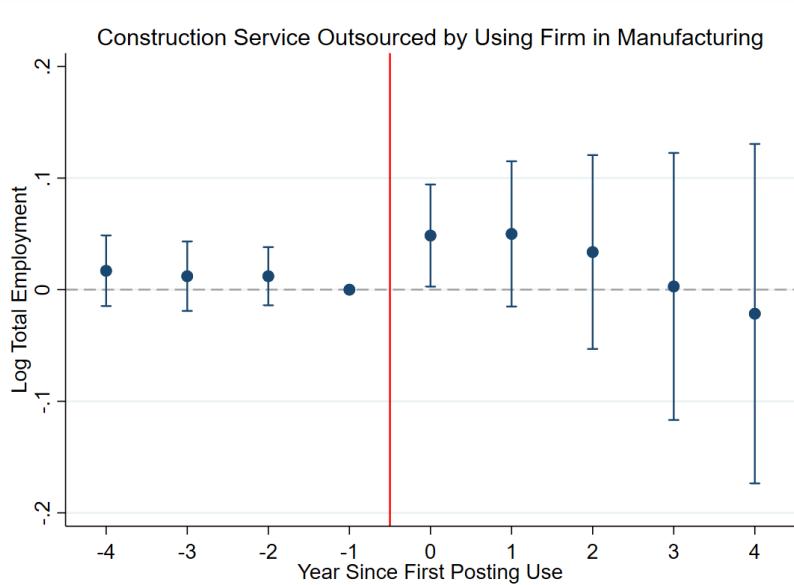
Notes: This figure studies how posting affects receiving firms and domestic workers in Belgium, one of the main receiving countries for posted workers. I use exhaustive administrative posting records of Belgian firms merged with administrative employment data to select the 11,796 firms that started using posted workers for the first time between 2014 and 2019. The figure plots the estimated event study coefficients γ_k from Equation (5) for the period 2008-2019, where the dependent variable is log wage. The event is defined as the first time a Belgian firm sources services to foreign posted employees. The coefficient of the year before the first posting use γ_{-1} is normalized to zero. The regressions include firm and three-digit sector \times calendar year. γ_k compares the outcomes of receiving firms in event year k to the outcomes of future posting firms in the same narrowly defined sector in the year before their event. The vertical line represents 95% confidence intervals computed from robust standard errors clustered at the calendar year \times province level.

Figure A.17: Firm-Level Displacement: Heterogenous Workers Exposure Across-Firm

A. Posted Workers Performing Same Tasks than Domestic Workers



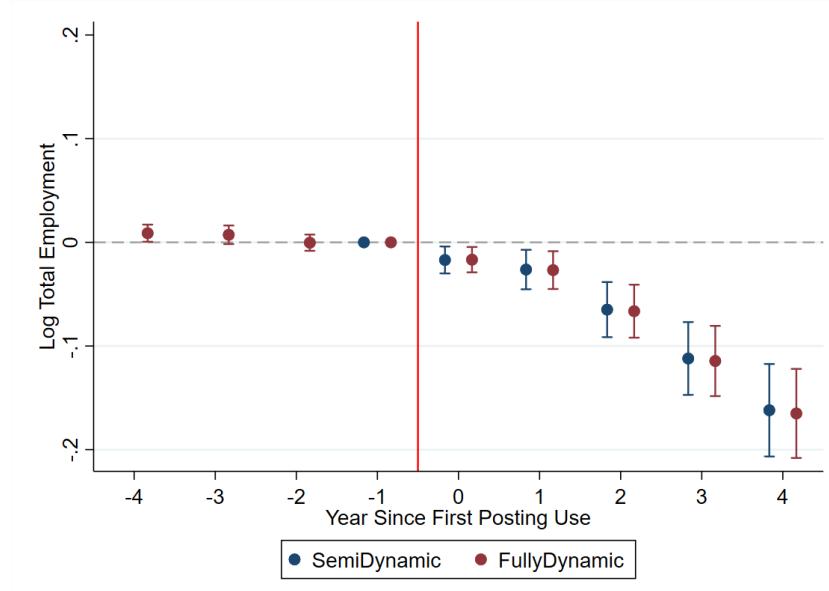
B. Posted Workers Performing Different Tasks than Domestic Workers



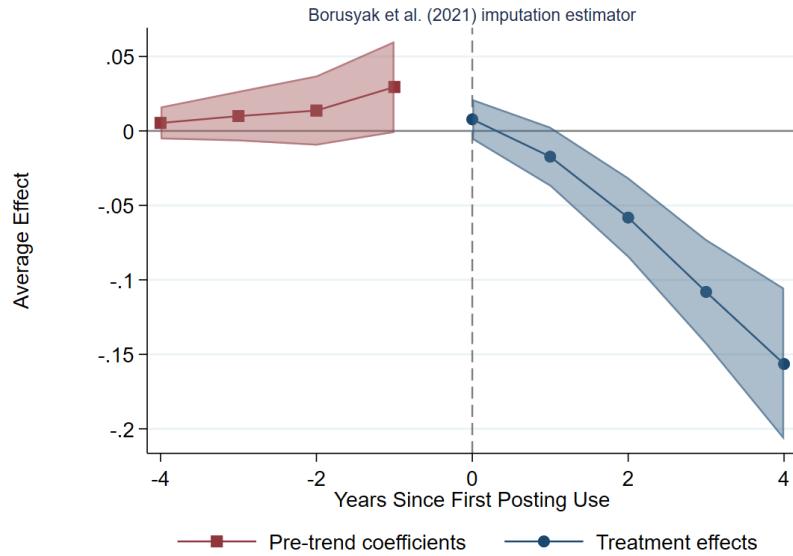
Notes: This figure uses exhaustive administrative posting records of Belgian firms merged with administrative employment data to select the 11,796 firms that started using posted workers for the first time between 2014 and 2019. The figure plots the estimated event study coefficients γ_k from Equation (5) for the period 2008-2019, where the dependent variable is log employment. The event is defined as the first time a Belgian firm sources services to foreign posted employees. The coefficient of the year before the first posting use γ_{-1} is normalized to zero. The regressions include firm and three-digit sector \times calendar year. γ_k compares the outcomes of receiving firms in event year k to the outcomes of future posting firms in the same narrowly defined sector in the year before their event. The vertical line represents 95% confidence intervals computed from robust standard errors clustered at the calendar year \times province level. Panel A focuses on the sample of Belgian clients that purchase a posting service in the same sector of activity than the one performed by their own domestic workers. Panel B focuses on Belgian firms that purchase a posting service in a sector of activity that is different than the main activity performed by domestic workers (a manufacturing firm purchasing a construction service).

Figure A.18: Firm-Level Displacement Effects: Alternative Specifications

A. Fully and Semi-Dynamic OLS Estimation

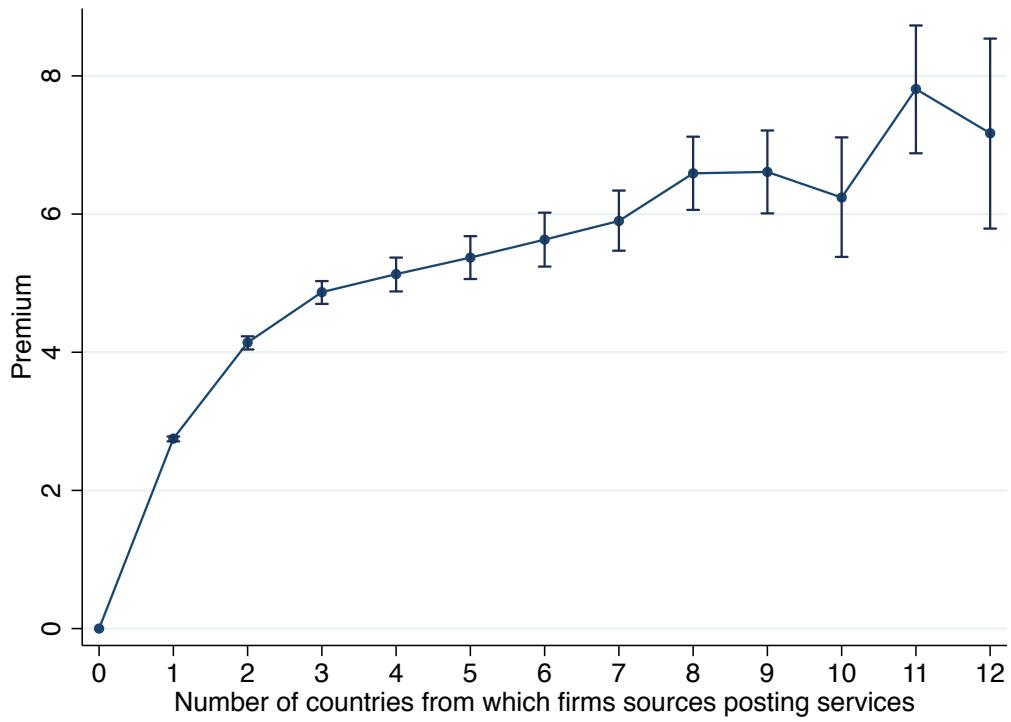


B. Estimates Accounting for Heterogeneous Treatment Effects



Notes: This figure uses exhaustive administrative posting records of Belgian firms merged with administrative employment data to select the 11,796 firms that started using posted workers for the first time between 2014 and 2019. The figure plots the estimated event study coefficients γ_k from Equation (5), investigating robustness to semi-dynamic specification (Panel A) and using an alternative estimator developed by [Borusyak and Jaravel \[2017\]](#) that accounts for heterogeneous treatment effects (Panel B).

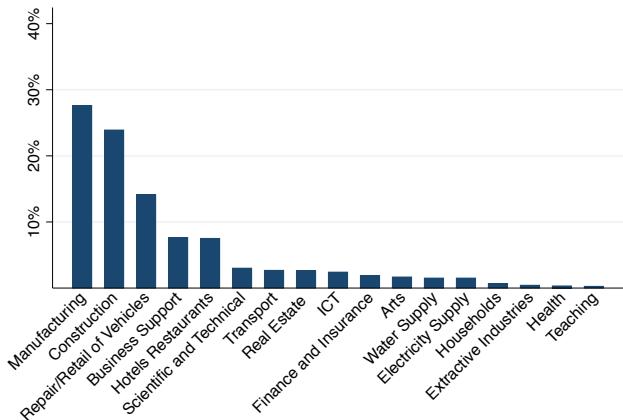
Figure A.19: Size Premium and Number of Sourcing Countries For Posting Services



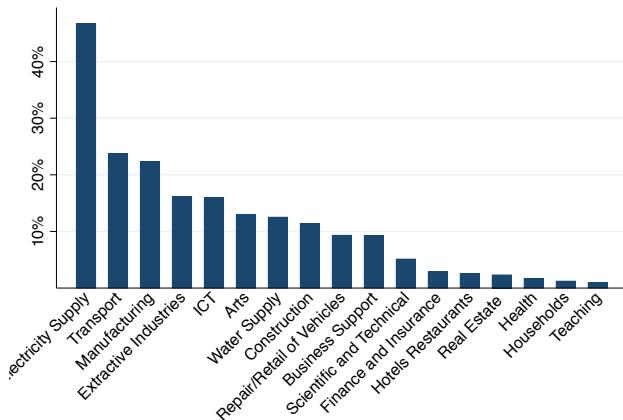
Notes: The Figure shows the size premium related to the number of sourcing countries for posting services in the second largest importer of posting services: France. I use the universe of mandatory posting declarations filed by foreign suppliers posting workers to France (DPD/SIPSI dataset) from 2017 to 2020. I select the number of firms that purchased a posting services at some point in 2018.

Figure A.20: Industry Shares of On-Site Offshoring Using Firms and Workers

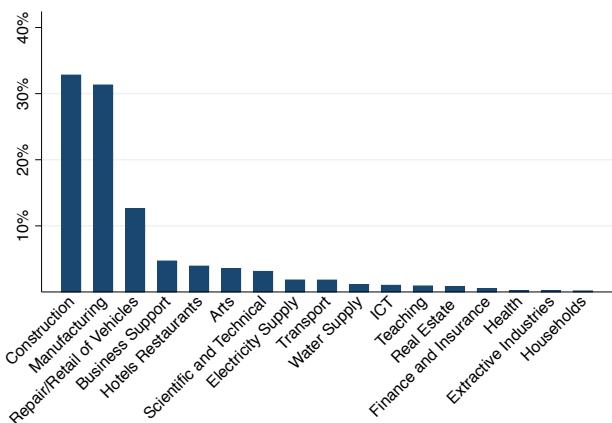
A. Distribution of Using Firms Across Industries



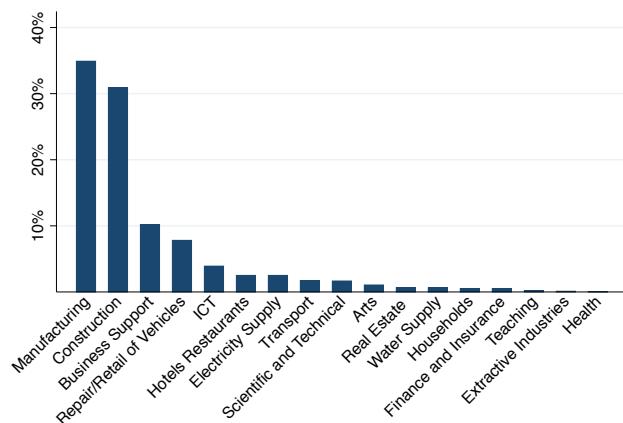
B. Share of Workers in Industry At Using Firms



B. Distribution of Postings Across Industries

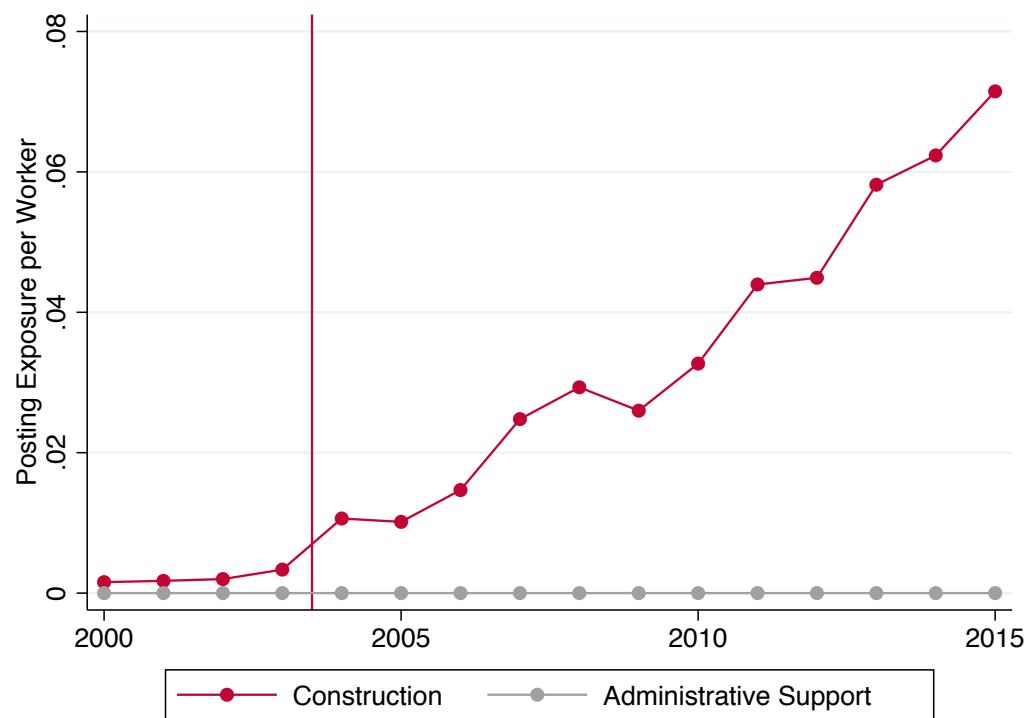


D. Distribution of Posting Expenses Across Industries



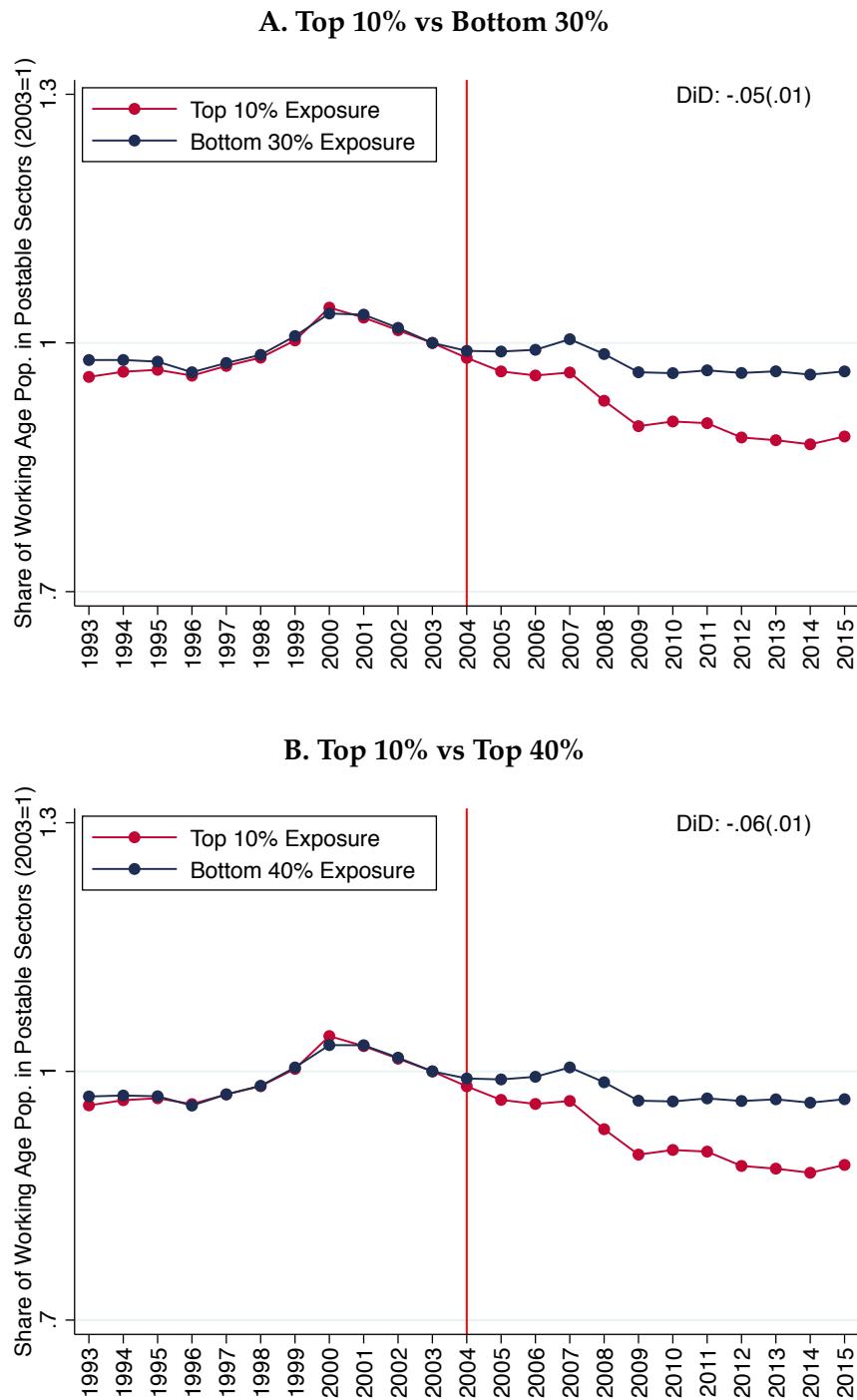
Notes: The figure shows distribution of domestic workers and using firms across industries and posting using status in the second importer of posting services: France. I use the universe of mandatory posting declarations filed by foreign suppliers posting workers to France (DPD/SIPSI dataset) in 2018 that I merge with exhaustive tax returns covering the universe of French companies excluding the one operating in the agricultural sector (FICUS/FARE dataset).

Figure A.21: Sectoral Import Exposure by Industry: Construction Versus Administrative Support



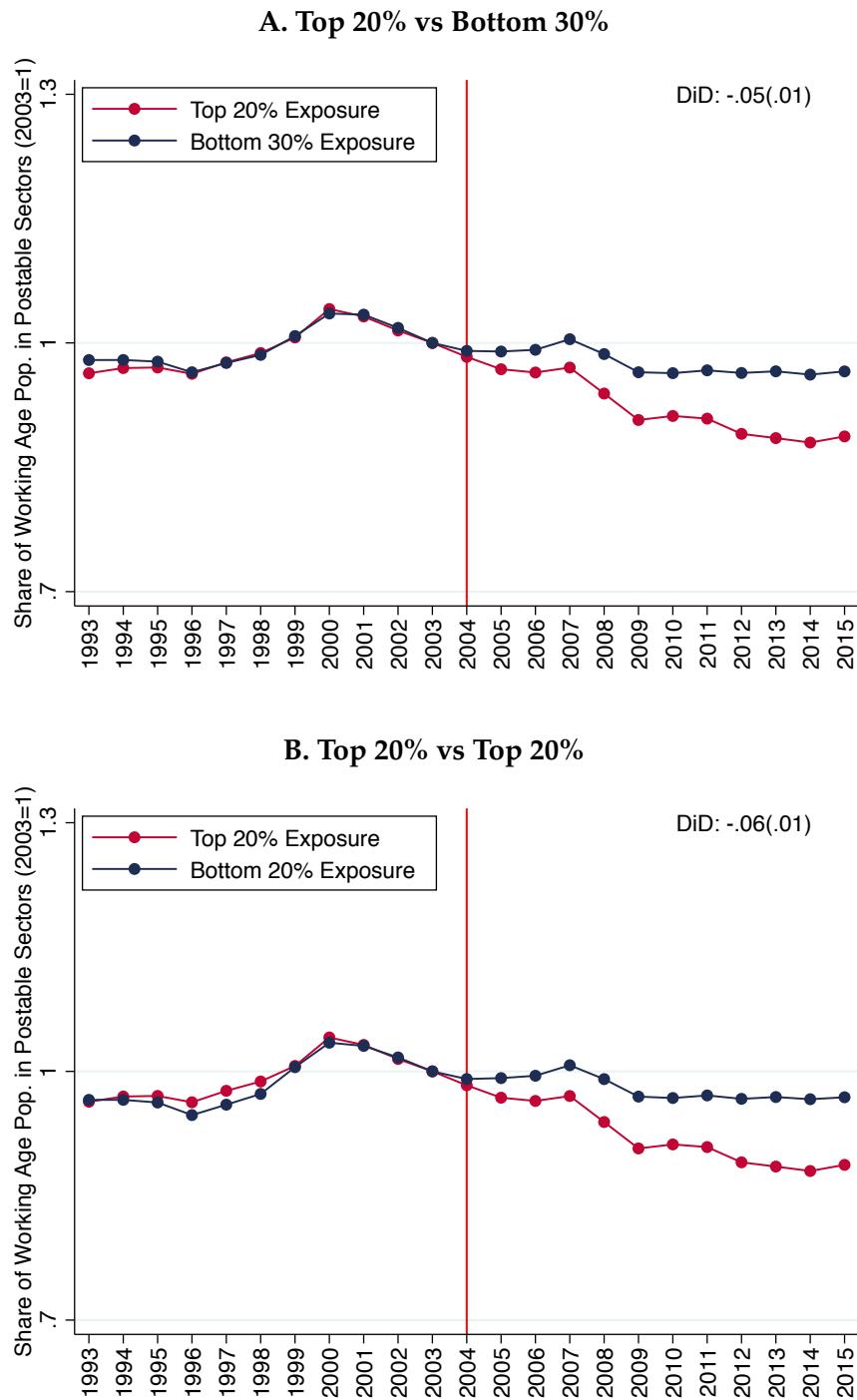
Notes: The Figure reports French received posting inflows by sector of the posting mission. Data come from mandatory posting declarations filed by foreign companies providing services in France (described in Appendix H). Posting inflows relate to the number of posting missions rather than unique posted workers: a worker can be posted several times. The number of posting missions are divided by domestic employment in each sector. The vertical line denotes the 2004 opening to mobile service provision performed by firms located in Eastern Europe (see Figure A.3).

Figure A.22: Employment Effects: Alternative Treatment and Control Groups



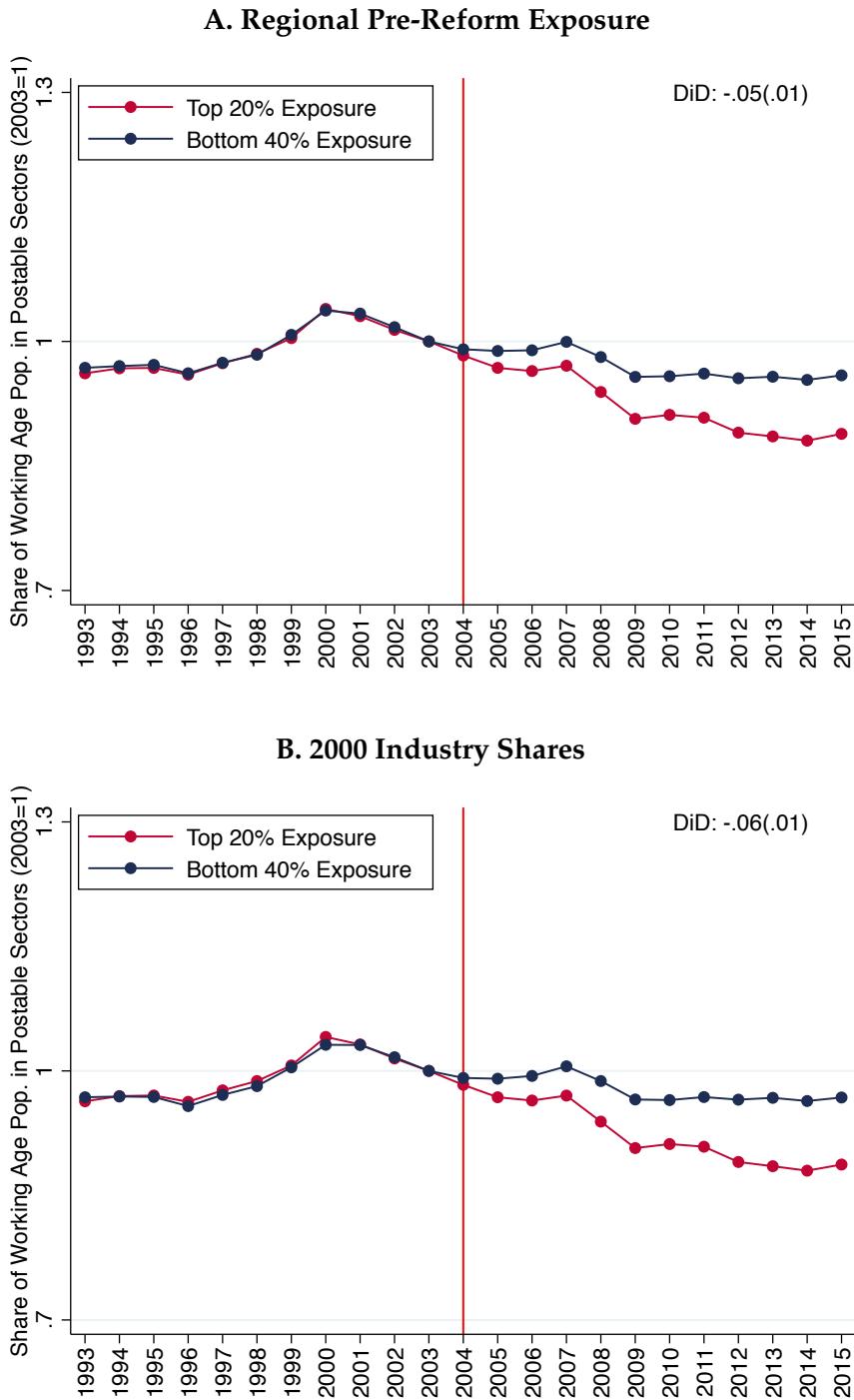
Notes: The figure studies the effect of posting on domestic employment in the second largest importer of posting services: France. I use the dataset on all posting declarations filed by foreign suppliers sending posted workers to France aggregated at the province-year-sector from 2000 to 2015 (DPD/SIPSI), merged with administrative data on French domestic employment and working age population at the province-year-sector from 1990 to 2015 from INSEE.

Figure A.23: Employment Effects: Alternative Treatment and Control Groups



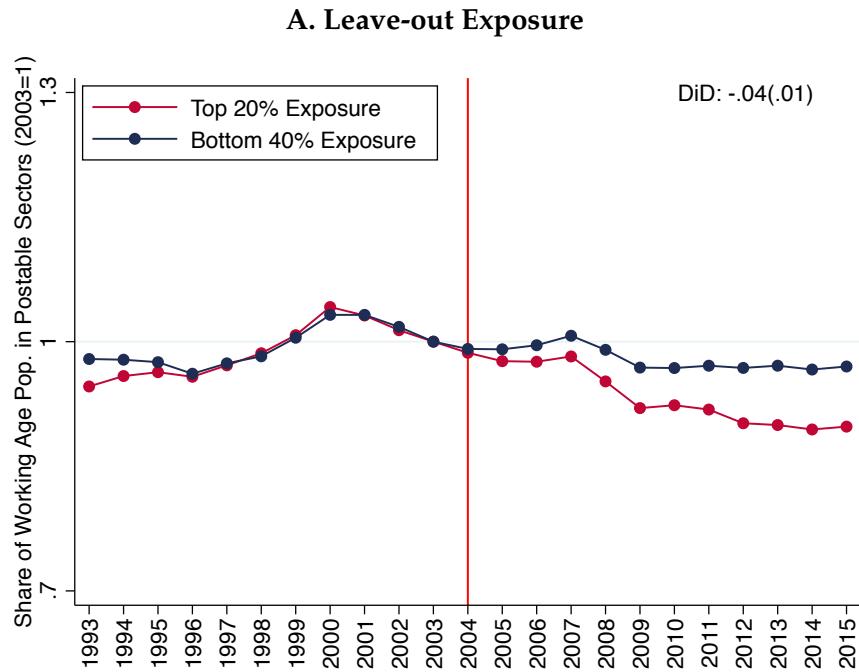
Notes: The figure studies the effect of posting on domestic employment in the second largest importer of posting services: France. I use the dataset on all posting declarations filed by foreign suppliers sending posted workers to France aggregated at the province-year-sector from 2000 to 2015 (DPD/SIPSI), merged with administrative data on French domestic employment and working age population at the province-year-sector from 1990 to 2015 from INSEE.

Figure A.24: Employment Effects: Alternative Pre-Reform Exposure Measures



Notes: The figure studies the effect of posting on domestic employment in the second largest importer of posting services: France. I use the dataset on all posting declarations filed by foreign suppliers sending posted workers to France aggregated at the province-year-sector from 2000 to 2015 (DPD/SIPSI), merged with administrative data on French domestic employment and working age population at the province-year-sector from 1990 to 2015 from INSEE. The aggregate DPD/SIPSI dataset builds on yearly province-level administration (DIRECCTE) reports to the French ministry of labor of the number of received posting declarations each year. In 2004, France lifted entry restrictions for workers posted from 10 Eastern European countries, leading to permanent increased import exposure in some sectors through posting (Figure A.21). Province-level exposure to the 2004 shock is defined by exposure to the shock before the reform, in 2003. Panel A shows the evolution of the share of domestic workers in exposed sectors, before and after 2004, in provinces with low and high exposure to the shock. Panel B shows the counterparts for the share of domestic workers in sheltered sectors, such as health or administrative support.

Figure A.25: Employment Effects: Alternative Pre-Reform Exposure Measures



Notes: The figure studies the effect of posting on domestic employment in the second largest importer of posting services: France. I use the dataset on all posting declarations filed by foreign suppliers sending posted workers to France aggregated at the province-year-sector from 2000 to 2015 (DPD/SIPSI), merged with administrative data on French domestic employment and working age population at the province-year-sector from 1990 to 2015 from INSEE. The aggregate DPD/SIPSI dataset builds on yearly province-level administration (DIRECCTE) reports to the French ministry of labor of the number of received posting declarations each year. In 2004, France lifted entry restrictions for workers posted from 10 Eastern European countries, leading to permanent increased import exposure in some sectors through posting (Figure A.21). Province-level exposure to the 2004 shock is defined by exposure to the shock before the reform, in 2003. Panel A shows the evolution of the share of domestic workers in exposed sectors, before and after 2004, in provinces with low and high exposure to the shock. Panel B shows the counterparts for the share of domestic workers in sheltered sectors, such as health or administrative support.

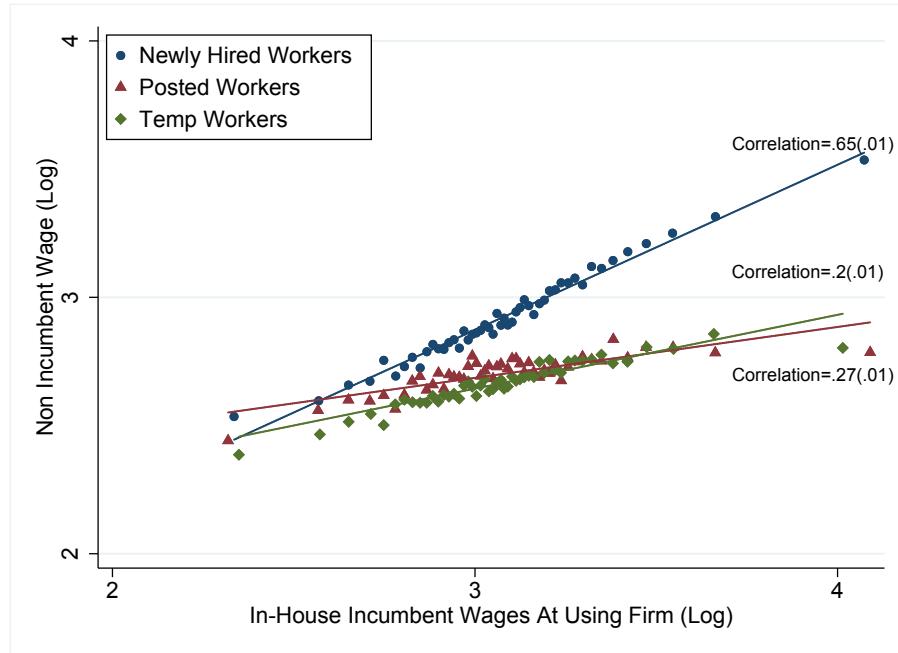
Figure A.26: Stickiness in Relationship Between Receiving Firms and Trading Partner



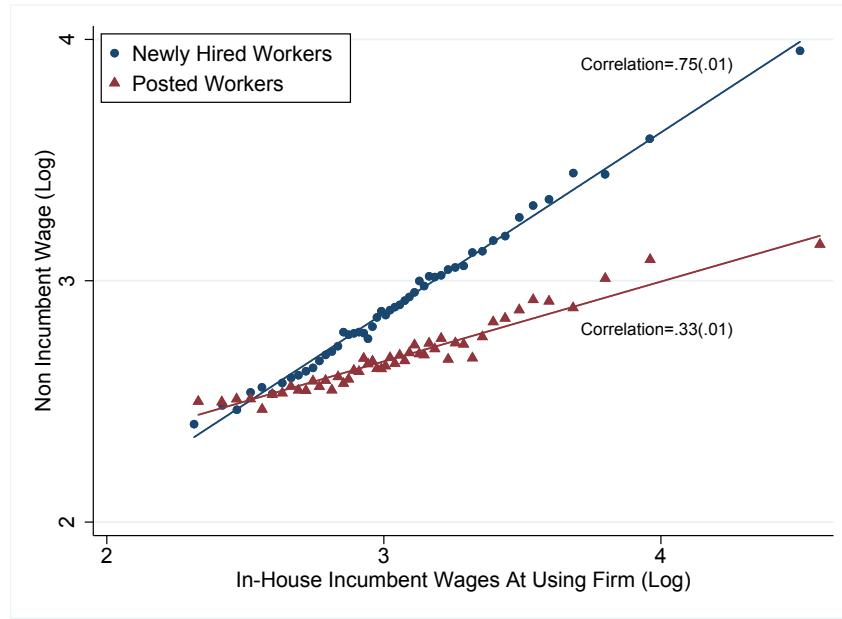
Notes: This figure shows the length of the relation between Belgian clients and their main supplier of posting service over time.

Figure A.27: Do Using Firms Share Pay Premia With Posted Workers?

A. Relationship Between In-House Workers and Posted Workers Wages

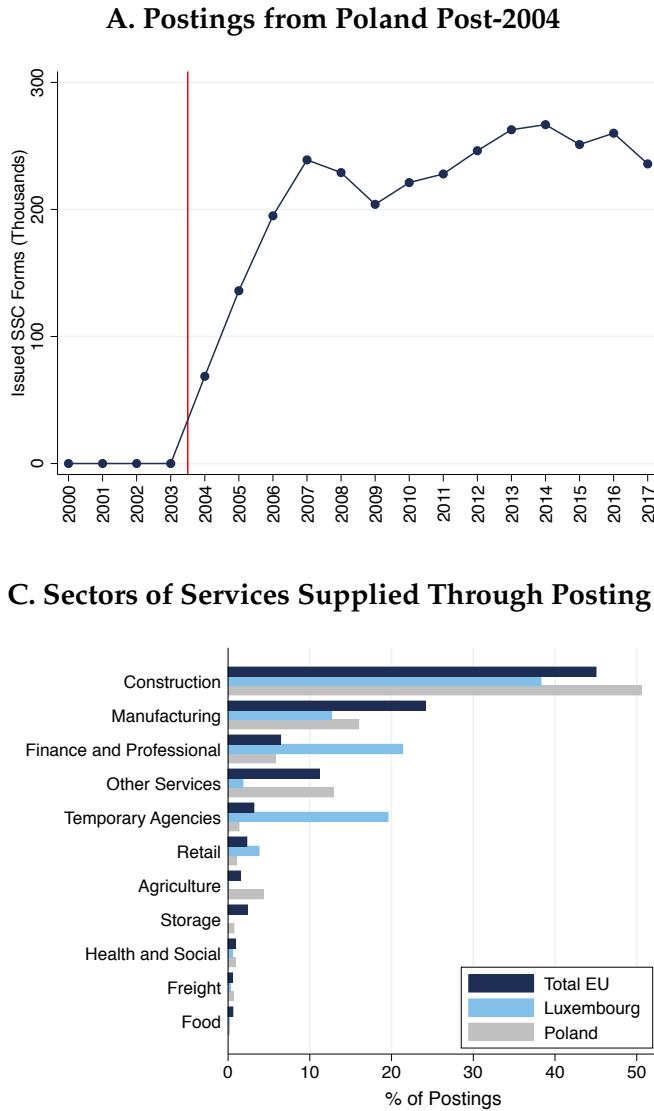


B. Raw Correlation (No 5-Digit Sector Residualization)



Notes: This Figures compares posted and domestic workers' wage *within a workplace* in the second largest importer of posting services: France, repeating Figure 10 with alternative specifications. Panel A completes Figure 10.A by adding the correlation between (domestic) temporary agency workers and incumbent workers at using firms. Panel B completes Figure 10.A by showing the raw correlation between incumbent wages and posted workers' wages (red plot) and newly hired domestic workers (blue dots), without adjusting for 5-digit sectors fixed effects. See footnote under Figure 10 for sample selection and specification details.

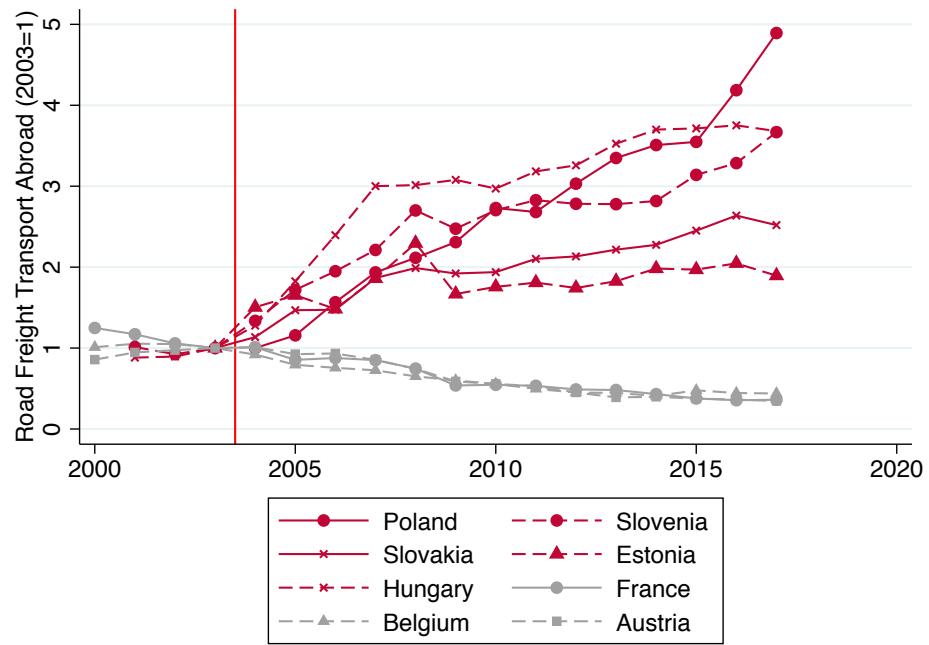
Figure A.28: Effects of the Liberalization Reform on Postings From Poland



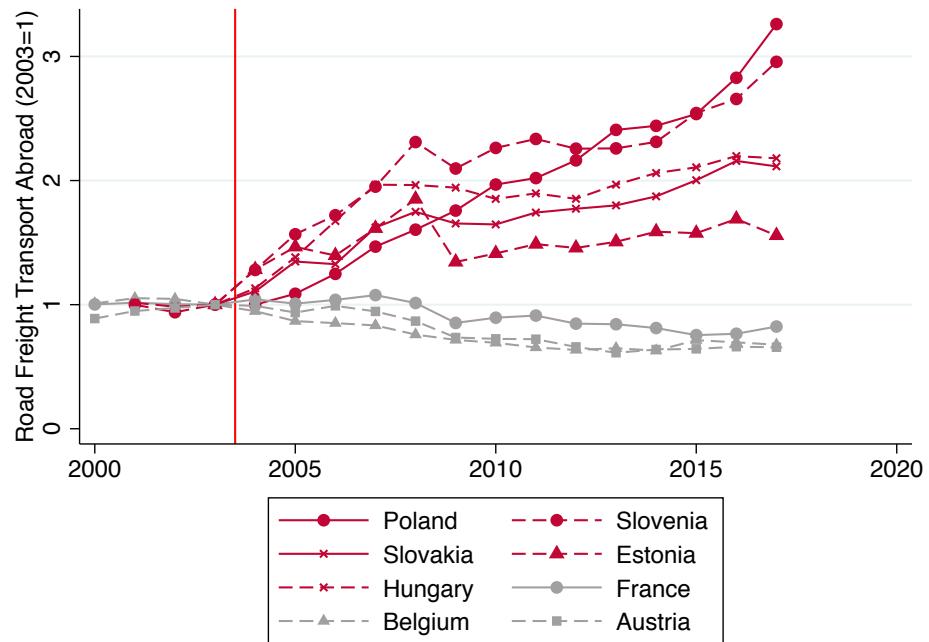
Notes: This figure shows the aggregate employment effects of posting openness for Poland, the first supplier of posting services since 2005. Poland became a EU member state in 2004. That year, all mobility restrictions for employees posted by Polish suppliers were lifted, except for postings from Poland to Austria and Germany that were deregulated in 2011 (the first-stage effects of these mobility reforms are analyzed in Figure 4). Panel A shows the effect of the 2004 service trade liberalization on E101/A1 mandatory posting forms issued by Poland. As described in the paper and Appendix F, E101/A1 forms are only measured for EU member states and are zero by construction for Poland before 2004. Panel B shows the heterogeneous exposure to the posting openness shock across sectors. Most of the postings from Poland occur in the construction sector, while regulated sectors like health, education, or public administration are covered by licensing regulations that prevent them from being performed abroad.

Figure A.29: Effect of Posting Policy on Non-Tradable Market Shares: Drivers Case-Study

A. Exports of Drivers' Road Transport Services by Exporting Country



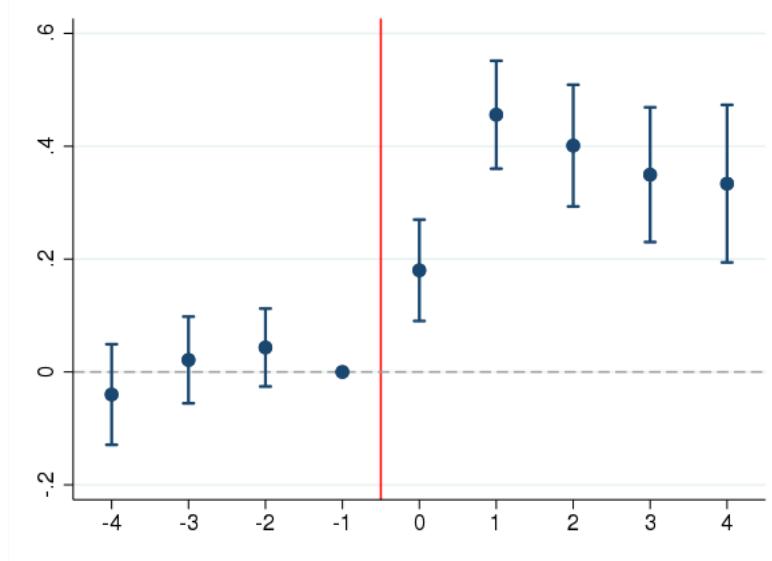
B. Total Drivers' Road Transport Services by Country



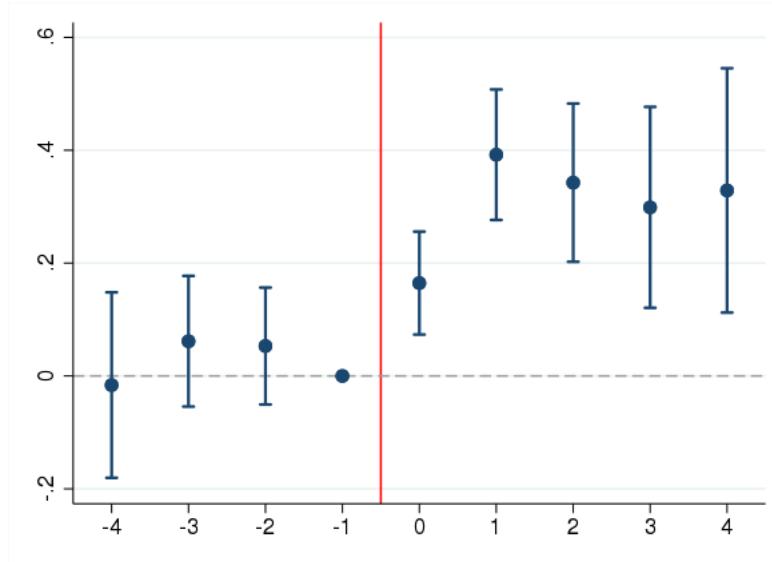
Notes: This figure shows the evolution of economic activity in the road transport service before and after that the posting policy was opened to NMS in 2004 (Poland, Slovakia, Slovenia, Estonia, Hungary). Economic performance in the road transport is measured in million-tonne kilometer performed by each country.

Figure A.30: Fiscal Externality of Posting for Sending Governments

A. Payroll Taxes at Sending Firms After Provision of Services Abroad

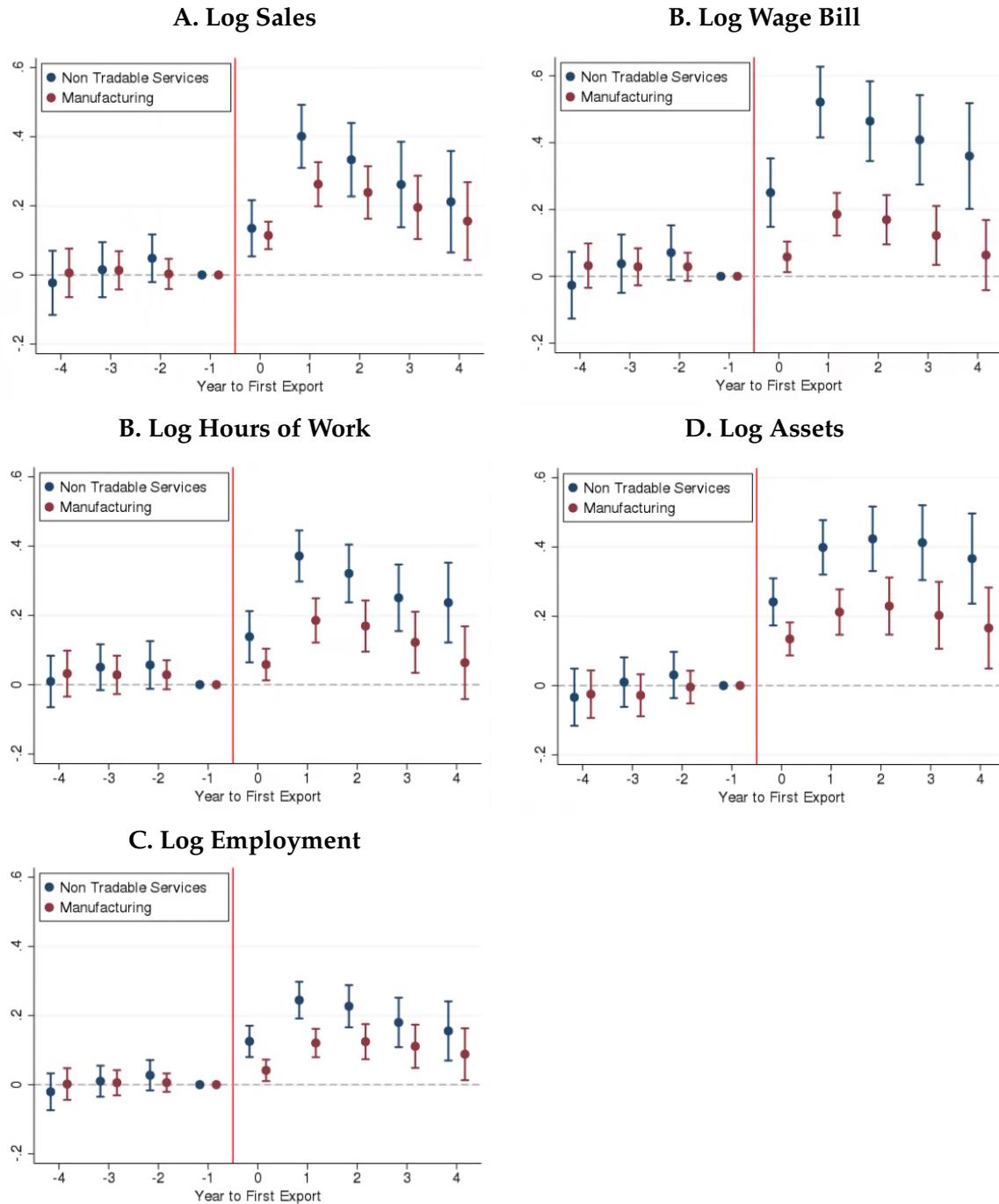


B. Corporate Income Tax at Sending Firms After Provision of Services Abroad



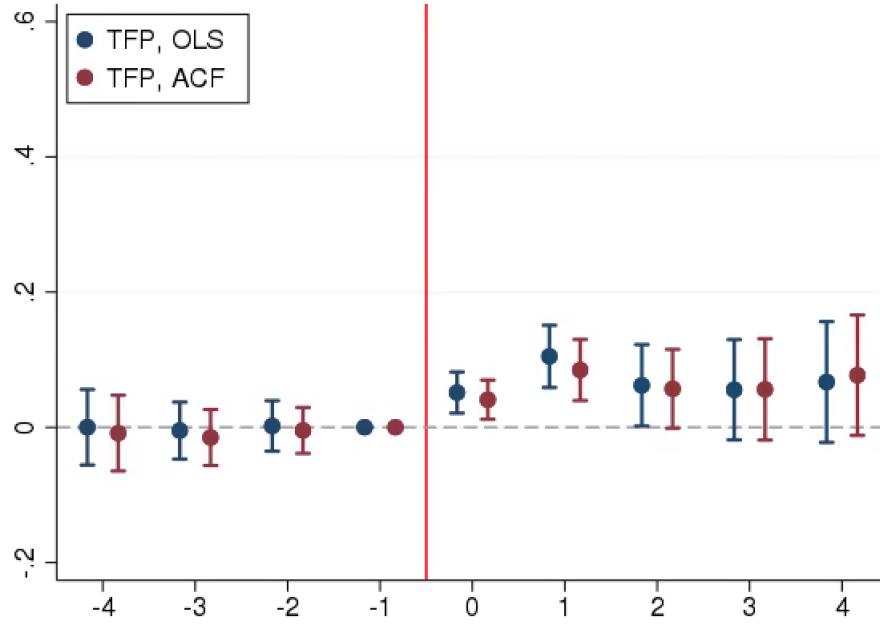
Notes: This figure studies how posting affects sending firms located in Portugal, one of the main suppliers of posting services in Europe. I use exhaustive administrative tax records of Portuguese firms merged with administrative records of services performed in another EU country from 2006 to 2017 to select the 4,151 firms (with a median of more than three employees over the period) that start posting workers abroad for the first time between 2010 and 2015. The figure plots the estimated event study coefficients θ_k from Equation (10) for the period 2006-2017 where the dependent variable is log social security contributions (Panel A) and log paid corporate income tax (Panel B). The event is defined as the first time a Portuguese firm provides non-tradable services in another EU country. The coefficient of the year prior to the first posting θ_{-1} is normalized to zero. The regressions include firm and five-digit sector \times calendar year \times province fixed effects. θ_k compares the outcomes of posting firms in event year k to the outcomes of future posting firms in the same narrowly defined sector and province in the year before their event. The vertical line represents 95% confidence intervals computed from robust standard errors clustered at the calendar year \times province level. The dataset and estimation sample are described in Appendix G.

Figure A.31: Firms' Scale Up After First Export: Manufacturing Goods vs Posting Services



Notes: This Figure studies how export events affect firms located in Portugal, one of the main supplier of posting services in Europe. I use exhaustive administrative tax records of Portuguese firms merged with administrative records of services performed in another EU country, as well as goods exported abroad, from 2006 to 2017 to identify two samples. The first sample is the group of 4,151 firms that start posting workers abroad for the first time between 2010 and 2015. The second sample is the group of manufacturing firms that start exporting manufactured goods abroad for the first time between 2010 and 2015. The Figure juxtaposes the estimated event study coefficients θ_k from Equation (10) estimated separately on (i) manufacturing exporters (red) and (ii) posting firms (blue). The event is defined as the first time a Portuguese firm post (blue) or export (red) abroad. The regressions include 5-digit sector \times calendar year \times province fixed effects. The vertical line represent 95% confidence intervals computed from robust standard errors clustered at the event-time \times province level. Sample and descriptive statistics can be found in Appendix G and Appendix ??.

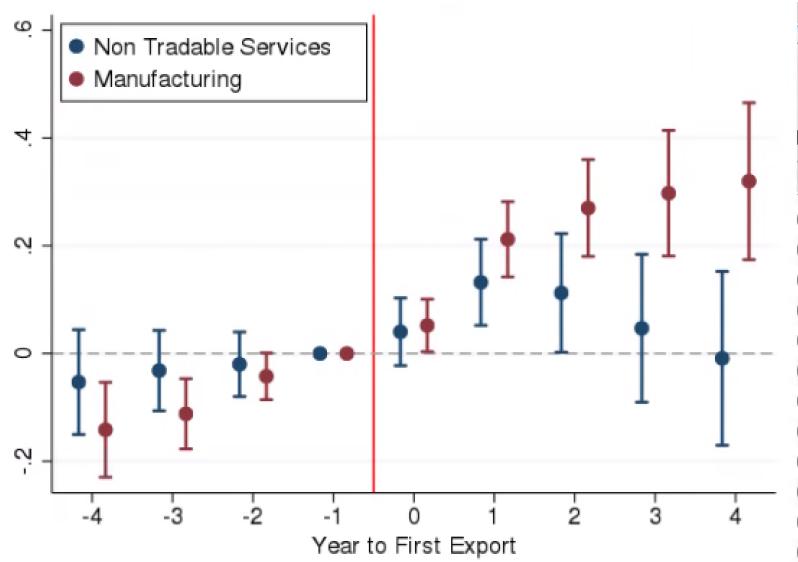
Figure A.32: TFP Evolution After That A Firms Starts Providing Services Abroad



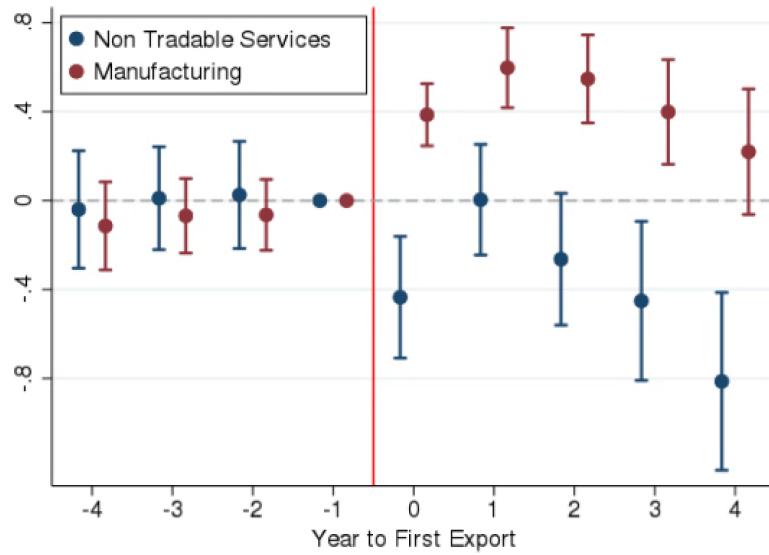
Notes: This Figure studies how posting affects sending firms located in Portugal, one of the main supplier of posting services in Europe. I use exhaustive administrative tax records of Portuguese firms merged with administrative records of services performed in another EU country from 2006 to 2017 to select the 4,151 firms -with a median of more than 3 employees over the period- that start posting workers abroad for the first time between 2010 and 2015. In Panel A, I measure TFP assuming a standard Cobb-Douglas technology, using a simple OLS framework where sales are the dependent variable and where employment, net assets and cost of materials are used as time varying controls. To take into account potential endogeneity in input choices at the service supplier level, Panel B relies on the method proposed by [Ackerberg, Caves, and Frazer \[2015\]](#) (henceforth ACF) to compute an alternative measure of TFP. The Figure plots the estimated event-study coefficients θ_k from Equation (10) for the period 2006-2017 where the dependent variable is OLS-based TFP measure (Panel A) and ACF-based TFP measure (Panel B). The event is defined as the first time a Portuguese firm provide non-tradable services in another EU country. The coefficient of the year prior to the first posting θ_{-1} is normalized to zero. The regressions include 5-digit sector \times calendar year \times province fixed effects. θ_k compares the outcomes of posting firms in event year k to the outcomes of future posting firms in the same narrowly defined sector and province in the year before their event. The vertical line represent 95% confidence intervals computed from robust standard errors clustered at the calendar year \times province level. The dataset and estimation sample is described in Appendix G.

Figure A.33: Industry-Specificities In Export Behavior: Non-Tradables vs Manufacturing

A. Manufacturing Firms Select Into Exporting By Buying Tangible Assets

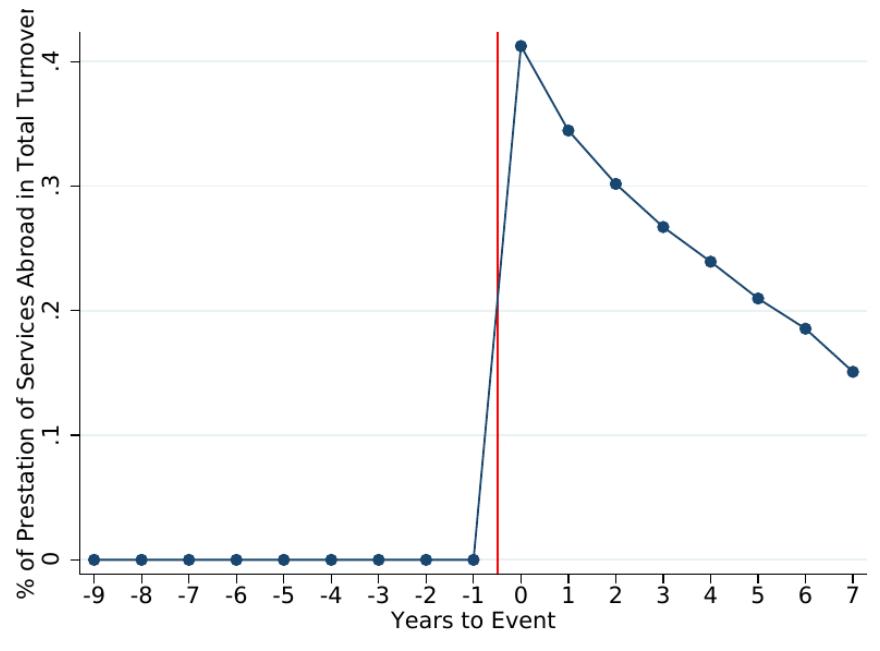


B. Services Suppliers Shift From Domestic to Foreign Sales After First Export



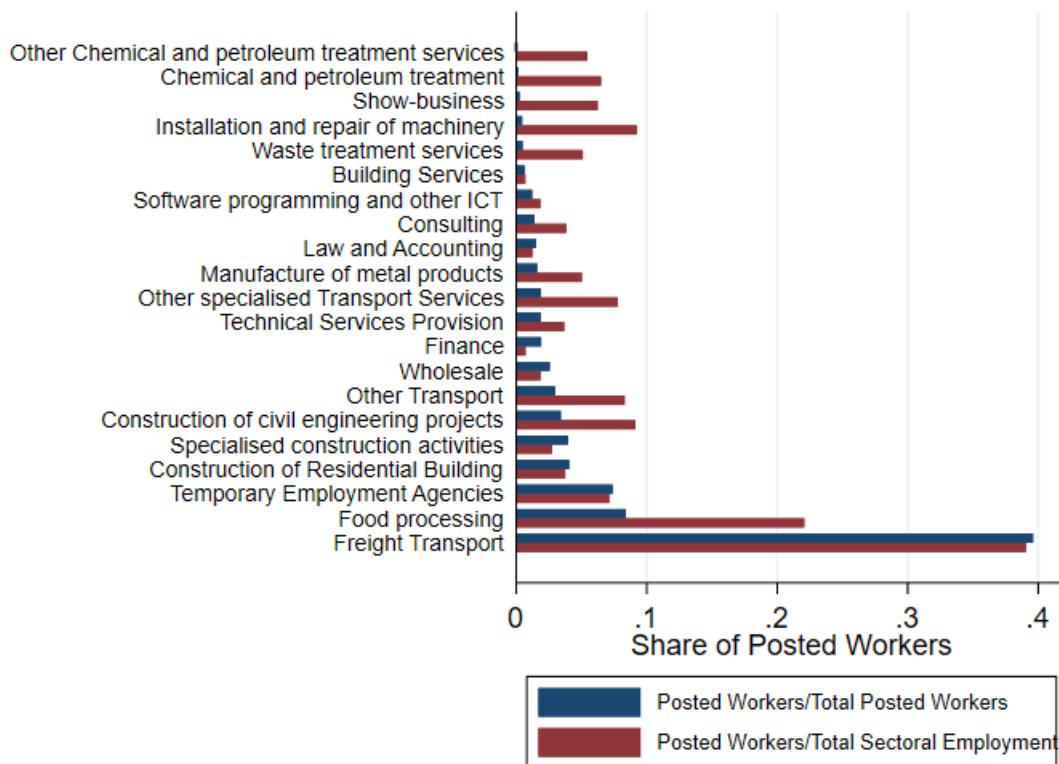
Notes: This Figure studies how export events affect firms located in Portugal, one of the main supplier of posting services in Europe. I use exhaustive administrative tax records of Portuguese firms merged with administrative records of services performed in another EU country, as well as goods exported abroad, from 2006 to 2017 to identify two samples. The first sample is the group of 4,151 firms that start posting workers abroad for the first time between 2010 and 2015. The second sample is the group of manufacturing firms that start exporting manufactured goods abroad for the first time between 2010 and 2015. The Figure juxtaposes the estimated event-study coefficients θ_k from Equation (10) estimated separately on (i) manufacturing exporters (red) and (ii) posting firms (blue). The event is defined as the first time a Portuguese firm post (blue) or export (red) abroad. The dependent variable is log tangible assets (Panel A) and log domestic sales (Panel B). The regressions include 5-digit sector \times calendar year \times province fixed effects. The vertical line represent 95% confidence intervals computed from robust standard errors clustered at the event-time \times province level. Sample and descriptive statistics can be found in Appendix G and Appendix ??.

Figure A.34: First Provision of Services Abroad Event



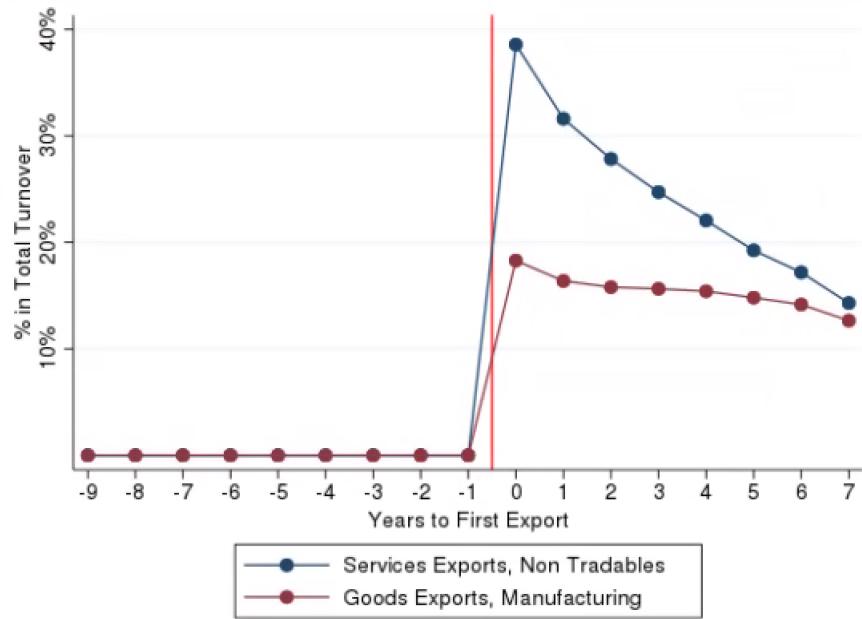
Notes: This Figure studies how posting affects sending firms located in Portugal, one of the main supplier of posting services in Europe. I use exhaustive administrative tax records of Portuguese firms merged with administrative records of services performed in another EU country from 2006 to 2017 to select the 4,151 firms -with a median of more than 3 employees over the period- that start posting workers abroad for the first time between 2010 and 2015. The figure describes the magnitude and persistence of the first provision services abroad event for Portuguese firms. It plots the average provision of services performed in another EU country in firm-level total sales before and after the first provision of services abroad. Sample and descriptive statistics can be found in Appendix G and Appendix ???. The distribution of the 4,151 baseline events by treatment duration is described in Table G.13.

Figure A.35: Exports of Services and Goods in Manufacturing



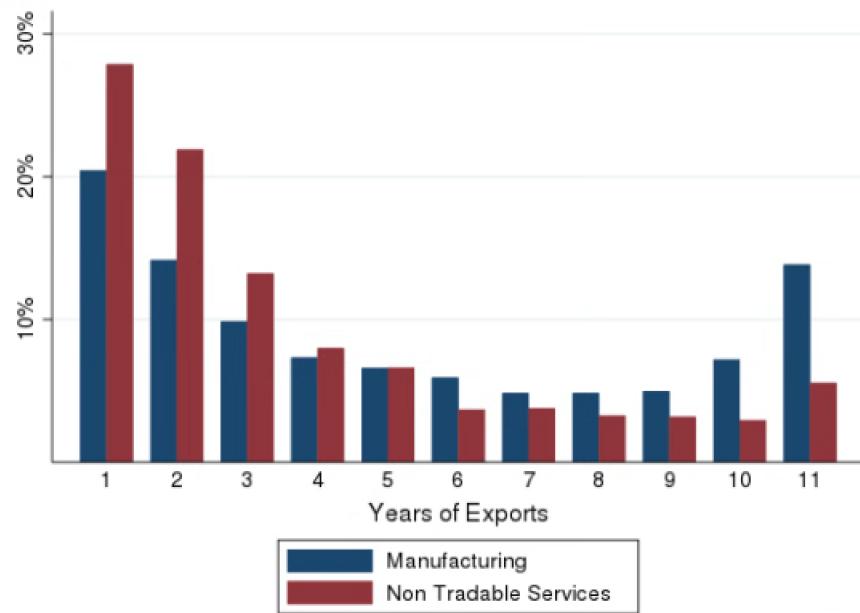
Notes: The Figure shows the amount of services and goods exports in manufacturing sectors. The Figure is based on detailed and exhaustive firm-level data from Portugal that is described in Appendix G.

Figure A.36: Intensity and Persistence of Exports



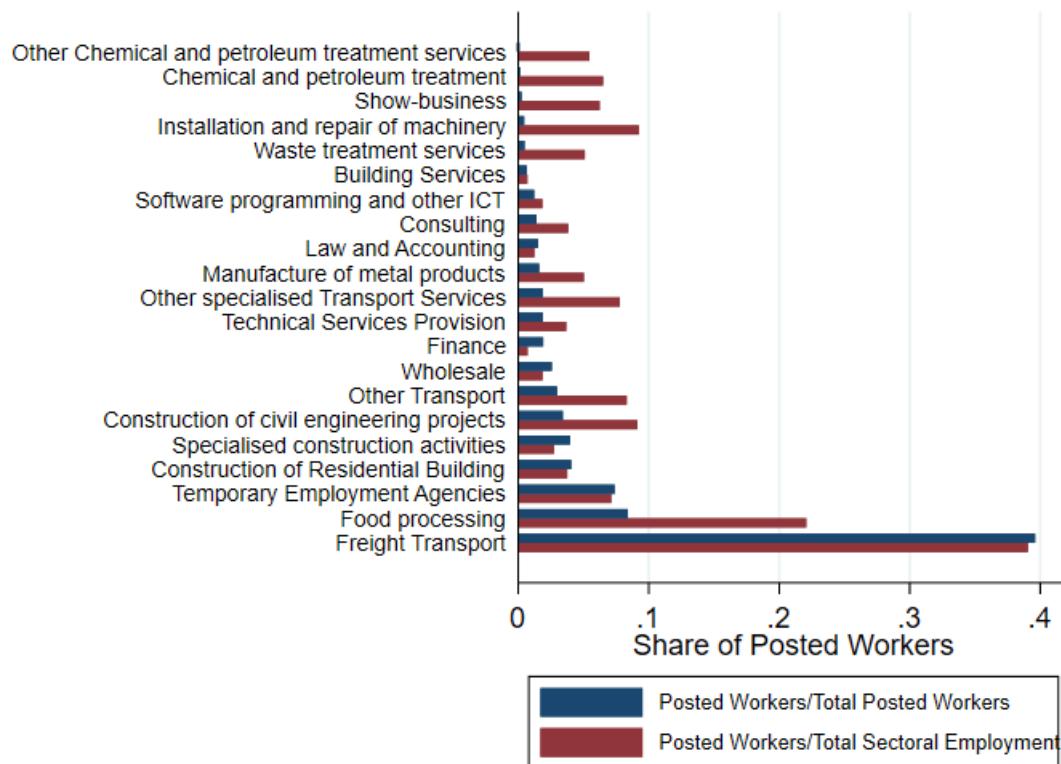
Note: This Figure shows the intensity of “first export” treatment for firms in manufacturing on non-tradable services industries. The dataset used is a detailed administrative firm-level balance-sheets data covering the universe of non-financial companies operating in Portugal between 2006 and 2017 merged with exhaustive information on trade in goods and services at the company-level. First export is defined for all firms that are observed exporting for the first time between 2010 and 2015, such that we can observe at least 4 years without export for firms that start exporting in 2007. The Figure displays the average exports/turnover ratio in years before and after first exports for exporters in manfuacturing (red) and non tardable services (blue).

Figure A.37: Export Duration for First Exporters of 2007



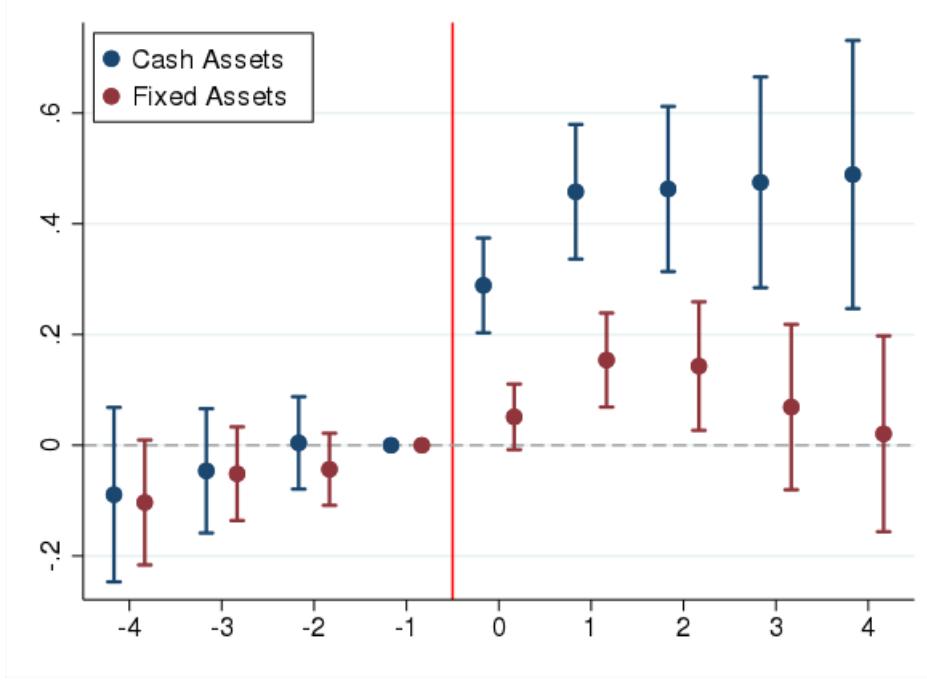
Source: This Figure compares the distribution of export duration for first that start exporting in 2007 in manufacturing versus non-tradable services. The dataset used is a detailed administrative firm-level balance-sheets data covering the universe of non-financial companies operating in Portugal between 2006 and 2017 merged with exhaustive information on trade in goods and services at the company-level.

Figure A.38: Exports of Posting Missions From Luxembourg



Notes: The Figure shows the amount of posting missions from Luxembourg based on the IGSS dataset.

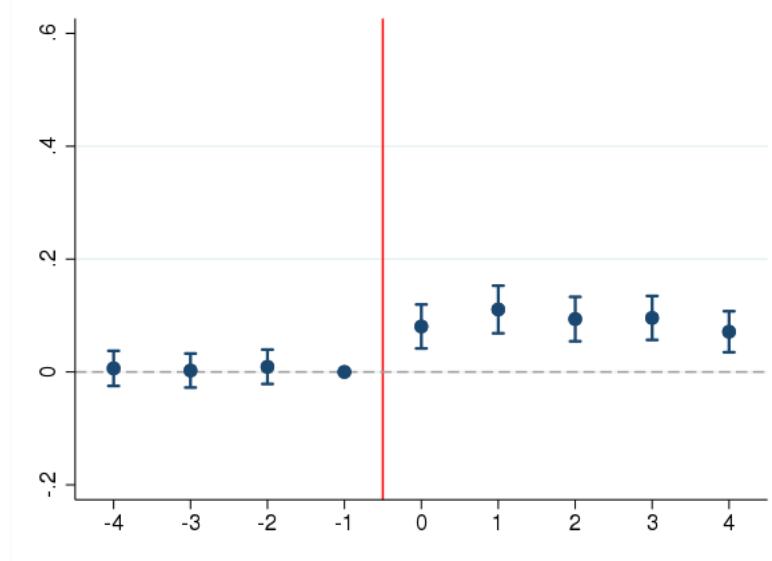
Figure A.39: Sending Firms' Increase Cash Rather Than Fixed Assets



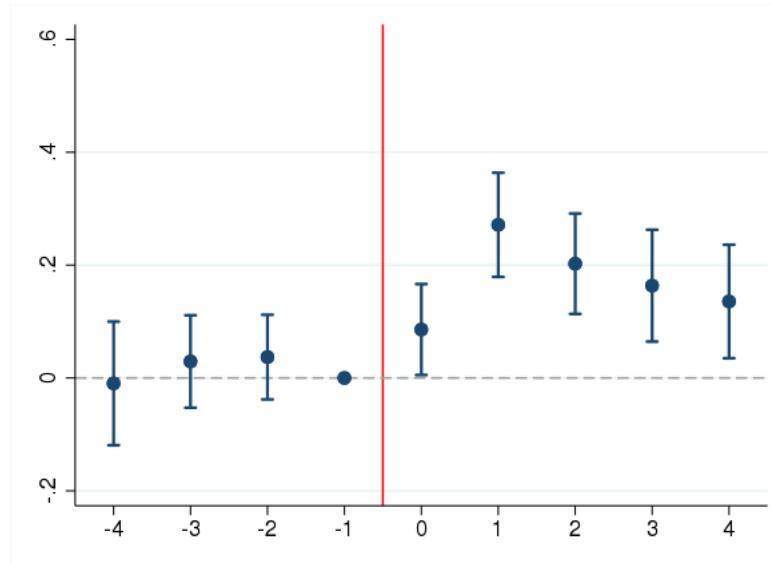
Notes: This Figure studies how posting affects sending firms located in Portugal, one of the main supplier of posting services in Europe. I use exhaustive administrative tax records of Portuguese firms merged with administrative records of services performed in another EU country from 2006 to 2017 to select the 4,151 firms -with a median of more than 3 employees over the period- that start posting workers abroad for the first time between 2010 and 2015. The Figure plots the estimated event-study coefficients θ_k from Equation (10) for the period 2006-2017 where the dependent variable is log cash assets (blue series) and log fixed assets (Panel B). The event is defined as the first time a Portuguese firm provide non-tradable services in another EU country. The coefficient of the year prior to the first posting θ_{-1} is normalized to zero. The regressions include 5-digit sector \times calendar year \times province fixed effects. θ_k compares the outcomes of posting firms in event year k to the outcomes of future posting firms in the same narrowly defined sector and province in the year before their event. The vertical line represent 95% confidence intervals computed from robust standard errors clustered at the calendar year \times province level. The dataset and estimation sample is described in Appendix G.

Figure A.40: Export-Mobility Surplus: Using Non-Postable Sectors As Additional Control Groups

A. Wage Rate Evolution Around First Provision of Services Abroad



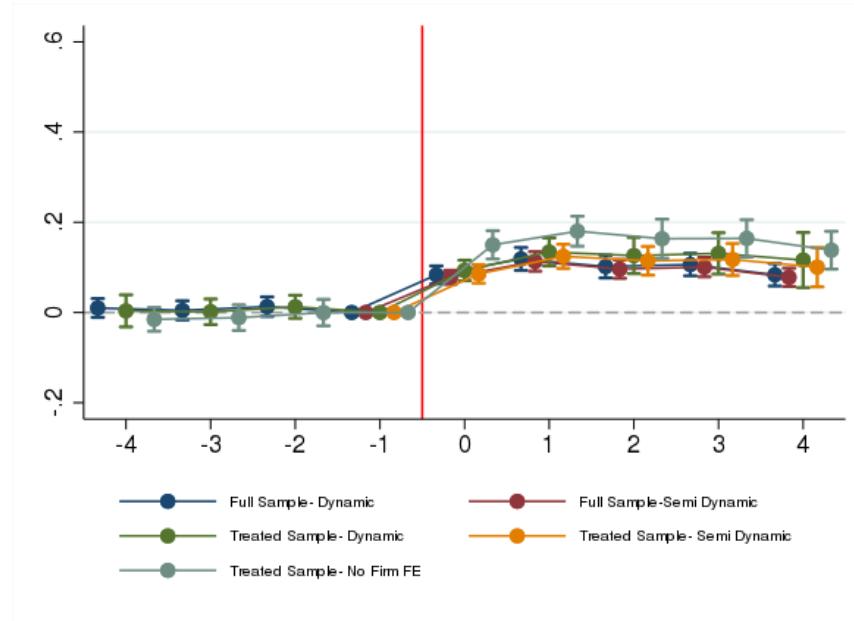
A. Profits Evolution Around First Provision of Services Abroad



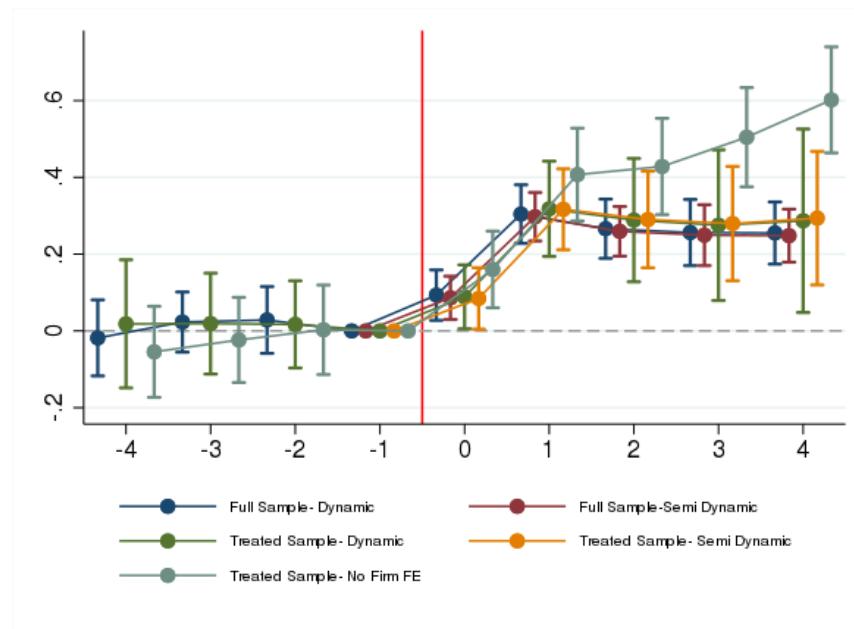
Notes: The Figure repeats the baseline analysis presented in Figure A.42 by adding firms in services sheltered from posting opportunities as additional control groups. This include firms operating in services activities that are not easily performed by mobile employees sent abroad, such as hotels, beauty salons, retail stores, licensed health professions etc. Provision of services abroad represent less than 2% of these sheltered sectors turnover. The Figure plots the estimated event-study coefficients θ_k from Equation (10) for the period 2006-2017 using the baseline 4,151 treated firms and the group of firms in non-postable industries as control group. The regressions include calendar year \times province fixed effects and standard errors are clustered at the calendar year \times province level. The dataset and estimation sample is described in Appendix G.

Figure A.41: Posting Surplus: All Specifications

A. Wage Rates Dynamics in Sending Firms Around the Posting Event



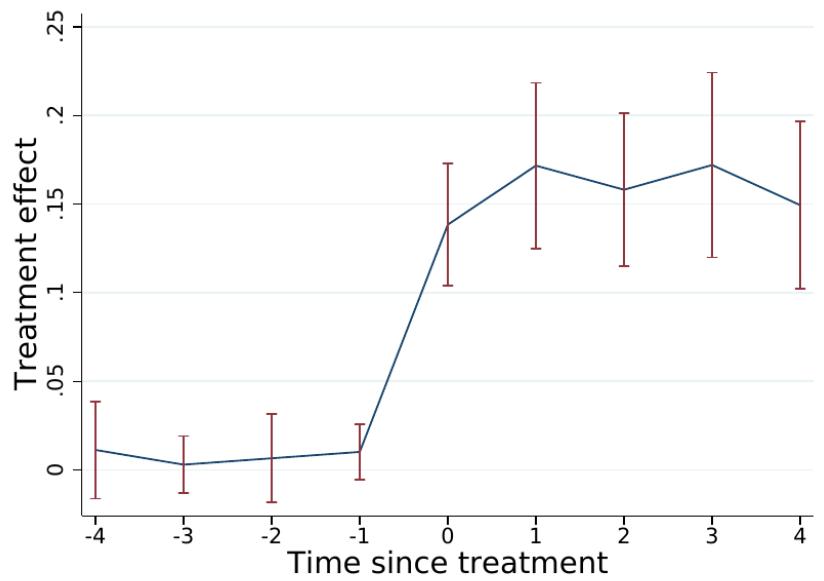
B. Profits Dynamics in Sending Firms Around the Posting Event



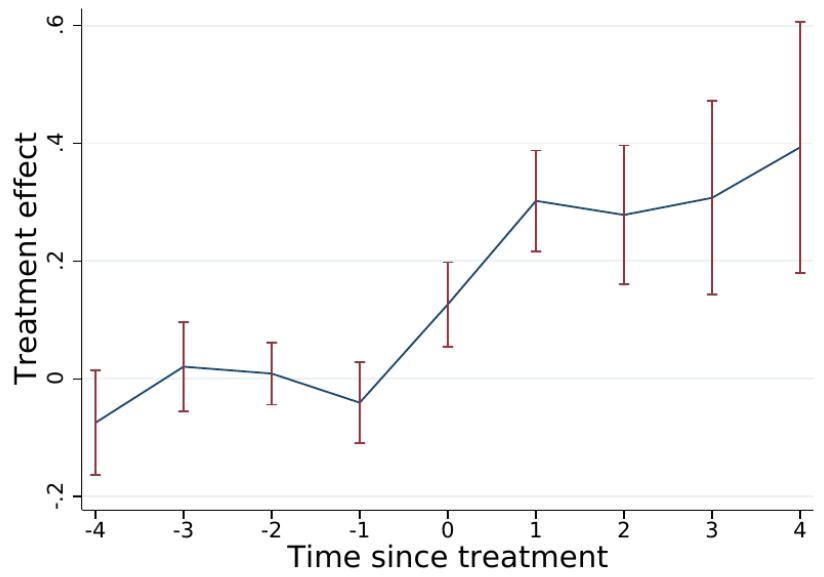
Notes: The Figure plots the estimated event-study coefficients θ_k from Equation (10) where the dependent variable is log wage rate (Panel A) and log earnings before taxes (Panel B) for various specifications. See the footnote under Figure 13 for details about the specification. The blue line shows the estimates of Equation (10) for all firms (4,151 treated firms and 28,803 control firms that never provide services abroad over the period), while the green line uses the restricted sample with only treated firms (baseline specification). The red and yellow line shows the estimates of the baseline event-study specification in a semi-dynamic fashion with θ_k specified for only $k > 0$, while light green line omits firms' fixed effects in the baseline specification. These tests help to assess the plausibility of heterogeneous treatment effects and negative weightinlh issues in the baseline twoay fixed-effects specification, and follow suggestions by [Borusyak and Jaravel \[2017\]](#).

Figure A.42: Posting Surplus: Accounting For Heterogeneous Treatment Effect

A. Wages Rates Dynamic Around the Posting Event

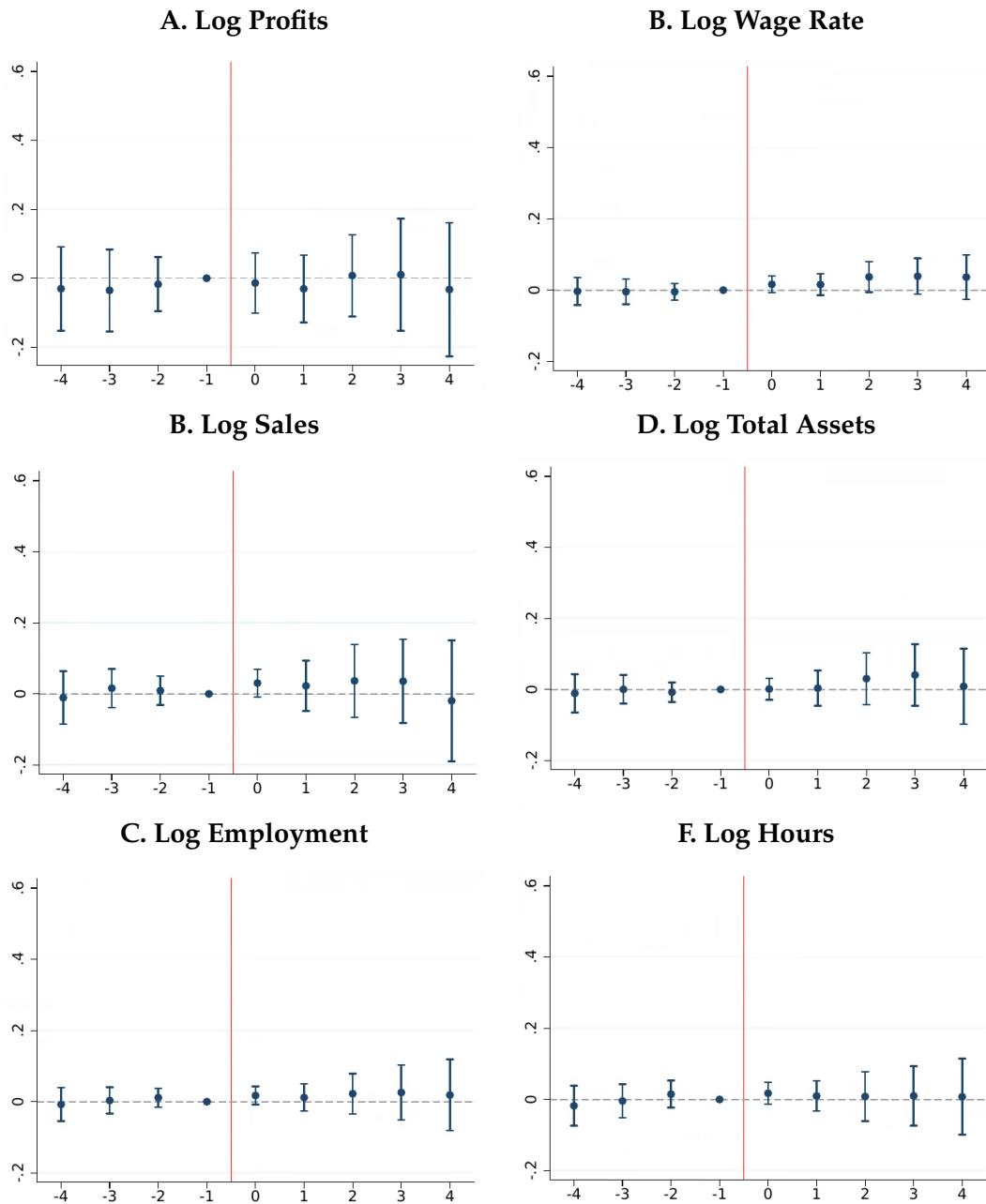


B. Profits Dynamic Around the Posting Event



Notes: The Figure uses an alternative estimator developed by [de Chaisemartin and d'Haultfoeuille \[2019\]](#) that corrects for negative weighting and is robust to negative weighting, using the build-in command multiple_did gt in stata.

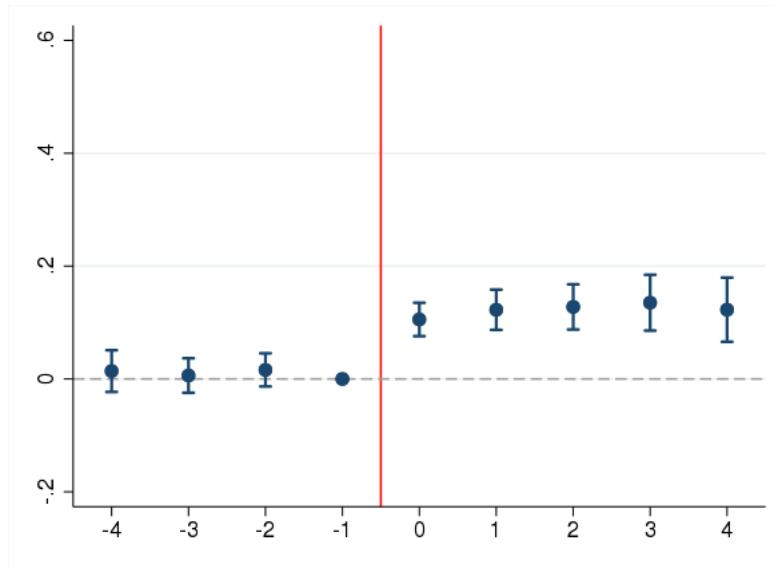
Figure A.43: Posting Surplus: Effects of Placebo Posting Events on Sending Firms



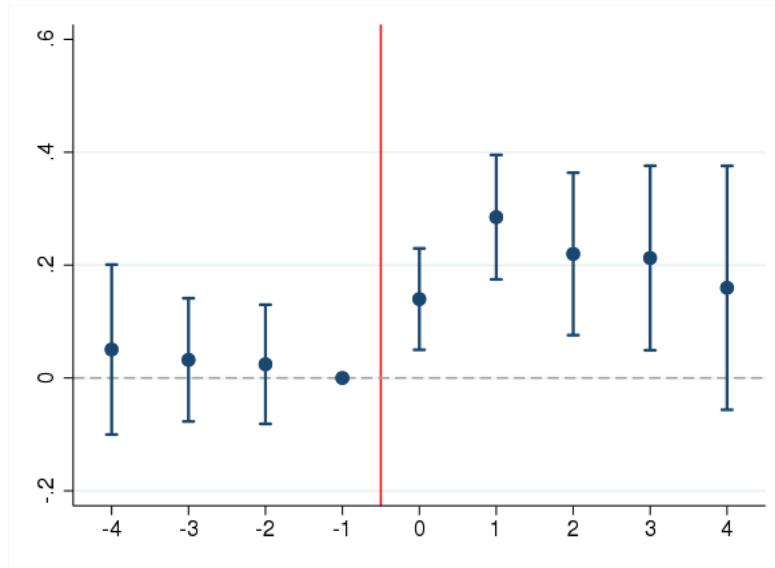
Notes: The figure repeats the baseline analysis presented in Figure 13 and Figure 11 by replacing the “first provision of services abroad event” by a placebo event. The placebo event year is randomly attributed across treated firms. All controls are the same than in the baseline analysis and are described in footnote of Figure 13 and Figure 11.

Figure A.44: Posting Surplus: Robustness to Balancing the Sample

A. Wage Rates Around First Posting



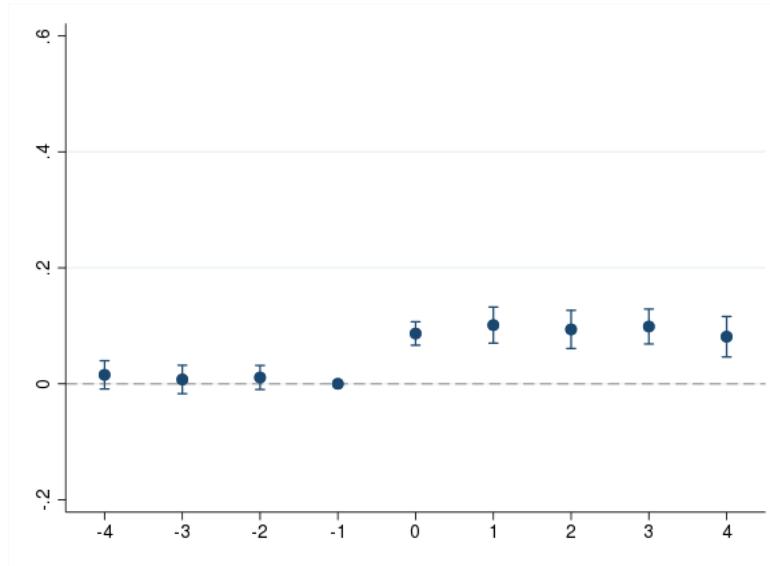
B. Profits Around First Posting



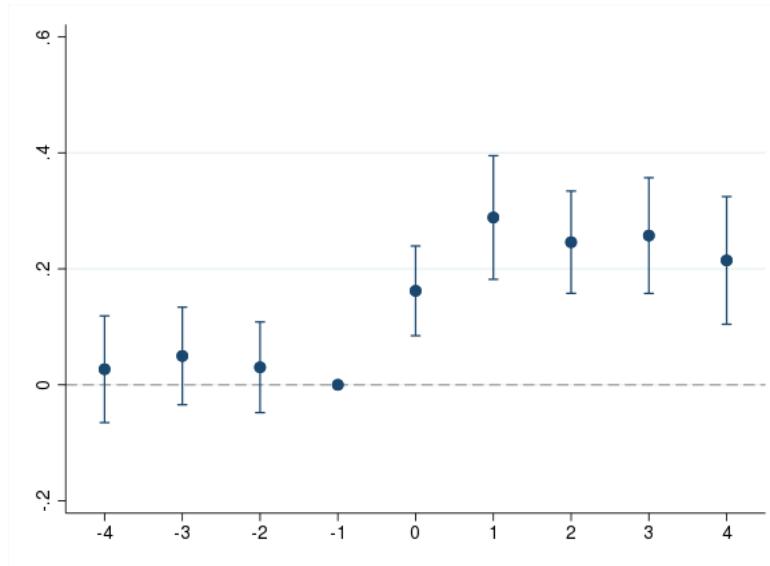
Notes: The Figure repeats the estimates plotted in Figure 13 where the baseline sample of estimation is balanced around event-time, keeping only firms that are observed the year prior and the year after the event of firms posting.

Figure A.45: Posting Surplus: Alternative Matching Estimators

A. Wage Rates Around First Posting



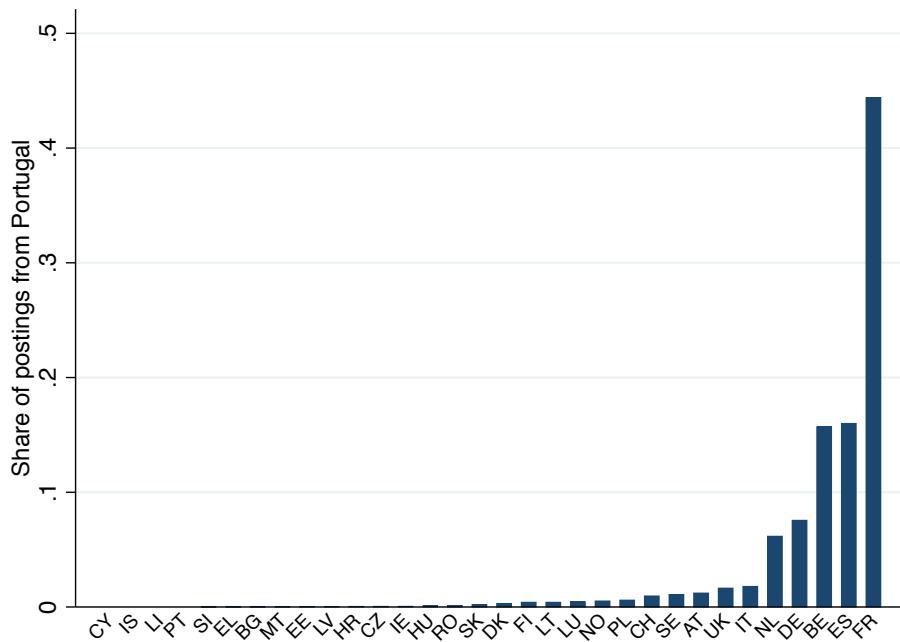
B. Profits Around First Posting



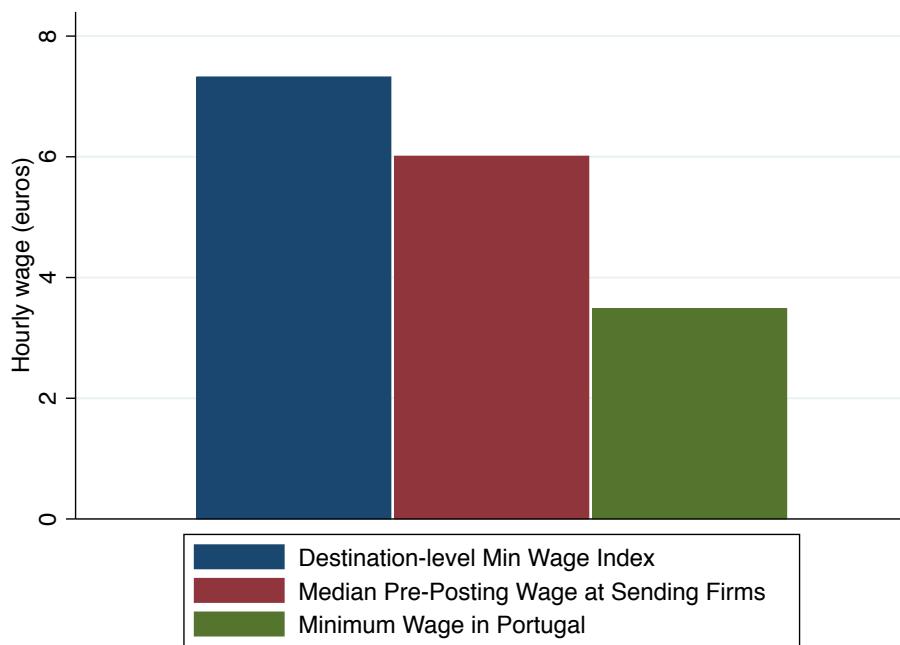
Notes: The Figure repeats the estimates plotted in Figure 13 using an alternative control groups built with matching method. More specifically, I match each treated firm observed as providing services abroad for the first time between 2020 and 2015 with a comparable firm that did not provide services abroad over the same period. The matching uses a propensity score matching to match treated firms with control firms in same province and sector, as well as with close pre-treatment characteristics (sales and number of employees). I then re-estimate Equation (10) with this novel control group.

Figure A.46: Destination-Level Minimum Wage Requirements for Portuguese Firms

A. Posting Services Exported by Portugal by Receiving Country

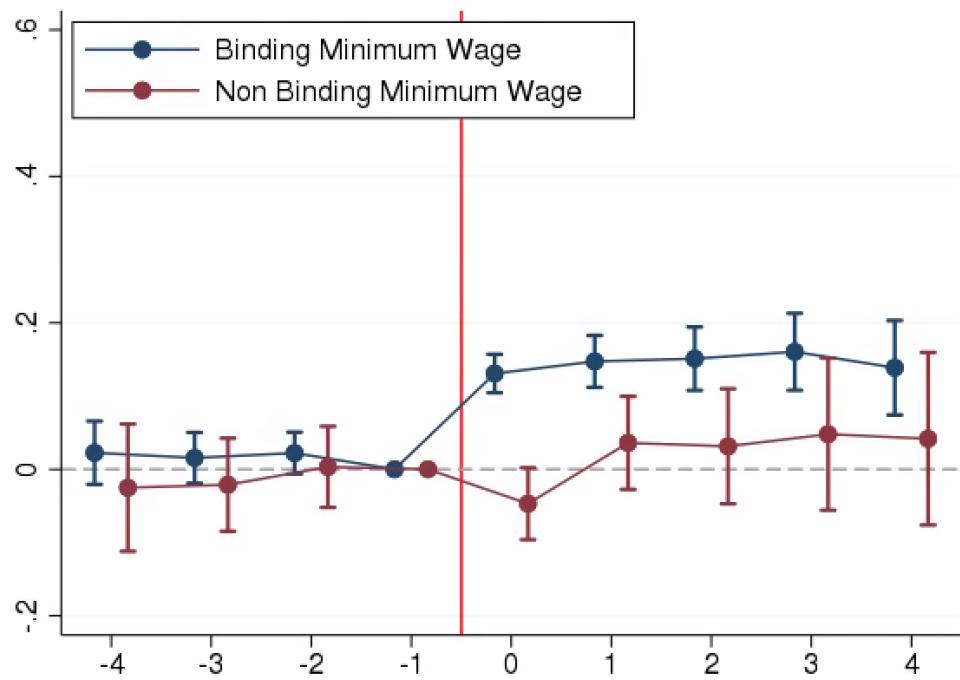


B. Destination-Level Minimum Wage Requirements Faced by Portuguese Firms



Notes: This figure describes destination-level minimum wage constraints faced by sending firms located in Portugal. The top panel shows the aggregate distribution of receiving countries for all missions performed by Portuguese companies, and is based on the EU-wide dataset on bilateral posting flows from A1 social security forms. The bottom panel shows the average destination minimum wage index faced by Portuguese companies based on the aggregate decomposition of receiving countries (blue bar). The red bar shows the median level of wages paid by sending firms the year before they start posting workers abroad.

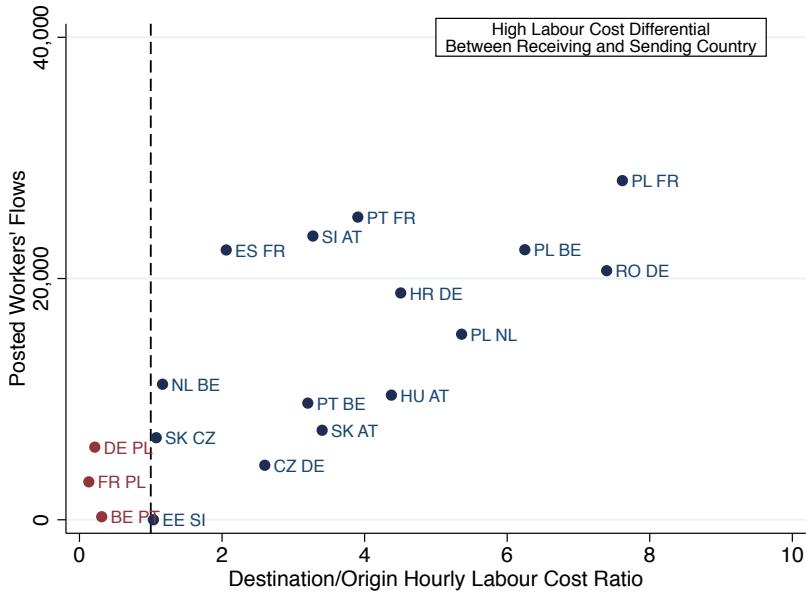
Figure A.47: Posted Workers' Wage Gains By Pre-Posting Bindingness of Wages



Notes: The Figure estimates Equation (10) using log wage as a dependent variable on two separate sample of sending firms located in Portugal. The blue line shows the estimated of θ_k for firms with a pre-posting level of wage below the average destination-level minimum legal wage index. As posted workers cannot be paid under the destination-level minimum legal wage, these firms should be constrained to increase their workers' wages when supplying services abroad. The red series shows the same estimates for sending firms with pre-posting wages above the average destination-level minimum legal wage.

Figure A.48: **Postings Flows from Low to High Labor Cost Countries**

A. Bilateral Flows and Labor Cost Ratio



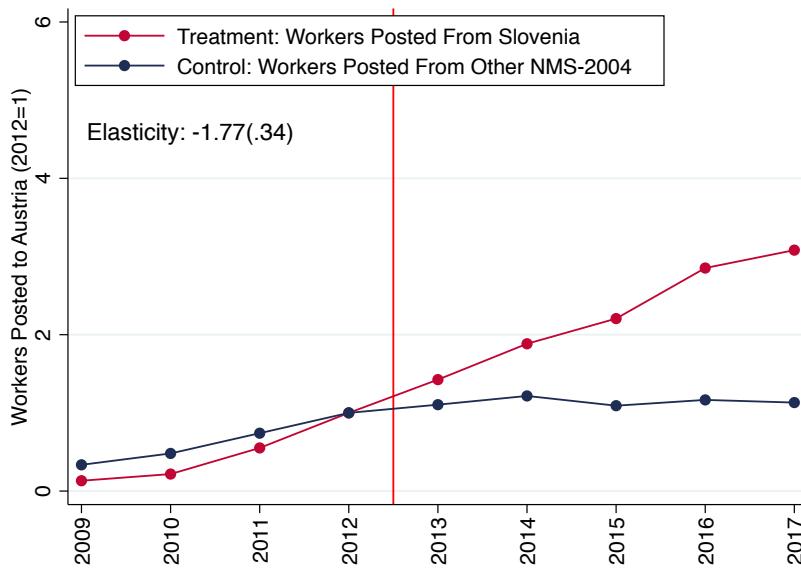
B. Steady-State Correlation



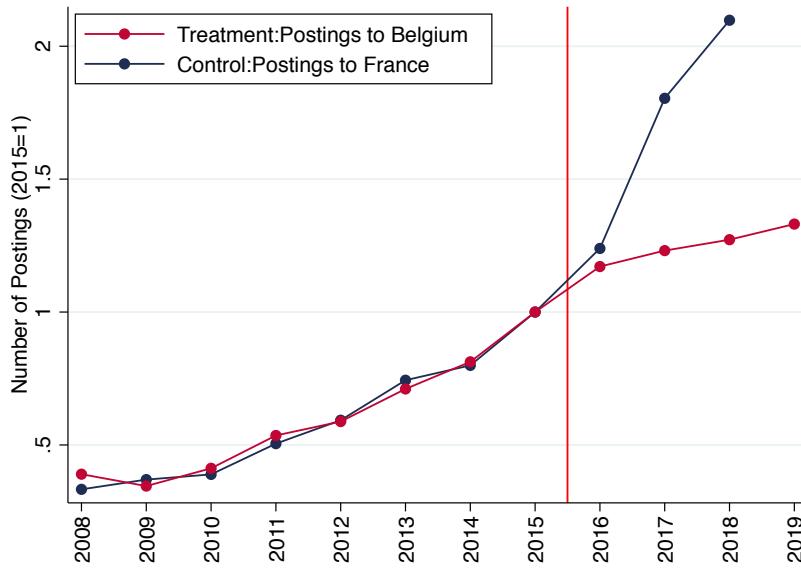
Notes: Posted workers pay origin-level labor taxes and are exempted from destination-level payroll taxes. The figure depicts the steady-state correlation between bilateral posting flows and destination-origin payroll taxes differentials for the period 2009-2017. The figure is based on the full matrix of bilateral posting flows within the EU merged with data on employers' payroll tax cost for 2009-2017. Posting flows are measured by mandatory E1/A101 social security forms that posted workers must hold when providing a service abroad, available at the origin-destination level each year for 2005-2017 (Appendix F). Data on employers' non-wage labor cost (social security contributions and other labor taxes) are from annual Eurostat Labor Cost Indexes and are available for 2009-2017. The top panel plots, for some destination-origin pairs, the average raw level of posting flows against the average destination-origin payroll tax ratio over the period. A large destination-origin non-wage labor cost ratio means the sending country is characterized by much lower level of payroll taxes than the receiving country. The black dotted line depicts country pairs with similar levels of payroll taxes. The bottom panel generalizes this relationship by plotting the binned scatter plot of log bilateral posting flows against the log of the destination-origin non-wage labor cost ratio for all country pairs and all years. The reported coefficient is the cross-sectional correlation between log posting flows and log labor cost ratio for the period 2009-2017.

Figure A.49: Effect of Payroll Tax Reforms on Posting Flows

A. Employers' Labor Cost Cut in Sending Country (Slovenia)



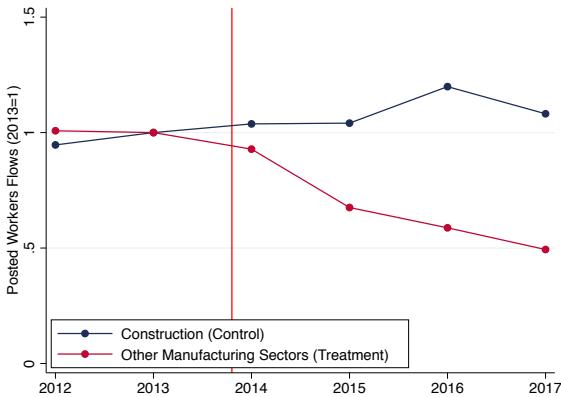
B. Employers' Labor Cost Cut in Receiving Country (Belgium)



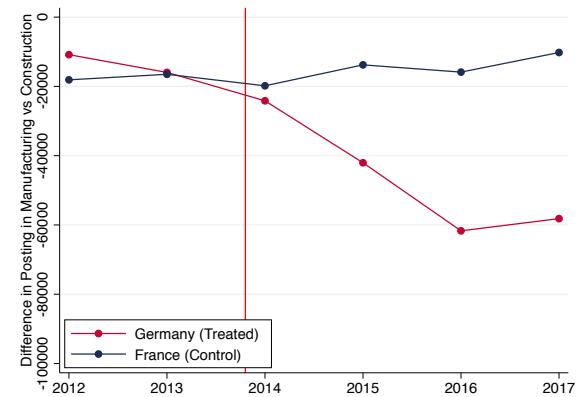
Notes: Posted workers pay origin-level labor taxes and are exempted from destination-level payroll taxes. This figure describes how posting flows are affected by exogenous labor cost reforms, exploiting two quasi-experimental changes in employers' labor cost in one of the main sending countries (Slovenia) and one of the main receiving countries (Belgium). A reform implemented at the end of 2012 in Slovenia decreased the labor cost of workers posted from the country by capping employers' social security contributions at 40% of the average Slovenian wage. Panel A shows how postings sent by Slovenia (treated, red series) evolved compared to posting flows from comparable countries (control, blue series) before and after the policy-induced change in labor cost. A reform implemented in Belgium in 2015 decreased Belgian employers' social security contributions by 8 percentage points. Panel B shows how postings received by Belgium (treated, red series) evolved compared to posting flows to comparable countries (control, blue series) before and after the policy-induced change in labor cost. All series are normalized to one the year before the implementation of the labor tax cut.

Figure A.50: Posting Flows Responses to Destination-Level Minimum Wage Reform

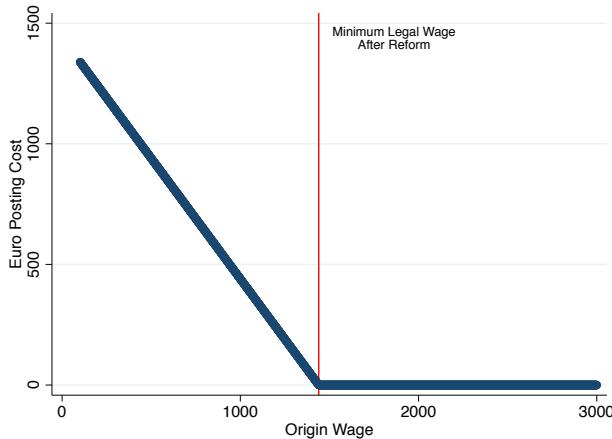
A. Postings to Treated and Control Sector



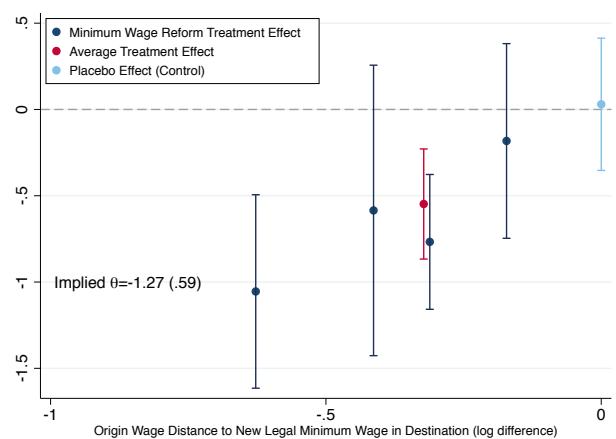
B. Treated vs Control Destination Country



C. Exposure to Reform by Sending Country

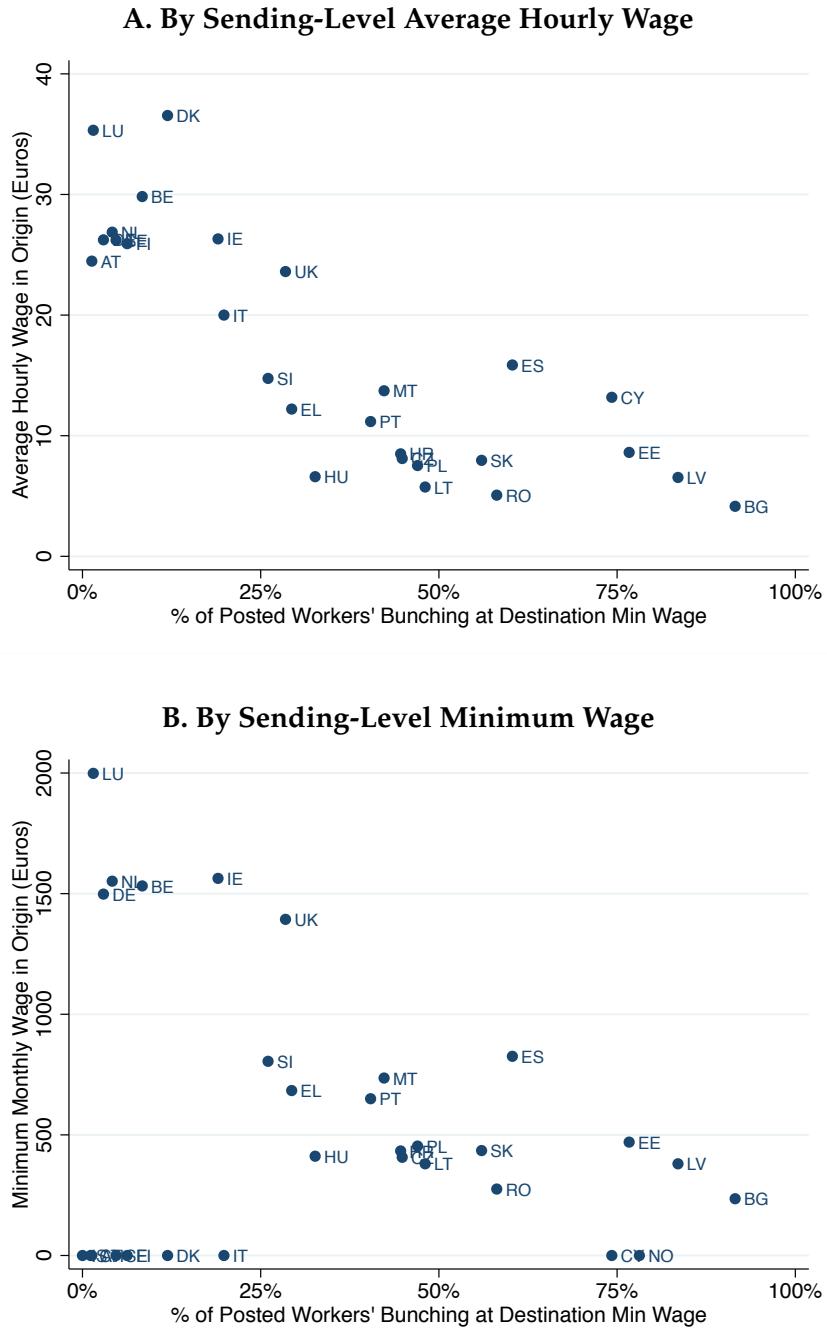


D. Treatment Effects of the Reform



Notes: Posted workers pay origin-level labor taxes but cannot be paid under the receiving country's minimum legal wage. This figure decomposes posting flows responses to a minimum wage reform in Germany. A minimum legal wage was implemented in the meat industry sector in August 2014 and in all other sectors in 2015. The construction sector was regulated by a minimum legal wage since 1996 (applicable to posted workers), while other manufacturing sectors had collective agreements for German workers (not applicable to posted workers). The reform created an additional cost for postings to the treated (manufacturing) sector from countries with wages below the novel minimum legal wage in Germany (8 euros per hour). The analysis of the reform exploits E101/A1 mandatory posting forms with sectoral information, available from 2012 to 2017 for a subsample of sending countries: Poland, Luxembourg, Hungary, Czech Republic, Lithuania, and Romania. For these sending countries, I observe the universe of posting missions performed in each receiving country in each sector. Panel A shows how postings to Germany in treated (manufacturing) versus control (construction) sectors evolved after the implementation of the minimum legal wage in Germany. Panel B shows the sectoral differential evolution in the treated (Germany) versus control (France) receiving country. Panel D exploits heterogeneous exposure to the reform *within* the treated (manufacturing) sector, exploiting the kinked relationship between the sending country's wage level and additional cost implied by the reform, as shown in Panel C. Panel D shows the treatment effect (and 95% confidence intervals) of the minimum wage reform by exposure to the reform, controlling for origin-year, destination-year, and pair-year fixed effects. The coefficient compares flows of postings in the manufacturing (treated) sector, before and after the German minimum wage reform, to Germany and other countries, for each sending country that have more or less exposure to that reform. The blue coefficient plots the estimated treatment effect for the sending country with zero direct exposure to the reform, Luxembourg (minimum wage above novel German minimum wage). The resulting elasticity with respect to additional posting cost implied by the minimum wage implementation is 1.27(0.59).

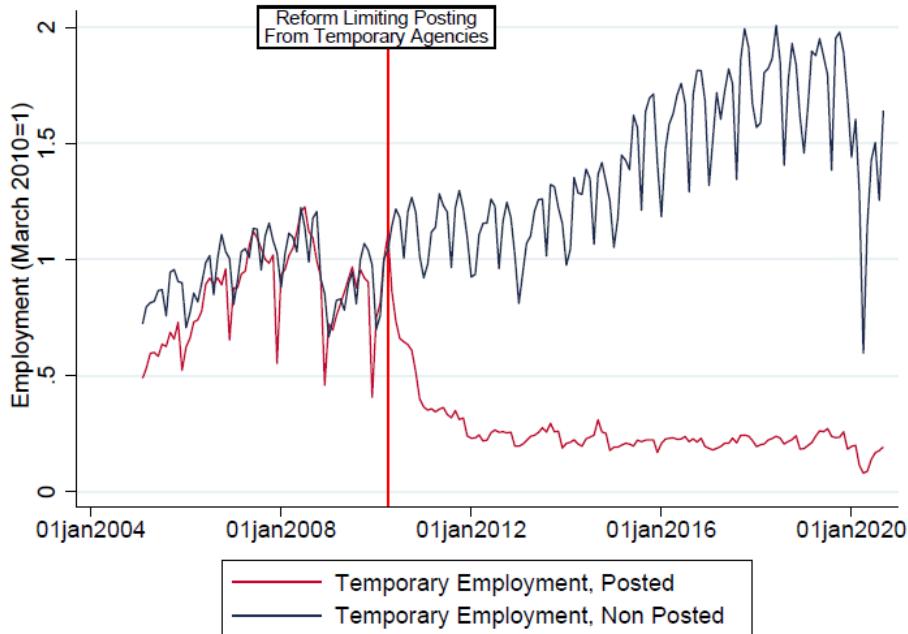
Figure A.51: Bunching at Destination-Level Minimum Wage by Sending-Level Wage



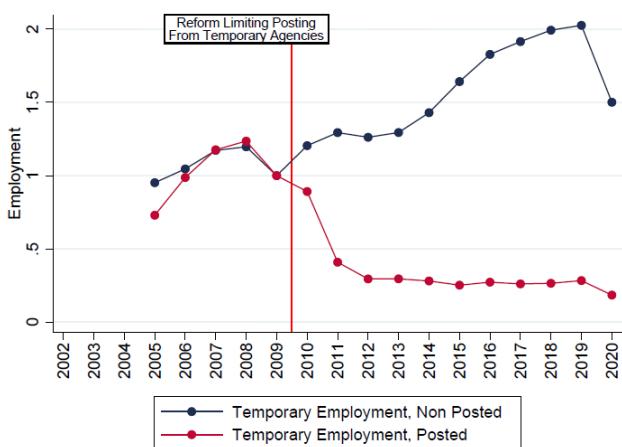
Notes: Posted workers cannot be paid under destination-level minimum legal wage. This Figure shows the relationship between destination-level wage and wages paid to posted workers in the second largest importer of posting services: France. I use the universe of mandatory posting declarations filed by foreign suppliers that send posted workers in the French territory (DPD/SIPSI dataset) from 2016 to 2020. The posting declarations contain information on wages paid by foreign firms to their employees posted in France during the posting mission, as well as detailed information on the posting contract. I use this information to compute the share of posted workers who are paid exactly at the minimum wage in France ("bunching at minimum wage") for each origin country. The share of posted workers bunching at destination-level minimum wage helps to assess the bindingness of the "prevailing wage" clause imposed by the posting policy. Panel A plots the relationship between origin country average hourly rate and the share of workers posted from that country that are paid exactly at the French minimum wage. Panel B plots the relationship between origin country minimum wage and the share of workers posted from that country that are paid exactly at the French minimum wage. Some origin countries have no minimum legal wage (Denmark, Italy etc).

Figure A.52: Effects of Destination-level Payroll Tax Exemption Reform on Sent Postings

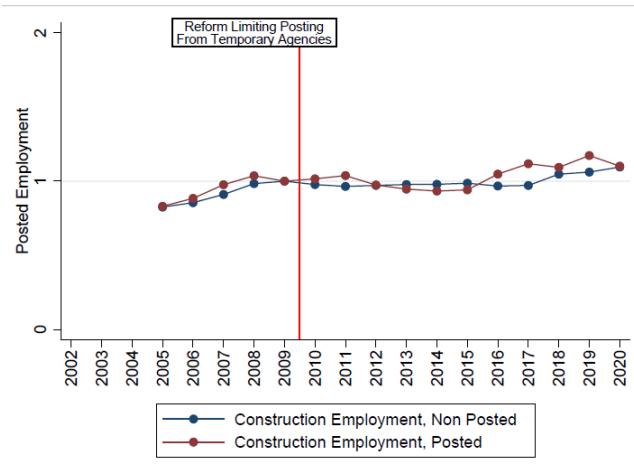
A. Treated Sector, Posted vs Non Posted Employment (Monthly)



B. Treated Sector, Posted vs Non Posted (Annual)

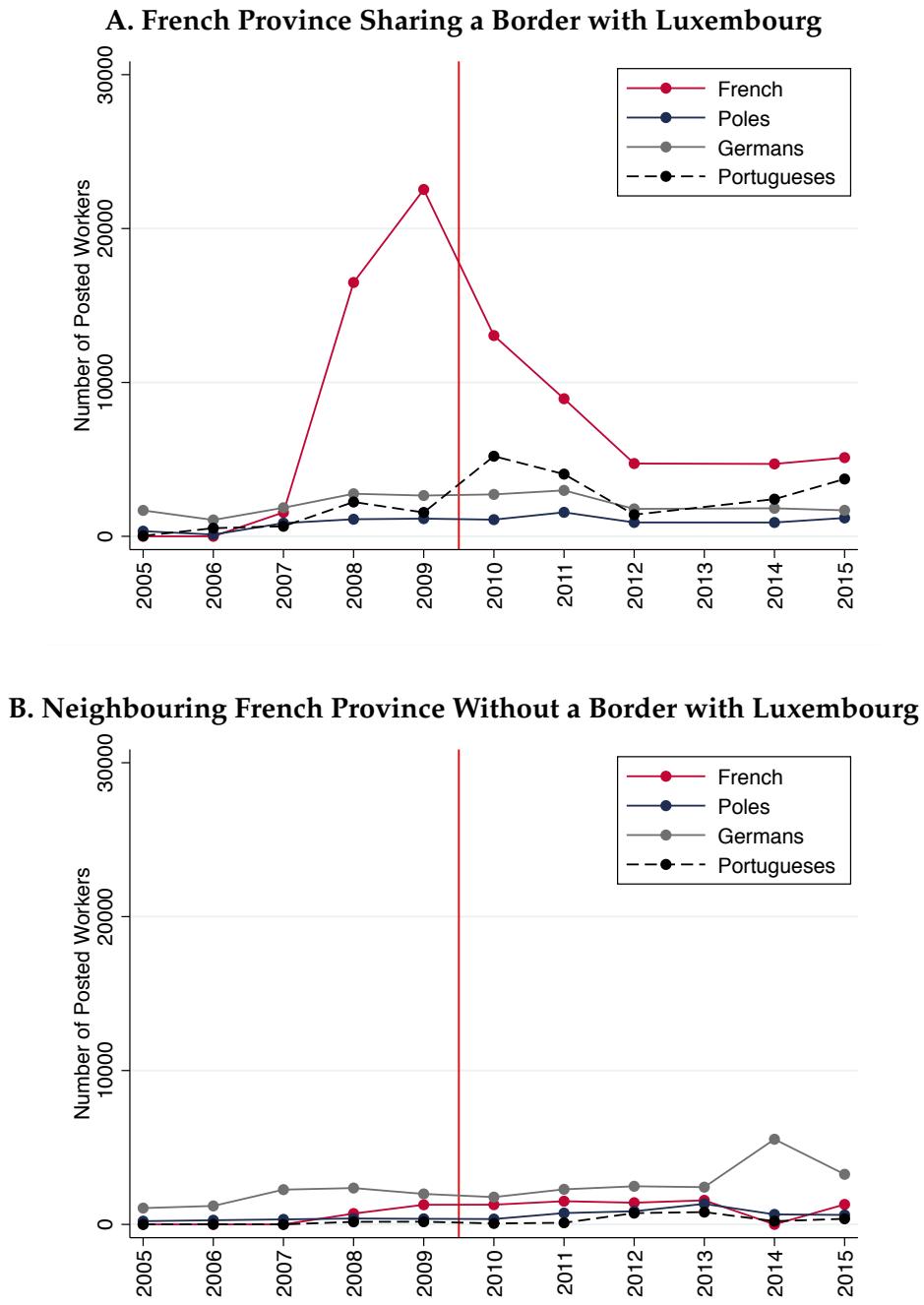


C. Control Sector, Posted vs Non Posted (Annual)



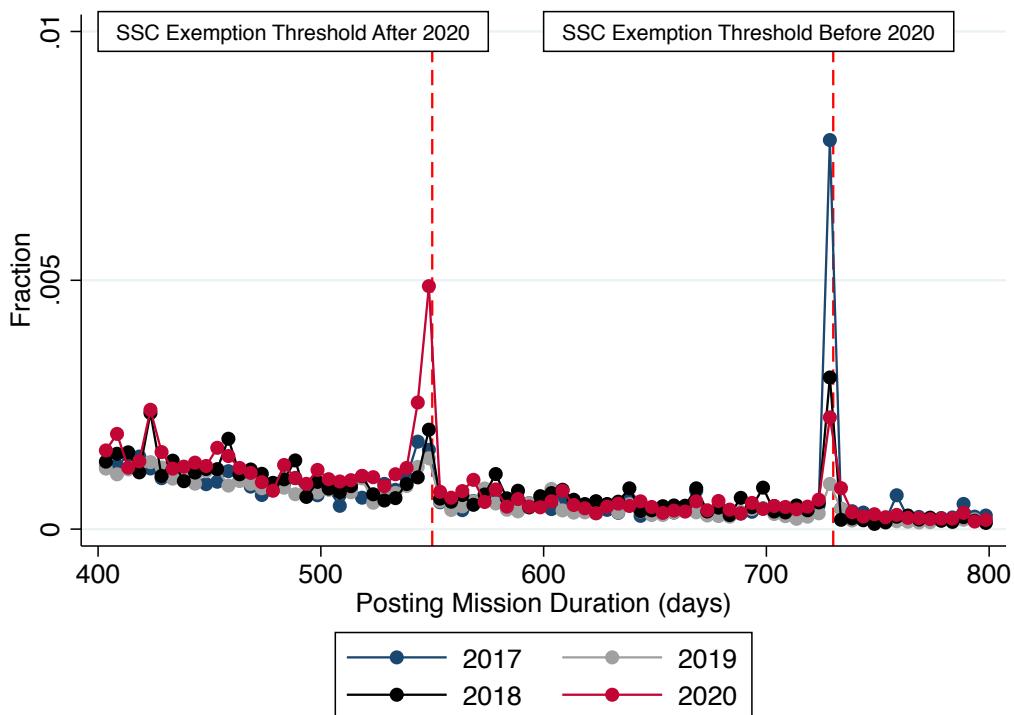
Notes: This Figure shows the effects of restricting posting-specific payroll tax exemptions in sending countries. I study a reform that restricted labor cost exemptions granted for workers posted from temporary agencies located in Luxembourg. The reform was implemented in May 2010 and described in Appendix D. To study this reform, I use exhaustive linked employer-employee data covering all job spells in Luxembourg from 2002 to 2020, merged with exhaustive mandatory posting declarations filed by Luxembourgish employers for 2004-2020. Panel A shows the monthly number of jobs (normalized to one in the month preceding the reform) at temporary employment agencies located in Luxembourg performed abroad by posted workers (red line) or performed in Luxembourg (blue line), before and after the reform (vertical red line). Panel B repeats the analysis at the annual rather than monthly level. Panel C shows the same comparison for an alternative sector in Luxembourg (transport) that was much less affected by the 2010 reform, compared to temporary employment agencies.

Figure A.53: Effects of Destination-level Payroll Tax Exemption Reform on Received Postings



Notes: This Figure shows the effects of restricting posting-specific payroll tax exemptions in receiving countries. I study a reform that restricted labor cost exemptions granted for workers posted from temporary agencies located in Luxembourg. The reform was implemented in May 2010 and described in Appendix D. French provinces close to Luxembourg were more exposed to this reform. The figures show the number of received posted workers in a French province that shares a border with Luxembourg (Moselle), before and after the reform (depicted by a vertical red line), by citizenship of workers posted to that province. Panel B shows received postings over the same period in a neighbouring province that does not share a border with Luxembourg (Meurthe et Moselle) and was thus less exposed to the reform.

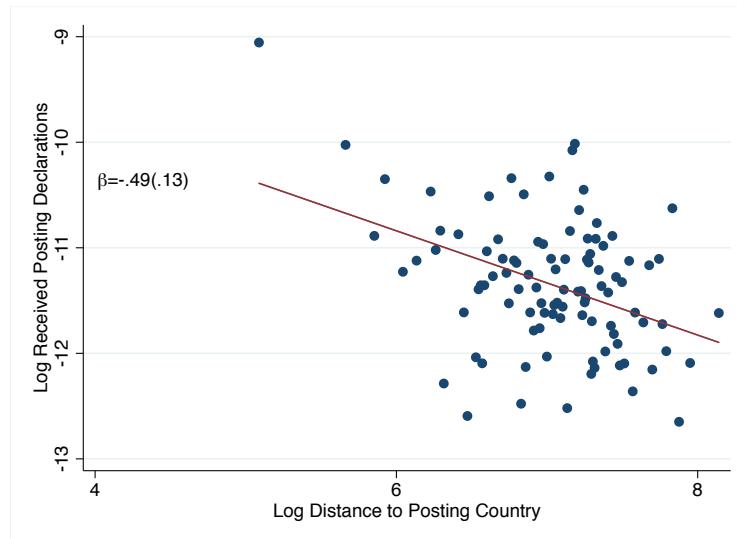
Figure A.54: Bunching at the Destination-level Labor Tax Exemption Threshold



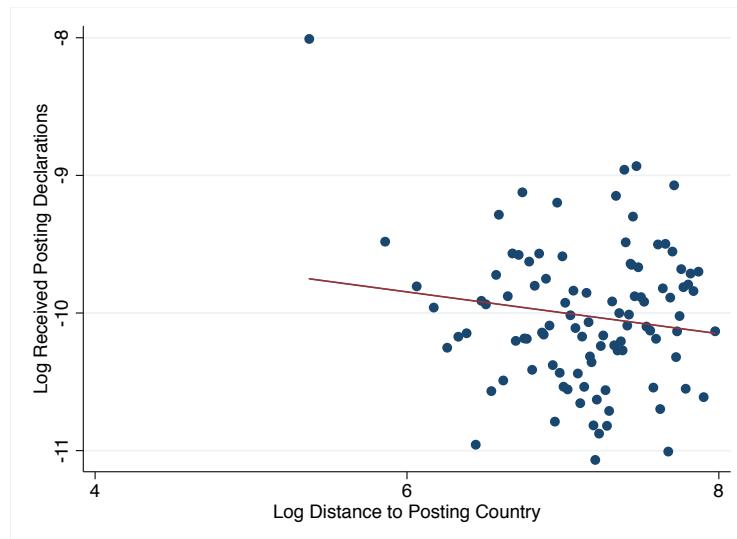
Notes: This Figure describes posting responses to a change in destination-level labor cost exemptions granted to posted workers, on data covering all posting missions performed in France. A European directive was voted in 2018 and entered into force in 2020 (see Appendix D for details). Before the adoption of the directive, destination-level labor tax exemptions were granted to individuals posted for less than 24 months. In 2020, the maximum duration to benefit from payroll tax exemptions in the country of work was decreased to 18 months. I use the universe of mandatory posting declarations filed by foreign suppliers posting workers to France (DPD/SIPSI dataset) from 2017 to 2020, to show the distribution of posting mission duration (in days) by unique posted worker and starting year of the posting mission. The new and old labor cost exemption duration thresholds are depicted by red dashed vertical lines.

Figure A.55: Link Between Geographic Distance And Posting Exposure Lowers Over Time

A. Distance and Posting Inflows, 2005

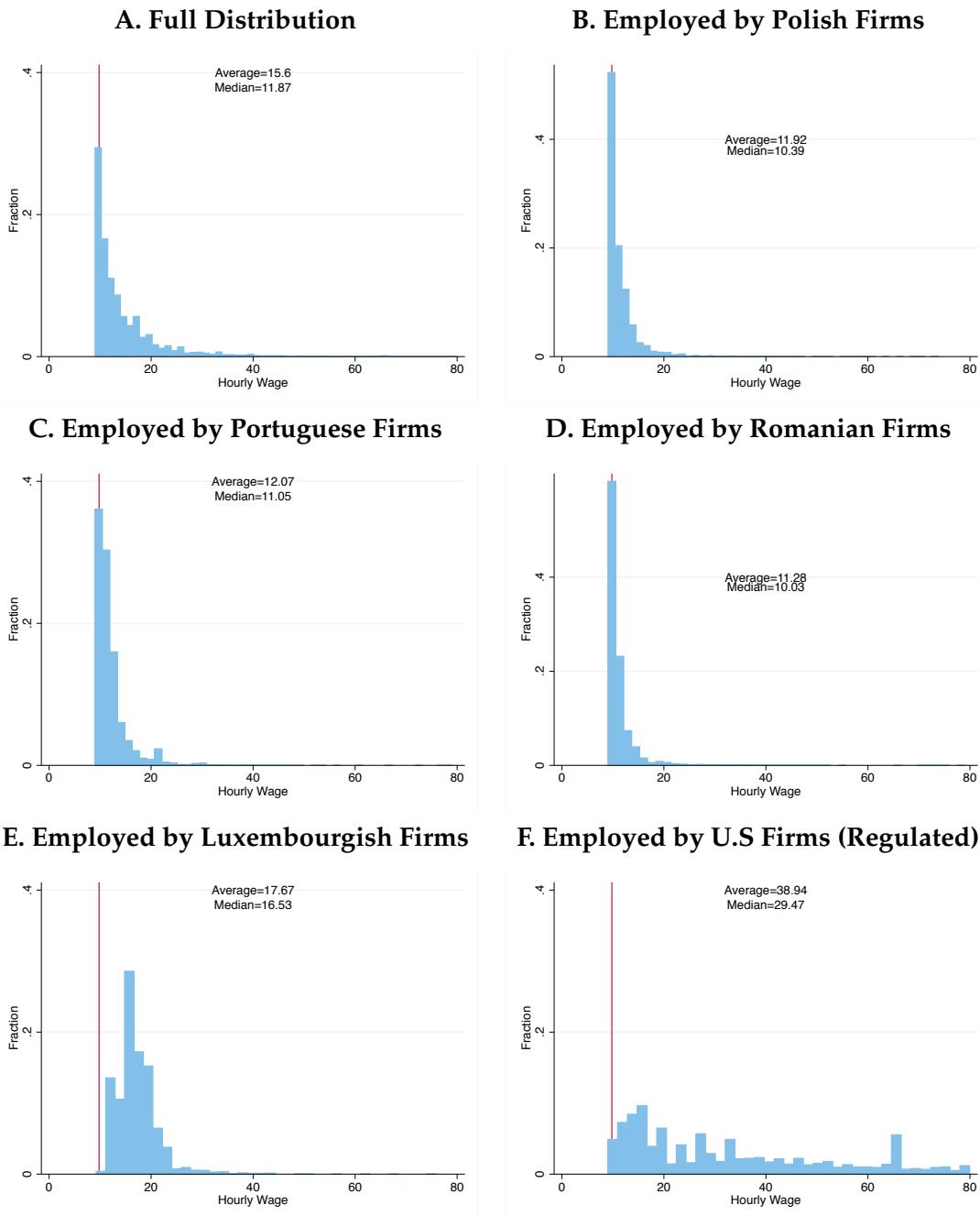


B. Distance and Posting Inflows, 2015



Notes: The Figure shows the relationship between distance to posting country and number of posting received from this country for each French province and each origin country.

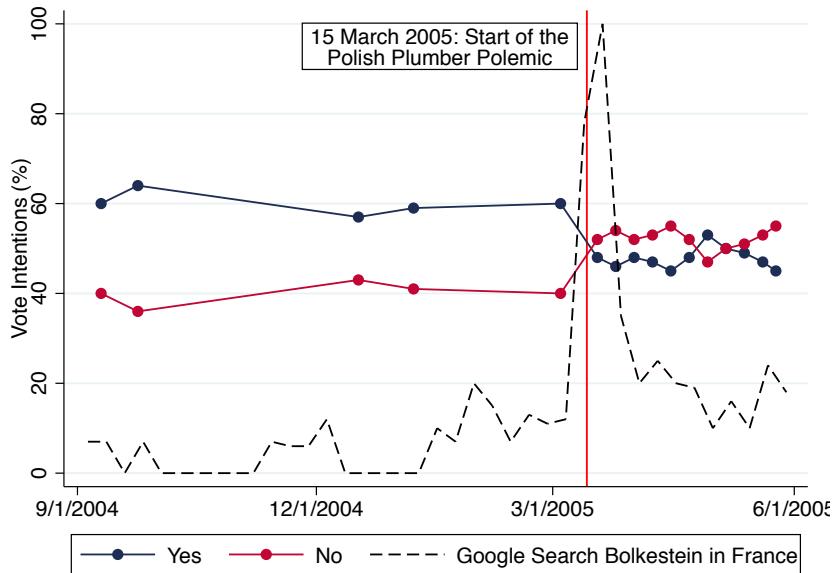
Figure A.56: Earnings of Posted Workers Performing Services in France



Notes: The Figure plots the distribution of hourly euro wage received by workers posted to France in 2018 and is based on the SPSI dataset described in details in [H](#).

Figure A.57: Political Backlash Against Posting Liberalization

A. Support for European Integration and Bolkestein Directive



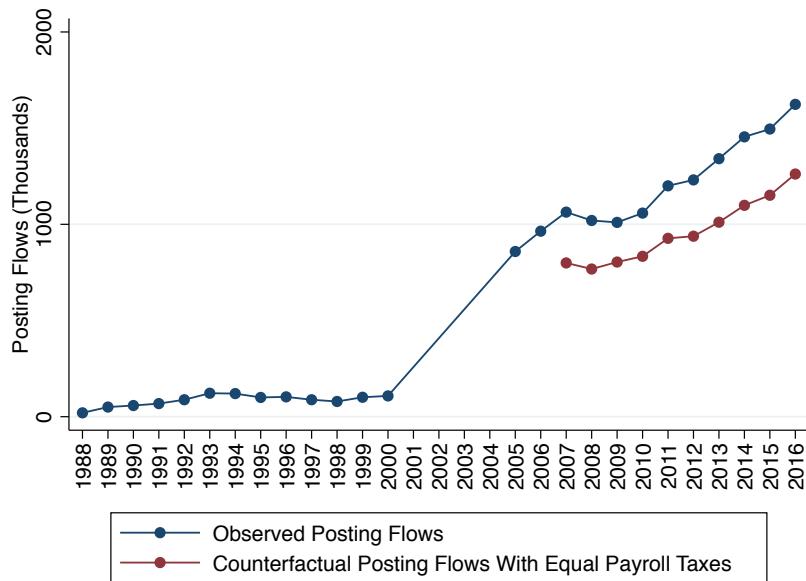
B. Protests Against Origin-Based Regulation in Bolkestein Directive



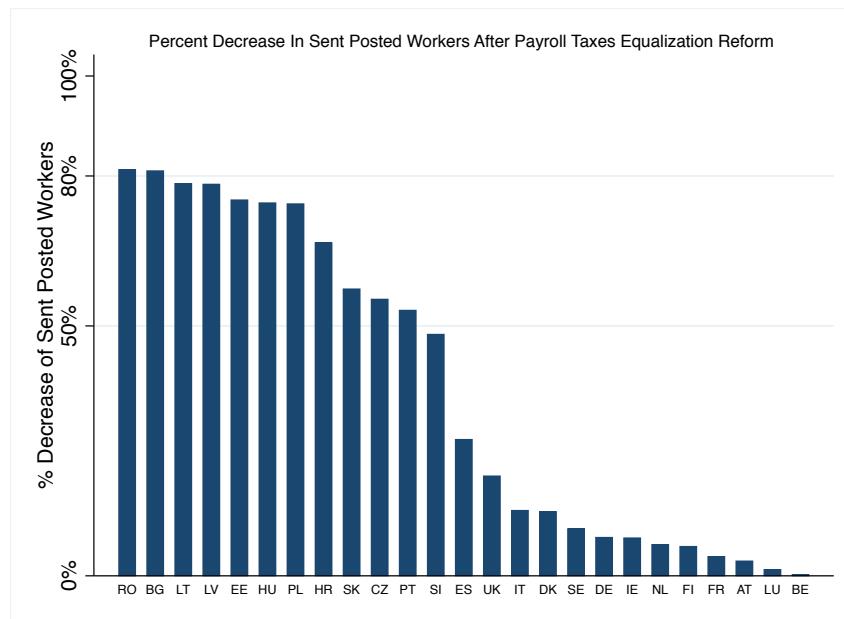
Notes: This Figure shows the effects of labor posting policy on support for European integration in one of the main European receiving country: France. In 2005, a referendum to adopt a European constitution was implemented in France. The Figure shows the vote intention, where "yes" denotes the option to increase European political integration. In March 2005, a proposition was made at the European commission to further liberalize the European posting policy, by exempting posted workers from all country of work regulations, including the minimum wage. This proposition (the Bolkestein proposition) led to massive debates in receiving countries, and gave birth to the "polish plumber" polemic the 15th of March 2005 when one of the main "no" leader, Philippe de Villiers, wrote a text evaluating that further services exports mobility liberalization will lead millions of French workers to lose their jobs. The same day, the number of searches for Bolkestein rose sharply in France. Few days after the polemic, the vote intentions against European integration rose, leading to reject the European political project in June.

Figure A.58: Posting Flows With Alternative Destination-level Tax Rules

A. Effect of Prevailing Labor Cost Reform

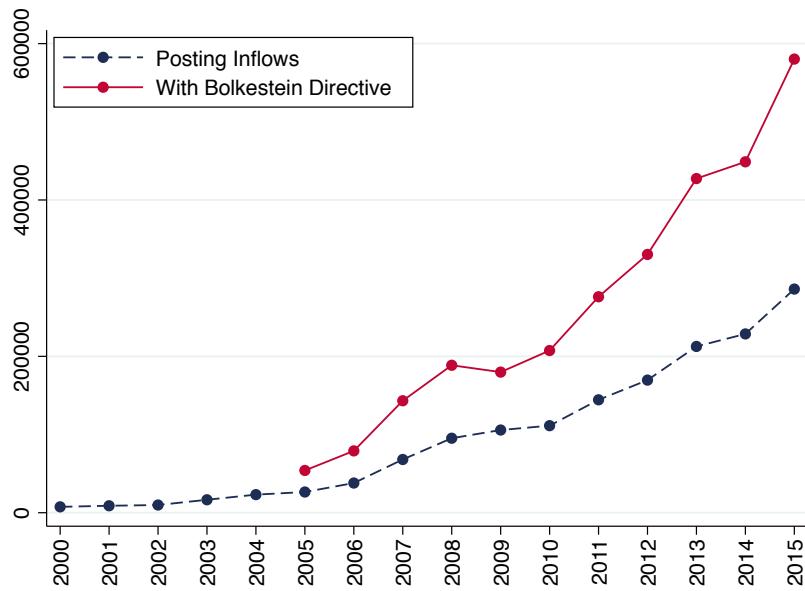


B. Distributional Effects of The Reform



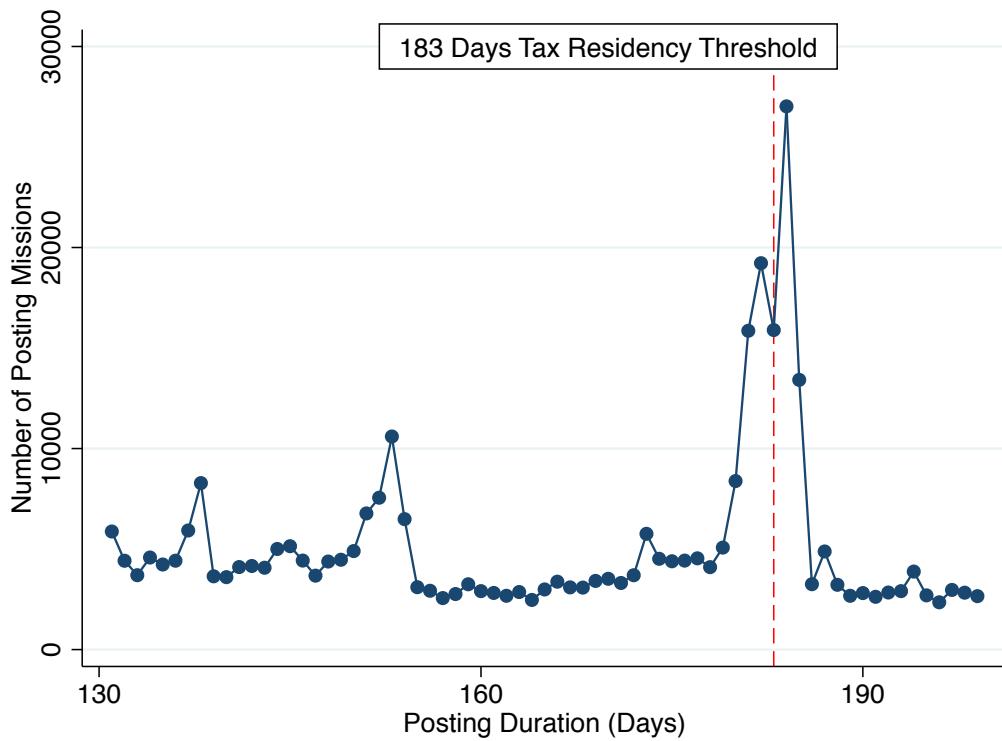
Notes: The Figure displays counterfactual posting flows when labor taxes are equalized across domestic and posted workers. The counterfactual flows come from a back of the envelope estimation using estimated posting elasticities displayed in Table 9 and assuming no general equilibrium or indirect effects, and can thus be considered as a first approximation of the full effects of an “equal tax” posting reform.

Figure A.59: Import Exposure in France Without Destination-level Minimum Wage Rule



Notes: The Figure displays counterfactual posting flows to France when posted workers are exempt from destination-level minimum legal wage. The counterfactual flows come from a back of the envelope estimation using estimated posting elasticities displayed in Table 9 and assuming no general equilibrium or indirect effects.

Figure A.60: Posting Duration Around the Income Tax Residency Threshold in Belgium



Notes: The Figure shows the distribution of posting missions duration in Belgium for the period 2008-2019 around the 183 days tax residency threshold that is depicted by the vertical dashed line. International tax treaties establish that individuals pay income taxes in the country where the work activity is performed. However, if the employer is not located in the country where the work mission is performed by its employee, and if the employee works less than 183 days in the country of work, the income tax is exceptionally levied by the country of residence, and not the country of work. On the other hand, if the employee works for more than 183 days in one country, the income tax on the wage received for the work mission is levied by the country of work, and not the country of residence. The income tax rate paid by posted workers for the wage earned abroad thus depends on the 183 days threshold. In addition of the rules related to part of the wage earned abroad, the 183 days rule can also affect total tax residency determination. If workers do not have a "central financial interest" in their country of origin, they become tax resident of the country of work if they stay more than 183 days in this country.

Table A.1: Administrative Datasets on the European Posting Policy

| Dataset | Source | Period | Description | Posting |
|-----------|-----------|-----------|---|---|
| EC/A1 | EC | 2007-2017 | Universe of SSC Forms Issued for posting in the EU | Yearly bilateral posted workers flows in the EU (by sector for some member states) |
| DPD/SIPSI | DGT/DARES | 2000-2019 | Universe of Administrative Forms for Workers posted to France | Yearly flows at the sending country-receiving province-sectoral level until 2015, individual data linkable to receiving companies and workers for 2016-2019 |
| LIMOSA | ONSS/CBSS | 2010-2019 | Universe of Administrative Forms for Workers posted to Belgium | Individual-level data linkable to receiving firms data |
| GOTOT-OUT | ONSS/CBSS | 2007-2019 | Universe of Administrative Forms for Workers posted from Belgium | Individual-level data linkable to sending firms data |
| CBHP | BoP | 2006-2017 | Universe of Portuguese Firms' Balance Sheets data merged with data on Service Prestation to the EU Market | Identify companies sending their workers abroad to perform services |
| IGSS | IGSS | 2002-2017 | Universe of Matched Employer-Employee Data in Luxembourg | Identify workers hired in Luxembourg with an indicator if the worker is posted abroad during the employment period |

Notes: The Figure summarizes the collected administrative datasets on the European mobility policy of posting and used for the empirical analysis. More details on the datasets can be found in the text. Each dataset on posting is also described in details in one dedicated appendix by dataset.

Table A.2: Administrative Datasets on labor Markets in Receiving and Sending Countries

| Dataset | Source | Period | Description |
|---------------|--------|-----------|---|
| Datawarehouse | BCSS | 2007-2019 | Administrative matched employer-employee data allowing to follow over time the universe of employment periods of the universe of workers hired in Belgium, that can be merged to the entire set of social security registries in Belgium. |
| AA | NBB | 2007-2019 | Balance sheets firm data from corporate tax returns covering the universe of non financial corporations established in Belgium |
| DADS Postes | INSEE | 1970-2018 | Administrative matched employer-employee data covering the universe of job spells in France |
| FICUS/FARE | DGFIP | 2000-2017 | Universe of corporate tax returns for the universe of firms established in France |
| IGSS | IGSS | 2022-2017 | Administrative matched employer-employee data allowing to follow over time the universe of employment periods of the universe of workers hired in Luxembourg, that can be merged to the entire set of social security registries in Luxembourg. |
| CBHP | BoP | 2006-2017 | Universe of corporate tax returns for the universe of firms established in Portugal |

Notes: The Figure summarizes the collected administrative datasets on workers and firms in receiving and sending countries. More details on the datasets can be found in the text.

Table A.3: Exporters and Employment in Mobility-Dependent Services Sectors

| Mobility-Dependent Sector | % of non-financial corporations (1) | % of salaried employment (2) | % of firms that export (3) |
|---|--|---------------------------------|-------------------------------|
| Roofing activities | .03 | .03 | 17.7 |
| Test drilling and boring | .02 | .03 | 5.9 |
| Construction of water projects | .01 | .04 | 12.5 |
| Construction of railways | .01 | .04 | 19.5 |
| Demolition | .03 | .04 | 6.5 |
| Plastering | .1 | .05 | 9.8 |
| Construction Utility Projects for fluids | .05 | .08 | 6.2 |
| Other Building Completion | .2 | .1 | 15 |
| Installation of Industrial Machinery and Equipment | .1 | .12 | 23.4 |
| Site preparation | .15 | .13 | 2.9 |
| Painting and glazing | .2 | .1 | 6.7 |
| Floor and wall covering | .3 | .2 | 20.1 |
| Construction of utility projects for electricity | .05 | .2 | 13.7 |
| Joinery installation | .4 | .2 | 13.6 |
| Installation of conditioning air | .3 | .2 | 8.4 |
| Installation of plumbing | .4 | .2 | 5 |
| Repair of machinery | .2 | .2 | 13.9 |
| Other construction installation | .2 | .3 | 11 |
| Construction of bridges | .01 | .35 | 29 |
| Other misc construction activities | .4 | .4 | 11 |
| Construction of roads | .09 | .7 | 11 |
| Construction of other civil engineering projects | .4 | .7 | 6.7 |
| Electrical installation | 1 | .9 | 5.4 |
| Freight transport by road | 2.0 | 2.4 | 29.7 |
| Temporary employment agency activities | .1 | 3.4 | 34 |
| Construction of residential and non residential buildings | 5.7 | 3.9 | 6.2 |
| Total Non-Tradable Services Sectors | 12.6 | 15.3 | 11.5 |

Notes: This Table shows describes firms in mobility-dependent services sectors. The estimations are based on detailed administrative firm-level balance-sheets data covering the universe of non-financial companies operating in Portugal merged with exhaustive information on trade in goods and services at the company-level. The dataset is described further in Appendix G.

Table A.4: Exporters and Employment in Manufacturing Sectors

| Manufacturing Sector | % of non-financial corporations (1) | % of salaried employment (2) | % of firms that export (3) |
|--|--|---------------------------------|-------------------------------|
| Bleaching and dyeing | .02 | .16 | 16.5 |
| Manufacture of medicaments | .02 | .17 | 44.3 |
| Processing and preserving of poultry | .01 | .17 | 44.7 |
| Sawmilling of wood | .12 | .17 | 27.1 |
| Treatment of metals | .12 | .19 | 11.3 |
| Manufacture of parts of footwear | .08 | .19 | 28.1 |
| Manufacture of marble | .20 | .20 | 40.8 |
| Processing and preserving of meat | .03 | .20 | 35.0 |
| Cotton-type weaving | .02 | .20 | 52.1 |
| Manufacture of motor vehicles | .01 | .21 | 28.7 |
| Operation of dairies and cheese-making | .06 | .2 | 29.2 |
| Support activities for crop production | .22 | .22 | 2.7 |
| Production of meat | .09 | .25 | 40.0 |
| Machining | .22 | .26 | 18.9 |
| Growing of vegetables | .30 | .26 | 8.2 |
| Manufacture of pastry and cakes | .22 | .26 | 7.7 |
| Manufacture of other metal products | .19 | .28 | 37.6 |
| Manufacture of textile | .14 | .31 | 34.0 |
| Manufacture of wine | .2 | .32 | 44.5 |
| Mixed farming | .8 | .33 | 9.8 |
| Manufacture of underwear | .07 | .34 | 41.9 |
| Manufacture of metal moulds | .16 | .38 | 39.6 |
| Other printing | .30 | .39 | 29 |
| Manufacture of plastic products | .13 | .40 | 53.2 |
| Manufacture of doors | .58 | .51 | 28.9 |
| Manufacture of metal structures | .22 | .54 | 28.2 |
| Manufacture of vehicles' parts | .06 | .84 | 49.9 |
| Manufacture of bread | .0.67 | 1.0 | 2.9 |
| Manufacture of footwear | .42 | 1.6 | 31.5 |
| Manufacture of ready-to-wear outerwear | .76 | 2.2 | 21.9 |
| Aggregate Manufacturing | 12.3 | 23.7 | 23.3 |

Notes: This Table shows describes firms in manufacturing sectors. The estimations are based on detailed administrative firm-level balance-sheets data covering the universe of non-financial companies operating in Portugal merged with exhaustive information on trade in goods and services at the company-level. The dataset is described further in Appendix G.

Table A.5: Exporters' Premium in Manufacturing vs Non-Tradable service trade

| | Exporters vs Non Exporters Manufacturing (1) | Non Trad. Services (2) | Exporters Manufacturing vs Non Trad. Services (3) |
|----------------------|--|---------------------------|---|
| Log Turnover | 1.57*** (.01) | .84*** (.01) | .68*** (.01) |
| Log Employment | .91*** (.01) | .63*** (.01) | .55*** (.01) |
| Log Wage | .18*** (.00) | .22*** (.00) | -.04*** (.00) |
| Log Capital/Worker | .64*** (.01) | -.14*** (.01) | .48*** (.01) |
| Log Payroll/Turnover | -.32*** (.00) | .04*** (.00) | -.19*** (.00) |
| Log EBT/Worker | .15*** (.01) | -.02* (.01) | .12*** (.01) |
| Fixed effects | Year×Sector×Prov | Year×Sector×Prov | Year×Prov |

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. This Table shows differences in firms exporting goods in standard manufacturing sectors and firms providing non-tradable services listed in Table A.3. The estimations are based on detailed administrative firm-level balance-sheets data covering the universe of non-financial companies operating in Portugal between 2006 and 2017 merged with exhaustive information on trade in goods and services at the company-level. A firm is defined as an exporter in a given year if exporting manufacturing goods or non-tradable services this year. Column (3) summarizes average differences between exporters' outcomes in manufacturing vs non-tradable services sectors. It shows the estimate from a OLS regression of log exporters' outcomes on a dummy that is equal to one if the exporter is operating in the manufacturing service, controlling for year×province fixed effects, and clustering standard errors at the firm level. Columns (1) and (2) summarize the average differences between exporters and non-exporters within respectively manufacturing and non-tradable services industries. It shows the estimate from a OLS regression on log firms' outcomes on a dummy equal to one if the firm is exporting in that given year, controlling for year×province fixed×5digit sector fixed effects, clustering standard errors at the firm level, run separately on all manufacturing firms (Column (1)) and all mobility-dependent services suppliers (Column (2)). Column (1) estimating the exporter premium in manufacturing is comparable in spirit with the estimates produced by [Bernard, Jensen, Redding, and Schott \[2007\]](#).

Table A.6: Export Exposure in Manufacturing vs Non-Tradable service trade

| | Manufacturing (1) | Non Trad. Services (2) |
|---------------------------------|----------------------|---------------------------|
| Exports in Turnover | 25% | 45% |
| % Shifting Full Activity Abroad | 3% | 19% |
| % Exporting in Founding Year | 9% | 21% |
| Average Export Duration (years) | 5 | 3.2 |
| % Permanently Exporters | 41% | 37% |

Notes: This Table summarizes descriptive statistics on exports of manufacturing and non-tradable services, based on detailed administrative firm-level balance-sheets data covering the universe of non-financial companies operating in Portugal between 2006 and 2017 merged with exhaustive information on trade in goods and services at the company-level.

Table A.7: Effect of First Posting on Sending Firms' Outcomes

| Dependent Variable (in log) | (1) Wage Rate | (2) Profits | (3) Total Assets | (4) Wage Bill | (5) Employees | (6) Turnover |
|---------------------------------------|---------------------|--------------------|---------------------|--------------------|--------------------|--------------------|
| A. Full Sample | | | | | | |
| γ | .0930*** (.0133) | .216*** (.0342) | .365*** (.0354) | .401*** (.0365) | .242*** .0244) | .367*** (.0300) |
| # of Firms | | | | | | |
| # of Observations | 235,471 | 167,496 | 245,134 | 236,237 | 236,704 | 233,146 |
| Firm FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Year \times 5DSect \times Prov FE | Yes | Yes | Yes | Yes | Yes | Yes |
| B. Only Treated Sample | | | | | | |
| γ | .0981*** (.0341) | .151*** (.0492) | .293*** (.0501) | .342*** (.0642) | .180*** (.0341) | .237*** (.0489) |
| # of Firms | | | | | | |
| # of Observations | 29,880 | 23,118 | 30,851 | 29,971 | 29,972 | 29,754 |
| Firm FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Year \times 5DSect \times Prov FE | Yes | Yes | Yes | Yes | Yes | Yes |

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The Table reports the difference-in-differences (DiD) estimates from the empirical specification described by Equation (??) for the period 2006–2017. The regressions include firms and 5-digit industry \times province \times year fixed effects. The top panel runs the specification on the full sample of firms, that includes all firms that are never observed posting workers between 2006 and 2017 and the 4,151 firms that post workers for the first time between 2010 and 2015. With this estimation sample, the coefficient γ captures the differences in firms' outcomes before and after the first posting of workers event compared to the outcomes of firms that do not post workers, including firms that will never post workers and firms that will post workers in the future. The bottom panel runs the specification on the restricted sample of only treated firms. In that case, the coefficient γ captures the differences in firms' outcomes before and after the first posting of workers event compared to the outcomes of firms that will only post workers in the future. Robust standard errors are clustered at the calendar year \times province level for the top panel and at the event-year \times province level to account for spatial autocorrelation of errors terms. The estimation sample is described in details in the Data Appendix.

Table A.8: Importer Premia of Firms Purchasing Posting Services

| | |
|-------------------------------------|-------------------|
| Log Turnover | 3.11*** (.01) |
| Log Employment | 1.64*** (.01) |
| Log Capital/Worker | .50*** (.01) |
| Log Payroll/Turnover | -.14*** (.01) |
| Log EBT/Worker | .16*** (.02) |
| Log Total Subcontracting | 2.43*** (.02) |
| Log Temp Agency Payroll | .81*** (.03) |
| Log Average Domestic Wage | .19*** (.003) |
| Share of Fixed Employment Contracts | .004*** (.001) |
| Fixed effects | 5-digit Sector |

Notes: *p<0.10, **p<0.05, ***p<0.01. This table displays the estimates of import premia at firms that used on-site offshoring in France in 2018. As it is standard in the literature, the import premium is obtained by regressing the log of firm outcome variable on a dummy that is equal to one if that firm has used services provided by a foreign supplier "on-site" and a 5-digit sector fixed effect. The coefficient can thus be interpreted as the average difference between offshoring and non offshoring firms within an industry. Data on French using firms' come from confidential administrative tax records (ESANE/FARE) and do not include companies operating in the agricultural sector as they benefit from a different tax regime.

Table A.9: Proximity between using firms 2-digit activity and purchased posting service

| Core Activity at Using Firm | Core Activity of Foreign Services Suppliers Same 5-digit Activity | Core Activity of Foreign Services Suppliers Same 2-digit Activity |
|-----------------------------|--|--|
| All | 22.7% | 56.4% |
| Agriculture | 46.4% | 94.8% |
| Business Support | 5.3% | 10.0% |
| Construction | 35.8% | 80.5% |
| Electricity Supply | 13.2% | 19.3% |
| Extractive Industries | 15.2% | 36.2% |
| Finance Insurance | 5.1% | 20.4% |
| Health | 1.5% | 2.3% |
| Hotels Restaurants | 39.0% | 63.7% |
| ICT | 13.4% | 44.2% |
| Manufacturing | 13.9% | 55.0% |
| Real Estate | 0.4% | 0.4% |
| Repair/Retail | 5.3% | 9.1% |
| Scientific Technical | 0.6% | 1.2% |
| Transport | 5.6% | 35.7% |
| Water Supply | 2.9% | 25.9% |

Notes: This table describes the sectoral decomposition of posting missions performed in the second largest importer of posting services: France. I use the universe of mandatory posting declarations filed by foreign suppliers that send posted workers in the French territory (DPD/SIPSI dataset) from 2016 to 2020. Since 2019, it is mandatory for foreign suppliers to report the 5-digit NACE code of the mission performed by foreign employees in France's territory. The identifier number of the using firm reported in the posting declaration further allows to recover the 5-digit NACE code of using firms' activity. I use these two informations to show the relationship between using firms' activity and type of activity offshored through posted workers, aggregated at the 2-digit level.

Table A.10: Proximity between using firms 5-digit activity and purchased posting service

| Receiving sector (% of all postings) | Offshored Task (% of Sectoral Overall On-site Offshoring) |
|--|---|
| Other specialised construction 8.2% | Other specialised construction 39.2% |
| Installation of machinery 4.2% | Professional and scientific 16.4% |
| Wholesale of machinery 3.6% | Other specialised construction 20.5% |
| Construction of buildings 3.2% | Construction of buildings 67.8% |
| Engineering and technical 3.1% | Other specialised construction 16.9% |
| Manufacture of vehicles 2.7% | Manufacture of vehicles 61.9% |
| Growing of vegetables 2.1% | Growing of crops 45.3% |
| Activities of head offices 1.5% | Petrol treatment 54.24 |
| Joinery installation 1.4% | Construction of buildings 28.5% |
| Manufacture of metal 1.4% | Other specialised construction 21.7% |
| Repair of machinery 1.3% | Manufacture of refractory 27.7% |
| Building of ships 1.3% | Building of ships 22.7% |
| Electrical installation 1.3% | Construction of buildings 22.3% |

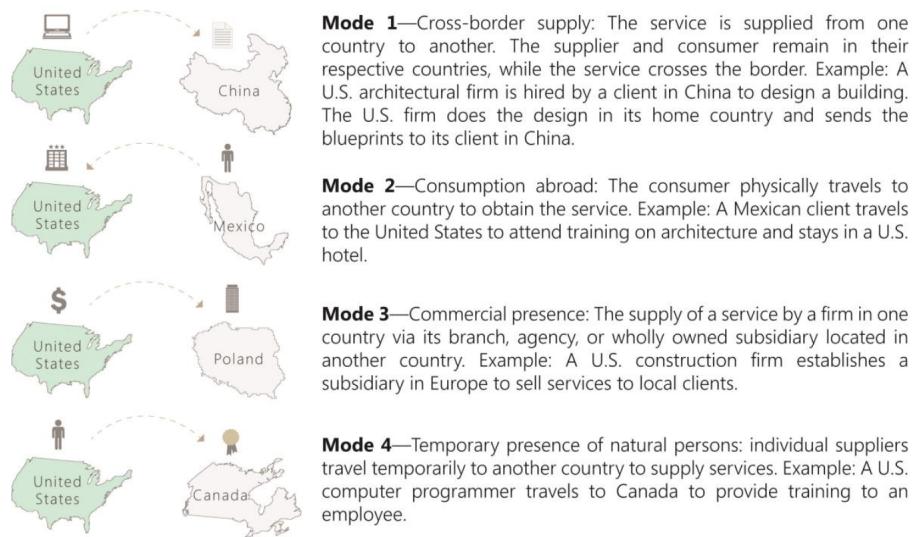
Notes: This table describes the sectoral decomposition of posting missions performed in the second largest importer of posting services: France. I use the universe of mandatory posting declarations filed by foreign suppliers that send posted workers in the French territory (DPD/SIPSI dataset) from 2016 to 2020. Since 2019, it is mandatory for foreign suppliers to report the 5-digit NACE code of the mission performed by foreign employees in France's territory. The identifier number of the using firm reported in the posting declaration further allows to recover the 5-digit NACE code of using firms' activity. I use these two informations to show the relationship between using firms' activity and type of activity offshored through posted workers, aggregated at the 5-digit level.

B Cross-Border Provision of Services Policies Across the World

WTO Regulatory Framework According to the official definition given by the WTO, international trade of services embeds four types of services supply. The modes of supply are defined based on the location of the service supplier and the consumer. A service can first be supplied from one country to another. In that case, both the service supplier and consumer stay in their country while the service crosses the border (mode 1). The consumer can also travel to consume the service abroad, typically for tourism purposes (mode 2). A foreign service provider could set up a branch, agency or subsidiary in another country in order to perform its activity there (mode 3). Finally, a service supplier can perform a service in the country where the consumer is established by sending its workers temporary abroad (mode 4). These 4 modes are described in Figure B.61. Services offshoring, which can be defined as the production of services tasks by foreign instead of domestic workers, thus only occurs with mode 1 and mode 4 of services provision.

Services offshoring is usually studied through the lens of mode 1 provision only, where the service mission is produced in the territory of a foreign country and is then imported and consumed by domestic entities.

Figure B.61: Mode of Supply for International Trade in Services



Source: Congressional Research Service “U.S. Trade in Services: Trends and Policy Issues” (2020).

An Overview of International Mobile Services Policies in the World Because it generates a unique interplay between destination-level territory and the production of the imported service, cross-border provision of services is amongst the most regulated type of trade flows and is most of the time restricted by important barriers. Countries can in particular impose heavy restrictions on the movement of foreign

firms' workers through compulsory temporary business visas and work permit restrictions. Today, few countries have fully lifted entry barriers for foreign employees sent abroad to perform services. The EU has by far adopted the most liberal mobility regime for the cross border provision of services in the world.

The North American Free Trade Agreement (NAFTA) signed in 1994 between Canada, Mexico, and the United States, and that has been replaced by the novel USMCA in 2020, regulates the international mobility of workers for temporary cross-border service provision. The agreement establishes the procedures for the temporary entry of individuals that are involved in international provision of services in the territory of another member state (business visitors and professionals). For a restricted set of workers and sectors involved in services related movements, the NAFTA/USMCA provisions eliminate some of labor certifications, work permits and right of residence restrictions. Foreign workers whose occupations is included in the list of 63 narrowly defined occupations are allowed to temporary entry in one of these three countries in order to perform a temporary work mission. Workers sent from a company established in one of the NAFTA members and that satisfy the agreements criteria are for instance exempted from the labor market opinion process, and have access to a specific temporary entry visas. Despite these specific dispositions, the regulation of services exports mobility in North America stays very restrictive compared to the European approach. First, the exemptions are only granted to a very specific set of occupations, are not open to self employed, and only benefit to highly qualified individuals who aim to pursue a temporary work mission in sectors like research, medical activities, or engineering.⁷² Second, if these foreign workers may benefit from a more flexible way to access the domestic market compared to other foreigners, they still have to request a work visa authorization. The country of destination keeps the right to unilaterally deny the temporary entry, and therefore entirely keeps the control of services related flows in its territory. Finally, foreign workers who aim to perform a temporary service mission still have to provide a large number of documents, such as qualification degrees.

In Africa and South America, policies that are very close to the European posting policy have been implemented, most of the time in recent years. For instance, since 2010 and the entry into force of a novel social security agreement between Chile and Argentina, firms established in one of these countries can send their workers freely to the other country for a maximum duration of 24 months. A worker hired by an employer established in one of country who temporarily provides services in the other country is subject to the employment law of the origin country, not the destination country. The treaty also establishes that workers sent abroad by their employer are fully exempted from labor taxes and social security contributions in the country of work. The recent Argentina-Chile (de)regulation of mobility-dependent trade is therefore almost identical to the initial provision for posting adopted in the EU in 1959. Interestingly,

⁷²The list of occupations eligible to services exports mobility measures within the NAFTA is available at https://www.nafsa.org/_/file/_/amresource/8cfr2146.htm

the disposition related to social security exemptions led to some political tensions regarding the adoption of the treaty, that took more than 7 years before being ratified by Argentina. In particular, some members of the Argentinian Congress were worried that the exemptions for foreign suppliers' employees could lead to unequal competition between workers hired in Chilean versus Argentinian firms, which echoes the European political debate on the exact same topic.

Trade liberalization of services has also been at work in the African continent. Within the APEC and the ECOWAS regions, firms are also allowed to send workers without restrictions for a maximum duration of 6 months, and these workers are fully regulated by the country of origin laws and social security contributions, similarly to what was in place in Europe before 1996.

Finally, many recent multilateral and bilateral agreements aim to enhance the international mobility of services suppliers. For instance, the General Agreement on Trade in Services (GATS) provides the first and only multilateral framework of principles and rules that affect trade in services among 164 WTO countries. These countries have already committed to further liberalize the international mobility of workers sent by foreign suppliers to their territory. Mobility-dependent trade is thus likely to be a key issue for governments and labor markets outside Europe for two main reasons. First, as the current level of regulation of this international mobility channel is still high, there exists a large scope to enhance this novel integration channel. Second, countries' recent commitments to liberalize these flows indicate that future trade and migration policies will shift towards more flexible regime of mobility-dependent trade.

Within-country services provision through mobile employees Regulating provision of services through mobile employees can also be a key issue within countries, especially when taxes, social insurance and wages differ across states. For instance in the U.S, the Constitution does not contain an express statement setting forth the freedom to provide interstate professional services. Regulatory barriers such as occupational licensing apply to services suppliers that wish to send their workers to another state in order to perform a work mission. Remarkably, the posting policy therefore allows a somehow more flexible regulatory framework to cross-country mobility of workers through services provision than the national-level U.S framework. The U.S law also provides some labor market regulations of cross-state provision of services through mobile employees. The prevailing wages laws (PWL) implemented by the Davis-Bacon Act in 1931 mandates that construction workers, employed on federally funded or federally assisted contracts in excess of \$2,000, should be paid no less than the *local* prevailing rate for similar work in the area. Because large public projects in an area may attract contractors from other regions, a potential problem arises when builders from low-wage areas bid on these projects. The U.S PWL ensures that this cannot be the case in public construction projects, by enforcing the minimum rate of pay based on the state of work, and not of employment of mobile workers. The Davis-Bacon Act is thus similar than the prevailing wage policy for

posted workers applied in Europe. An interesting historical anecdote is that the European Posted Workers Directive of 1996, that introduced the destination-level requirements for posted workers, was directly inspired from the U.S Davis-Bacon Act for services provision across U.S states.

C Industry-Level Gains From the Liberalization: The Truck Drivers Example

To further document the aggregate industry-level gains from the posting policy, I take advantage of unique European data on economic activity in one sector heavily affected by the posting policy: road transport.⁷³ After 2004, truck drivers from NMS were granted the right to perform their activity in other EU countries. The data allows me to observe precisely measured economic performance in that sector (million-tonne per kilometer) in each European Member State, and conveniently disaggregates economic activity between services performed domestically or in other member states' territories. Figure A.29, Panel A, shows the evolution of truck driving services performed by European countries in other countries' territory, before and after the liberalization of posting. NMS export of driving services started to increase dramatically after they gain the right to post workers abroad. For instance, exports of road transport services from firms located in Poland has been multiplied by 5 between 2004 and 2017. Figure A.29, Panel B, shows that as they gain access to foreign markets, NMS countries increase their overall economic activity in the treated sector. At the same time, economic performance of firms located in other countries such as France, Belgium or Austria, starts to decrease following NMS entry. It thus exemplifies the large redistribution of market shares in formerly non-tradables sectors that followed the expansion of the posting policy to low-wage countries.

⁷³Unfortunately, there is not harmonized data on economic performances in other sectors like construction. I thus focus on the road transport sector as Eurostat provides very detailed information on economic activity in that sector.

D Reduced-Form Estimates of the Posting Elasticity

D.1 Causal Effect of Payroll Tax Reforms on Posting Flows

In this section, I illustrate how posting flows are affected by large and exogenous reforms in employers' payroll taxes. If posting flows significantly respond to labor cost reforms in sending or receiving countries, this implies that payroll tax exemptions granted to posted workers by receiving countries significantly shape cross-border services provision. I test this assumption with two quasi-natural experiments: (i) a large reform in employers' social security contributions in one of the largest sending countries (Slovenia), (ii) a large reform in employers' social security contributions in one of the largest receiving countries (Belgium).

I first study the implementation of a reform in Slovenia that decreased the labor cost for workers posted by companies located in Slovenia. The reform was implemented in December 2012 by a new social security regulation (*ZPIZ-2 par 144*). It establishes that payroll taxes paid by Slovenian firms on posted workers' wages are capped to 60% of the average annual salary in Slovenia, introducing a large labor cost cut for workers posted by Slovenian suppliers.⁷⁴

To estimate the effect of this origin-specific tax cut on posting flows, my empirical strategy is a difference-in-differences where I compare the flows of workers posted from Slovenia affected by the payroll tax cut after 2012 with workers posted from similar countries not affected by the tax cut, within the same receiving country. My control group contains workers posted from other new member states (NMS) of 2004: these countries face the same posting restrictions as Slovenia in all receiving EU countries and are similar in many aspects (geography, development path, industrial specialization). Given that posting flows from Slovenia and other NMS of 2004 are affected by similar shocks, they should have followed similar trends absent the reform's implementation in Slovenia.

Figure A.49 shows graphically the differences-in-difference setting provided by the reform. The top panel plots the number of posted workers from 2008 to 2017 (normalized to one in 2012 just before the reform implementation) sent by Slovenia (treatment) and by other NMS (control) to Austria, the main receiving country for workers posted from Slovenia.⁷⁵ The figure shows compelling evidence that the number of workers posted from Slovenia increased after the payroll tax cut compared to workers posted from other comparable countries. While the series were following parallel trends before the reform, the number of workers posted from Slovenia to Austria increased threefold five years after the tax cut. Over

⁷⁴The effect of this payroll tax cut "posted bonus" has been documented by a worker union (EFBHW) that filed an official complaint at the European court of Justice in 2019. The complaint against Slovenia argues that this payroll tax cut for workers posted from Slovenia lowers labor cost for Slovenian suppliers and creates unfair competition between European countries.

⁷⁵Focusing on the differential evolution of treated versus control flows to the same receiving country allows me to graphically differentiate out the destination-specific term Φ_{jt} that should affect demand for workers posted from Slovenia and other NMS 2004 countries similarly.

the same period, posting flows from control countries stayed very stable, suggesting the observed increase in Slovenian postings has been primarily driven by the reform. The reduced-form elasticity of posted worker flows with respect to origin-specific labor cost given by this country-level experiment is large and significant, with a point estimate of -1.77 (0.34) in Austria, -1.70 (0.38) in Germany, and -1.6 (0.33) for all receiving countries, controlling for destination-year fixed effects.

I complete this finding by studying a large exogenous payroll tax cut reform in one of the main receiving countries, Belgium. At the end of 2015, the Belgian government announced a large decrease in labor taxes (“tax shift”): employers’ social security contributions rate on all employees hired in Belgium was decreased from 33% to 25% starting at the beginning of 2016.⁷⁶

To empirically investigate the effects of this destination-specific payroll tax cut on posting inflows, I rely on a difference-in-differences setting where I compare the flows of workers posted to Belgium before and after the reform to the flows of workers posted to a similar receiving country not affected by the tax shift. I use workers posted to France as my control group because of common characteristics between these two countries: they share a border and a language, are among the largest receiving countries, and have a similar origin and sectoral composition of posting inflows. Postings to France and Belgium should be affected by similar regional and origin-specific shocks, while only posting flows to Belgium should be affected by the reform.⁷⁷

Figure A.49 shows graphically the differences-in-difference setting provided by the reform. The bottom panel plots the number of posted workers from 2010 to 2018 (normalized to one in 2015 just before the reform implementation) sent to Belgium (treatment) and to neighboring France (control). Posted worker flows to these two receiving countries were following perfectly parallel trends before 2015, suggesting that posting to France provides a credible comparable counterfactual for postings to Belgium. Postings to Belgium started to slow down immediately after the tax shift was implemented, while the number of workers posted to France kept growing at a fast rate. In line with the previous experiment, the bottom panel of Figure A.49 provides compelling evidence that the large decrease in employers’ labor cost implemented in Belgium significantly slowed down posting flows to this country compared to a comparable neighboring receiving country. The implied estimated elasticity of posting flows with respect to destination-specific payroll taxes is 1.44 (0.35).

⁷⁶The decrease in employers’ social security labor cost was progressively implemented, and the rate of contributions was decreased from 33% to 30% in 2016, then from 30% to 28% in 2017 and from 28% to 25% in 2018.

⁷⁷Focusing on a receiving country with a similar composition of posting inflows allows me to filter out the importer-specific effect while exploiting a shock in the destination-specific term Φ_{jt} .

D.2 Causal Effect of Minimum Wage Reforms on Posting Flows

I have shown that two large employer labor cost reforms have significantly affected posting flows in Slovenia and Belgium, with estimated reduced-form elasticities of 1.7 and 1.4, already suggesting that destination-level labor cost policies, such as payroll tax exemptions, shape mobility-dependent trade flows. I complete these findings by showing how minimum wage reforms affect posting flows.

I study the effects of minimum legal wage implementation in Germany, where no national minimum statutory wage was in place until 2015: minimum pay rates were agreed upon at the sectoral or firm level and were therefore not applicable to posted workers.⁷⁸ Since 1996, only construction-related industries are entitled to a minimum legal wage regulation at the sectoral level.⁷⁹ In August 2014, the meat processing industry implemented a minimum legal wage in the sector, and before that a national minimum wage was implemented in January 2015 in all sectors.

To investigate the effects of this reform, I use A1/E101 data on bilateral *sectoral* posting flows that are available for a subset of sending countries: Poland, Luxembourg, Hungary, Czech Republic, Lithuania, and Romania. I can observe postings to all of these sending countries since 2012 in manufacturing and construction. In a double differences spirit, I look at differences in posting inflows to Germany's construction sector where a prevailing wage was already in place compared to manufacturing sectors that were affected by the introduction of a minimum legal wage. Panel A of Figure A.50 shows that postings to Germany in construction and manufacturing were similar in 2012, but the two series started to diverge in 2014 when the prevailing minimum wage was implemented in the meat industry. Postings to the German manufacturing industries decreased further in 2015 when all the manufacturing industries became regulated by a minimum wage, while postings in construction stayed close to their pre-reform level. The corresponding estimates indicate that postings differentially decreased by 60% in sectors treated by the reform, accounting for origin-year and destination-year fixed effects.

To confirm that this finding is not driven by origin-specific sectoral supply shocks simultaneous to the minimum wage reform, I use a triple differences approach and compare the evolution of postings in treated and untreated sectors in countries treated and untreated by the minimum wage reform. Graphically, I use France as a control group because Germany and France are neighboring countries and the two largest users of posting services. The bottom panel of Figure A.50 shows that the gap between manufacturing and con-

⁷⁸Foreign services suppliers are only bound to comply with destination-level minimum legal wages, or generally applicable rules. Therefore, most industry-level or firm-level minimum pay rules do not apply to posted workers.

⁷⁹In 1996, the prevailing wage policy for posted workers was implemented in Europe and adopted by German national law through the "Posted Workers Act" (AEntG law). Remarkably, this law created the first legal basis for minimum sectoral legal wage in Germany. Since 1996, sectoral minimum legal wages in Germany have been thus implemented through the addition of branches in the AEntG scope. This anecdote shows that not only do prevailing wage policies play the role of trade policies for on-site offshoring, but they also triggered the implementation of sectoral minimum wage for domestic workers as a way to protect domestic labor markets from foreign competition.

struction mobile services stayed stable in the control country (France), while it decreased drastically after the minimum wage reform in 2014 in Germany. This confirms that the decrease in manufacturing versus construction postings to Germany is not driven by origin sectoral shocks that would have affected France and Germany similarly. The full triple differences model accounting for origin-year, destination-year, and pair-year fixed effects indicates that postings to Germany in the treated sector differentially decreased by 57%.

The double and triple differences models rest on the assumption that the construction sector provides a credible control group for postings in manufacturing. These sectors could, however, be affected by unobserved shocks within a receiving or sending country. A particular concern is that the implementation of the minimum wage in manufacturing affects the demand of posting services in that sector through other channels than the change in posting cost. To make progress on this issue, I exploit further variations *within* the treated industry across receiving and sending countries. The identifying variation comes from the *kinked* relationship between the posting allowance shock caused by the minimum wage reform and the initial wage level in sending countries, illustrated in Panel C of Figure A.50. Workers posted from low-wage countries such as Romania or Hungary receive a large additional allowance after 2014, while wage cost of workers posted from high-wage countries such as Luxembourg should not be directly affected by the new rule.

I then compare how in the treated sector (construction) posting flows from a given sending country evolved differentially in Germany versus other countries, before and after the German minimum wage reform, controlling for origin-year and destination-year fixed effects. The estimated coefficients plotted in Panel D of Figure A.50 show that following differential exposure to the reform, postings from countries experiencing the largest “posting allowance shock” see the largest differential decline in postings to Germany. The corresponding elasticity of posting flows with respect to wage cost change after the reform is -1.3 (0.29), which is, again, remarkably similar to the elasticity estimates obtained with payroll tax reforms in sending and receiving countries exploited in Figure A.49.

D.3 Causal Effect of A Reform in Labor Tax Exemption Rules

I study a change in the European regulation on social security coordination (EC Regulation 883/2004) that entered into force as from 1 May 2010 and that affected labor tax exemptions granted to posted workers in specific countries and sectors. The reform was implemented in a context where potential tax avoidance strategy and artificial posting practices were questioned by Member States, in particular from temporary employment agencies located in Luxembourg. In particular, postings of French workers to France through temporary employment agencies located in Luxembourg started to boom in 2008, and could easily be

described as “artificial posting”.

The reform of 2010 aimed at strengthening the posting rules, targetting specifically posting through temporary agencies, and reinforcing the rules related to social security exemptions in some contexts that could be interpreted as tax avoidance. The reform first establishes that workers that have not been affiliated to the SSC organization of the origin country for at least a month cannot be exempted from country of work labor taxes if they are posted abroad. Second, the reform reinforces the condition under which payroll tax exemptions can be granted to individuals who are posted to their own country of residence. After the implementation of the reform, a French resident posted to France by a company established in Luxembourg has to pay the French social security contribution and cannot stay affiliated to the Luxembourg regime only. Finally, the reform implements clearer limitations under which the companies can post workers abroad while staying affiliated to the origin country social insurance system: sending firms must perform more than a pure administrative activity in the sending country (*“substantial activity rule”*).

I begin by studying how the 2010 labor tax exemptions reforms affected postings from affected sending countries and treated sectors. I take advantage of unique administrative matched employer-employee data for all firms located in Luxembourg merged with information on all postings from Luxembourg since 2004. Luxembourg is an ideal laboratory to study the effects of this reform, as it is the country where (i) “artificial” postings were the most substantial and (ii) postings from temporary employment agencies is prevalent. The 2010 reform limited social security exemptions granted to posted workers for temporary employment agencies, compared to other sectors. As temporary employment agencies specialize in hiring and providing labor to (domestic and foreign) using firms, hiring of workers from abroad in order to post them immediately to a third country is more likely to occur through temporary employment agencies. Most of French residents posted to France from Luxembourg were hired by temporary employment agencies. These sending firms are also more likely to be affected by the substantial activity rule enforced by the reform.

I show in Figure A.52 the evolution of workers hired in temporary employment agencies located in Luxembourg that are posted abroad (red line) and that perform work in Luxembourg (blue) line, before and after the labor tax reform. While the two series followed similar trends in months preceding the reform, workers posted abroad by temporary agencies started to decline immediately after that the 2010 reform was implemented. Is this effect driven by a simultaneous unobserved shock that would affect all mobile service provision flows, beside the effects of the labor tax exemption reform? When looking at sectors less affected by the exemption restrictions, such as transport, mobile service provision did not decline compared to non-posted employment after the reform.

I further investigate in Figure A.53 the counterpart of this reform on a receiving perspective. I compare

the evolution of incoming posted workers in a French province exposed to posting from Luxembourg, against postings to a neighbouring French province that does not share a border with Luxembourg. The graph shows that export of mobile services to the geographically exposed *département* (Moselle) declined substantially immediately after the implementation of the reform, and this decline was concentrated on French workers posted to France, that were mostly affected by the reform. By comparison, posting of workers to the neighbouring province with no immediate border with Luxembourg were not affected by the reform.

Figure A.52 and Figure A.53 emphasize the large mobile service provision response to a reform in posted workers' labor tax exemptions. The reform that restricted labor tax exemptions granted to some posted workers drastically reduced postings sent from treated origin countries and sectors, and decreased the number of postings received in treated destination countries.

D.4 Bunching Posting Responses to Payroll Tax Exemptions Rules

In 2018, a novel directive on posting was voted at the European level and implemented novel rules to regulate mobile service provision. First, the new directive extends the prevailing wage rule: workers posted to a country are now entitled to the wage earned by domestic workers at the using firm, rather than destination-level minimum legal wage. Second, the new regulation changed the maximum posting duration to benefit from destination-level payroll tax exemptions. From 2010 to 2018, posted workers could be exempted from destination-level taxes and rules if they were posted for less than 24 months in that country. The 2018 directive reduced this duration threshold to 12 months with an almost guaranteed extension to 18 months if the service provider submits a motivated notification. The EU directive was transposed in the French labor law in 2019, and entered into force in July 2020. I investigate how the reform in the social security exemption threshold changed posting behaviours. I show in Figure A.54 the distribution of posting duration by year of posting mission start: 2017, 2018, 2019, 2020. After that the novel exemption rule was implemented, a substantial bunching at the new threshold appears, while bunching at the old exemption threshold is substantially lower.⁸⁰ These distortions in the distribution of posting mission duration around the social security exemption thresholds provides evidence that mobile service provision is significantly affected by labor taxes exemptions granted in destination countries.

⁸⁰The decrease in bunching at the 2-year exemption threshold started earlier. This can be explained by the fact that there were important uncertainties about the application of the 2018 directive in the French law. As the application decree was not yet implemented, it was also uncertain whether posting missions starting in 2018 (after that the directive was voted in the EU) for a 2 year period could be affected by affiliation to the French social security system after that the directive would formally be implemented in national law.

E Are Posted Workers Different From Standard Migrants?

A natural question following the trade-related boom in mobility generated by posting is whether the increase in international mobility though posting may occur at the expense of other international mobility channels, such as permanent migration. In that case, the overall aggregate mobility effects of posting policies may be lowered by crowding-out of permanent migration. To investigate potential substitution and crowding-out between posting and migration flows, I exploit different timings in posting and migration liberalizations within the EU. After EU accession, workers from NMS get access to free migration within the EU. Restrictions for permanent migration of workers from NMS were lifted gradually across destination member states, and in most cases migration restrictions were lifted after posting restrictions. I exploit these differences in timing to investigate whether postings react to changes in permanent migration restrictions. I show in Figure A.11 that liberalization of permanent migration for citizens from some countries does not change services exports mobility flows from these countries. This finding indicates that posting is not used as a substitute for permanent migration, and that individuals do rarely shift from one mobility regime to the other.

In this subsection, I discuss and test potential mechanisms that suggest that firms alleviate part of the frictions that constraint individuals' migration decision.

Permanent migration of individuals may first be constrained by information frictions. Individuals can lack experience in knowing how to search work opportunities abroad, because it requires specific knowledge about the foreign country. For instance, a given worker who wish to move to France or Italy may be able to search for jobs in these countries, but will most likely not be able to search simultaneously in every possible destination countries. Firms could have a specific information technology that allows them to be efficient in searching the best opportunities for their workers to provide services abroad. Because of this advantage in information technology, some services suppliers may even get further specialized in the provision of services abroad, and in "efficiently matching" demand and supply of services across states.

Migration is also subject to important fixed costs that are borne by individuals. For instance, migrating abroad may require to learn a new language, to comply with administrative and search costs (send a CV, establish a new employment contract abroad, find a place to live in the new country etc). Service suppliers can centralize these fixed costs and may therefore experience increasing returns in the international mobility of workers, in contrast with permanent migration based on individuals' decision alone.

Finally, individuals can face financial constraints that restrict their international migration decisions. Moving and working abroad requires important initial expenses, in order to travel, to settle and start a professional activity in another country. While individuals may not have the financial means to do so, foreign services suppliers finance these costs, by paying for all workers' expenditures abroad.

A first path to investigate whether posting firms alleviate part of mobility frictions faced by individuals is to study which workers self-select into mobility intermediated by firms, in contrast with standard migration. Differences between workers who move through firms and individuals who decide to immigrate could be suggestive of underlying frictions and determinants of posting compared to standard permanent migration. For a given destination country, I compare the characteristics of workers posted by firms to this country (posted) versus the characteristics of foreigners who moved permanently to this country (migrants) in Figure A.10. I focus on Belgium and France as destination countries as these countries provide detailed data on posted workers' demographics. The Figure shows striking evidence that individuals moving through posting exhibit systematic and significant differences compared to migrants.

Migrants are on average 24 years old when they move permanently to their new country of residence, while workers are on average 38 years old when they are posted abroad by their employer. As age is heavily correlated with potential attachment to the origin labor market, this first difference is suggestive that labor posting is used by workers that potentially face larger mobility costs compared to standard migrants.

A second key difference between posted workers and migrants regards the country of origin. While 50% workers who move through firms originate from lowwage European countries (NMS13), its is only the case for 5% of overall permanent migrants. This difference suggest that large distances and cultural differences between destination and origin countries constraint permanent migration from Eastern European countries to the West, while it does not affect posting flows. This fact can also be verified at the Europe-wide level. The international mobility effects of free migration agreements for NMS have been very heterogeneously shared across destination countries. While Ireland and the UK captured 60% of permanent emigration from Poland, most of other countries saw limited migration inflows. In contrast, the aggregate mobility gains triggered by posting liberalization (Figure 4) were much more homogenous across EU countries. For instance, the number of workers posted from NMS 2004 to France increased by 450% after that posting flows were liberalized, while the effect of permanent migration liberalization for NMS 2004 to France did not have an effect statistically different from zero on permanent migration flows from these countries. What explains that the aggregate mobility gains of permanent migration liberalization waves since 2004 have been mostly directed towards some destination countries? One of the main rationale that has been put forward by the European Commission is that english-speaking countries were much more accessible for migrants, compared to other countries. In contrast, as posting does not require to learn the language or to integrate the domestic labor market, most of labor mobility coming from the East in countries like France, Netherlands, Belgium or Austria has occured through posting rather than immigration as showed by Figure A.10. This explanation suggests that mobility frictions and costs such as language or labor market rigidities have restricted permanent migration flows to some countries, while

not constraining posting flows to these countries.

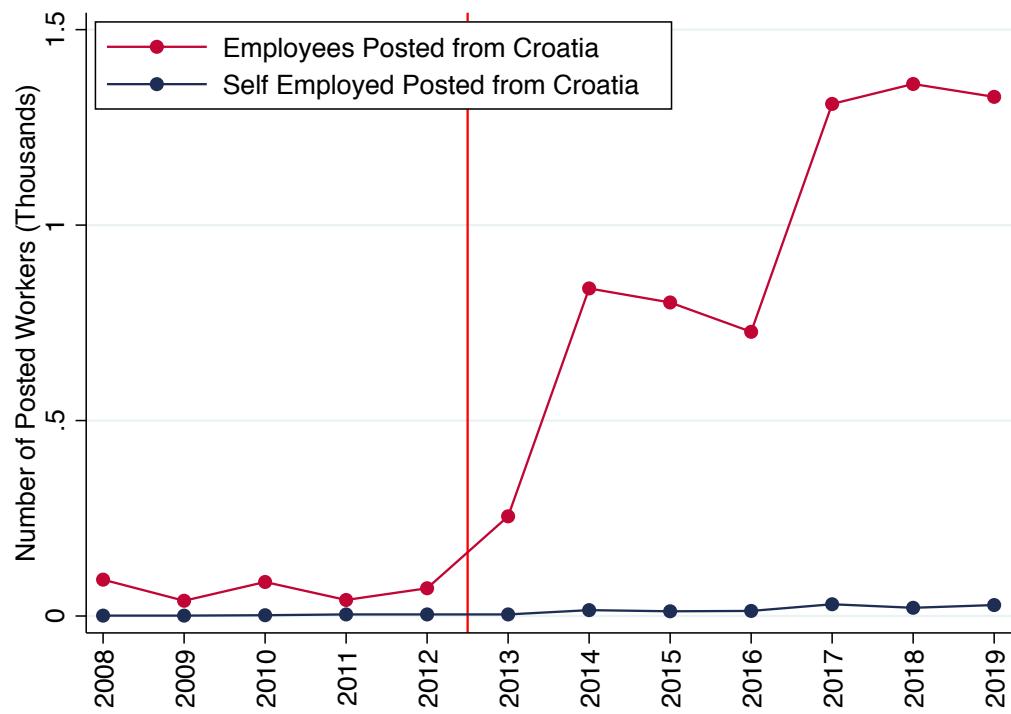
A final central aspect of posting flows relates to the average level of education of workers posted abroad by firms. It has been showed that migrants tend to be positively selected in terms of education levels and face lower mobility costs and frictions than high skilled. Figure A.10 shows that the traditional “mobility gap” documented by the literature for standard permanent migration is reversed when the mobility is intermediated by firms. While tertiary educated workers represent 30% of migrants, they only account for 2% of workers posted abroad by service suppliers.⁸¹ Workers with lower levels of education may face higher migration frictions in terms of language, liquidity constraints or ability to access relevant information regarding work opportunities abroad. Firms may be able to substantially alleviate mobility frictions faced by these individuals, by setting-up the mobility transaction and by providing all mobility costs required by the mission abroad, such as transportation and housing.

A second way to understand what is the key role played by firms in mobility costs and frictions is to focus on self-employed posted workers. Self employed posted workers are individuals who decide individually to provide a service mission abroad: they thus face similar information, search and mobility fixed costs and frictions than permanent migrants. In the case of employees posted abroad by their employer, these costs and frictions are entirely borne by the sending company. Self-employed who post themselves abroad therefore provide a unique laboratory to study the role of individual-level mobility frictions in posting. If posting firms do not play a key role in alleviating these frictions, one may expect posting flows to be largely composed by individuals who post themselves abroad. The data shows that in 2016, self-employed individuals represented only 8% of the overall number of postings within the EU. Therefore, most of posting flows are indeed explained by employees sent abroad by a service supplier, rather than individuals who would individually use posting in order to work abroad, which provides evidence that firms play the central role in posting flows. To understand whether the large aggregate mobility gains from posting liberalization is explained by firms or individuals responses, I further study responses of employees and self-employed flows to the same mobility cost shock in Figure E.62. The Figure shows evidence that international mobility responses to a posting liberalization reform are fully driven by employees posted abroad by their employer, rather than self employed. This therefore indicates that firms do alleviate part of the mobility frictions that are borne by individuals both in migration or self-posting decisions. The role of firms in alleviating information frictions faced by individuals can also be emphasized from the granular data on posting. Using individual-level data on workers posted to Belgium, I find that almost 30% of self-employed posted workers came earlier as employees posted by their employer. This confirms that service

⁸¹ Interestingly this large difference holds even after adjusting for different composition in origin countries. I find that 27% of migrants from NMS 13 countries have a tertiary level of education against 2% of posted workers.

suppliers play a key role in acquiring important information about the destination country that may be later passed on their workers.

Figure E.62: Employed Versus Self-Employed Mobility Response to Posting Liberalization



Notes: The Figure depicts the log of posted workers flows between two countries against the labor cost differential between these two countries. A positive slope means that a higher labor cost in the destination country compared to the origin country leads to higher posted worker flows from the origin to the destination country.

F Data Appendix: E101/A1 Dataset

The E101/A1 dataset is based on social security forms for posting issued in the EU for the period 2005-2017. Before being sent abroad by their company, European posted workers must request a proof that they stay affiliated to their origin country social security system through a certificate E101, that has been renamed PD A1 in 2010. This certificate concerns the social security legislation which applies to a person and confirms that this person has no obligations to pay contributions in another Member State. This social security forms finds its legal ground in the European regulation on social security coordination (EC 883/2004)

The social security forms for posting are issued by social security organizations and are compulsory before any posting of workers within the European Union. The form contains many information on the posting mission such as origin and destination countries, the length of the work mission, the employment status of the individual (employed or self-employed) and sector of activity of the posting mission performed by the mobile employee. Importantly, the numbers on E101/A1 forms have to be interpreted as posting missions, and not number of unique posted workers, as workers may be posted several times during the year. Therefore, one issued form for posting corresponds to one posting mission. Importantly, the E101/A1 social security form only concerns posting of workers within the EU, as it is directly linked to the

Yearly statistics on E101/A1 dataset are centralized by the European Commission that collects from competent authorities in each member state the number of posting social security forms issued each year since 2005.⁸² Interestingly, the E101/A1 forms were issued way before that, but the collection of this data was not used for statistics and reports purposes, as posting remained limited in magnitude. The only historical data available on E101/A1 numbers before 2005 have been collected from the European Commission (EC) by the ECLRC for the period 1987-2000. This early E101/A1 dataset allows to observe the total number of posting forms issued each year, without additional information at the sending-origin level. Since 2005, national social security organizations are required to provide yearly numbers of issued A1/E101 by destination member state, sector of activity, and employment status. However, for earlier years (2005-2008), part of sending countries only reported total issued posting forms. From 2009 onwards, all countries report disaggregated number of posting forms at the bilateral level (origin-destination). The coverage of the data at the origin-destination-sector level has not always been exhaustive, as some member states chose to report the statistics at the sectoral-destination level only for most recent years. To avoid potential biases induced by this break in E101/A1 data collection, the 1987-2017 series are not exploited in the empirical analysis. I focus my empirical analysis on the 2009-2017 period when using the E1/A101 dataset on posting, and use other administrative datasets with no breaks in data collection when investigating the effects

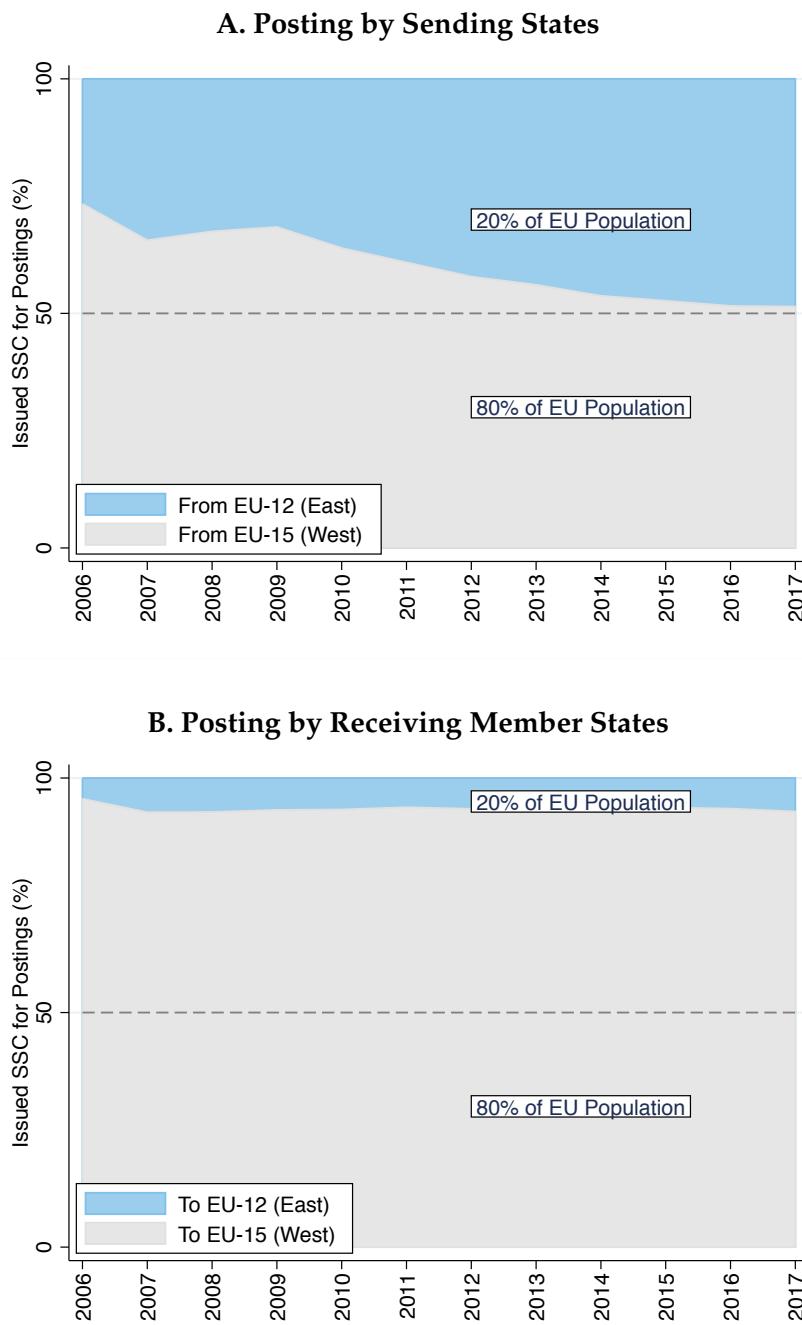
⁸²It is interesting to note that the EC started to constitute a detailed and exhaustive dataset on posting in 2005, one year after the biggest European enlargement that led posting to gain a substantial importance in the EU.

of posting with a longer time perspective.

The E101/A1 dataset has been used as the main source of information to track posting in the EU, especially by the European Commission that produces yearly statistical reports on issued social security forms for postings since 2007.

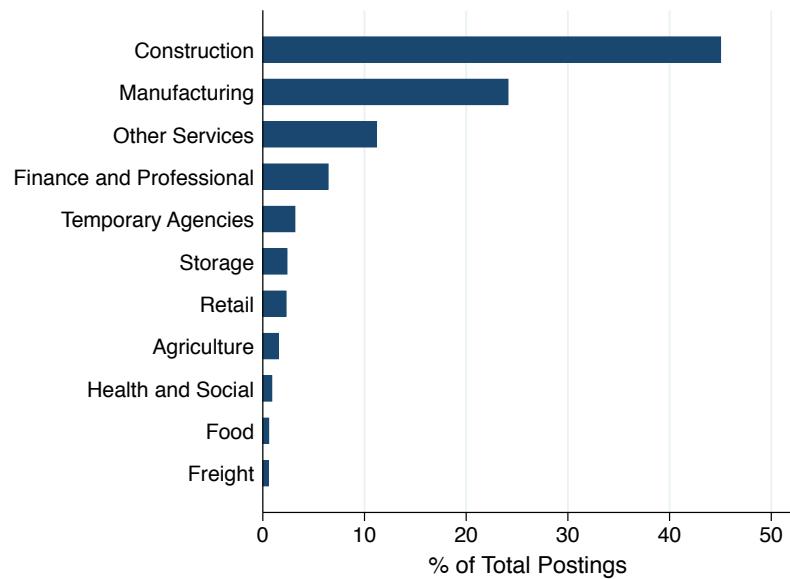
Pluriactive workers While I focus on E101/A1 forms issued for posting within the EU, the E101/A1 forms also provide information on “pluriactive” workers: these workers have several employment in several member states, but stay affiliated to their home social security institution. Fortunately, the E101/A1 dataset provided by the European Commission allows to distinguish between social security forms for postings and social security forms for pluriactive workers. I focus on posting forms issued for posting of workers only. If we include the number of pluriactive workers in the EU, the amount of individuals exempted from destination-level labor taxes in country of work reaches 3 million of individuals.

Figure F.63: Posting of Workers within EU



Notes: The Figure shows the decomposition of posted workers flows within the EU by sending (top panel) and receiving (bottom panel) member states. The EU-12 includes Poland, Slovakia, Slovenia, Czech Republic, Lithuania, Latvia, Malta, Cyprus, Hungary, Bulgaria, Romania and Croatia. The EU-15 includes France, Spain, Portugal, Italy, United Kingdom, Germany, Greece, Austria, Denmark, Luxembourg, Netherlands, Belgium, Finland, Sweden and Ireland. Data on posted workers flows build on social security forms issued for postings and collected from the European Commission for the period 2006-2017 at the origin-destination level.

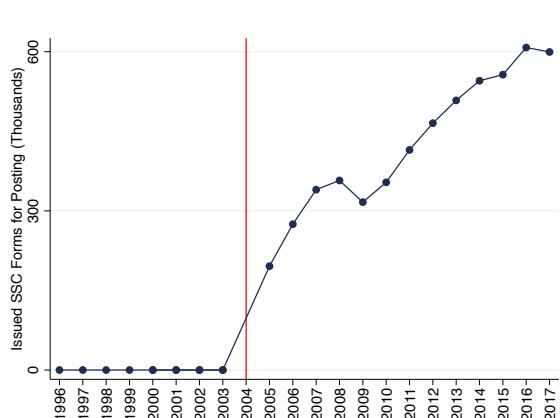
Figure F.64: Posting of Workers by Sector of Work and Sending Member State



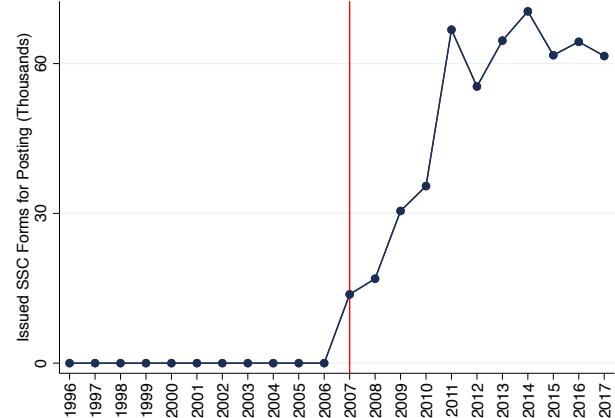
Notes: The Figure shows the sectoral composition of posted workers flows by sending member states in 2015. Data on posted workers flows build on social security forms issued for postings and collected from the European Commission for the period 2006-2017.

Figure F.65: Effect of Posting Liberalization on Postings from Treated Countries

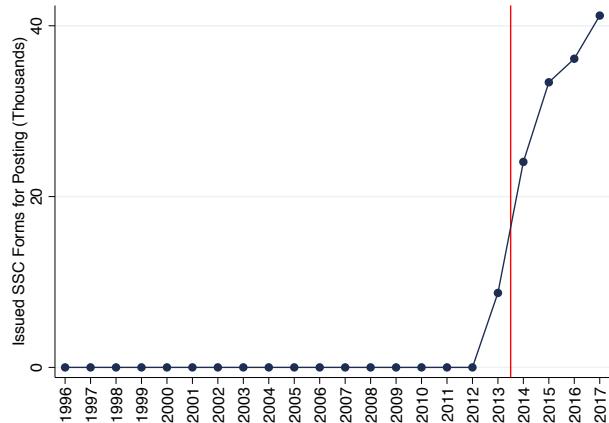
A. Postings from NMS 2004



B. Postings from NMS 2007



C. Postings from NMS 2013



Notes: This Figure shows the effects of services exports mobility liberalization on international mobility through postings within the EU. As described in the text, EU accession triggers transition from quasi autarky to full liberalization of mobility of workers through firms' trade in services for new member states.

G Data Appendix:CBHP Dataset

Data description and sample restriction I leverage administrative dataset on the universe of firms in the non-financial sectors established in Portugal. The dataset has been provided by the Bank of Portugal and comes from compulsory tax declarations (IES declaracao simplificada). The CBHP/CB dataset cover the population of all Portuguese non-financial corporations. The classification of non-financial corporations follows the guidelines on the “European System of National and Regional Accounts” (ESA 2010).

It includes market producers mainly dedicated to the production of non-financial goods and/or services, such as private and public corporations, cooperatives and partnerships recognized as independent legal entities, non-profit institutions or associations serving non-financial corporations, public independent legal entities, private and public quasi-corporations, and head offices. The IES declaraiton is mandatory and contains tax, accounting and statistical information at the firm and establishment level, and is submitted electronically to the Portuguese Ministry of Finance every year. The Tax Authority sends the information collected through IES files to the Institute of Registration and Notary Affairs (IRN) that is then in charge of sending the files to Banco de Portugal that implements a quality control of the data.⁸³ Importantly, the information reported in the IES is cross-checked with other administrative sources, such as Quarterly Survey of Non-financial Corporations (ITENF), the Central Credit Responsibility Database (CRC), the Communication of External Transactions and Positions (COPE) and the Securities Statistics Integrated System (SIET). The dataset contains exhaustive information on firms' balance sheets, including detailed information on firms' financial activity, employment, investment and taxes paid. In addition of these financial and employment information, firms are required to provide information on their activity performed abroad. More specifically, firms report every year the amount of earnings derived from prestation of services performed in the EU market. I use this exhaustive information on firms' prestation of services outside Portugal to select posting firms established in Portugal.

When firms post workers abroad in order to perform a service, the transaction is recorded as an export of services from the country where the firm is established to the country where the work mission is performed. To robustly identify posting firms in the CB/CBHP dataset, I focus my analysis on sectors where international provision of services can only be performed through the physical presence of persons abroad. I follow the methodology used by central banks to identify service exports through the temporary sending of workers abroad (mode 4 in GATS for the balance of payment computation). The method consists in selecting the branchs of activity where services can only be physical, and thus have to be performed locally by workers. For instance, sectors like construction, installation of machinery, plumbing, transport by road, are sectors where exporting a service requires to send workers to the site of the customer. Following this so-called "balance of payment" methodology, I use the very fine classification of sectors (5 digits) provided in the CBHP dataset in order to select sectors where services can only be exported through the posting of workers. The exercise leads to a final selection of 27 sectors that are listed below in Table A.3 where cross-border provision of services relies on employees' geographical mobility across space. This methodology induces a lower bound on the selection of posting firms, as posting may occur in other sectors, like manufacturing or other services, where services exports through presence of workers abroad cannot clearly be

⁸³More information on CB and CBHP datasets are available at .

separately identified from services exports where the service itself crosses the border. However, data from Luxembourg Overall, my analysis can be more generally interpreted as studying the effects for firms to perform services abroad, which is exactly what is made possible by the posting policy within the EU.

My sample is constitute by the population of operating firms in Portugal that are active at some point between 2006 and 2017 in the 27 sectors where the performance of services abroad can be automatically assimilated to the sending of workers abroad. I restrict my attention to firms with a median of at least 3 workers across all years of activity in order to avoid measurement noise induced by very small firms, following [Alfaro-Ureña, Manelici, and Vasquez \[2019\]](#). The selected final estimation sample covers almost exhaustively the full economy, as showed in table G.11. I also drop a minor number of firms that performed services in a country outside the EU, as these services provisions are not covered by the European posting regulation, but by the restricted posting policy for non-EU member states.

Figure G.66: Identifying Services Exports Mobility in Trade Data

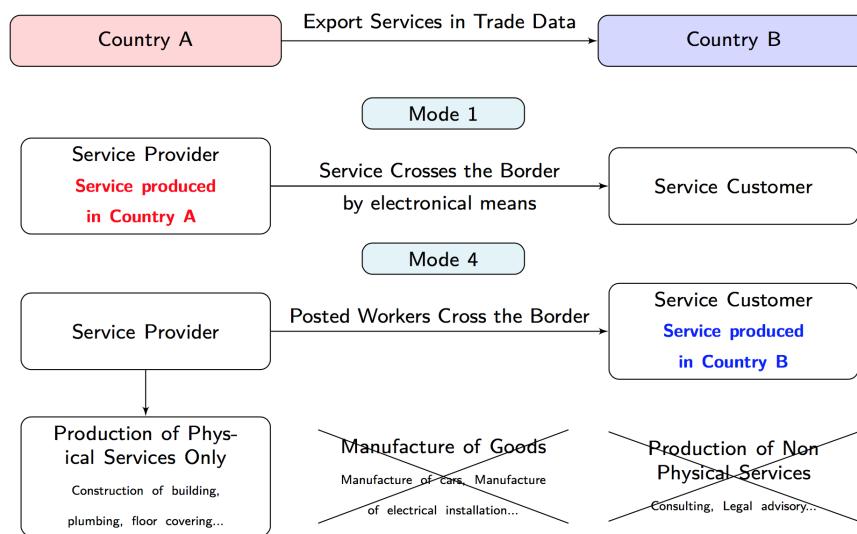


Table G.11: Coverage of the Estimation Sample

| | |
|------------------------|-----|
| Number of Workers | 93% |
| Hours Worked | 94% |
| Wage Bill | 96% |
| Total Assets | 72% |
| Turnover | 85% |
| EU Service Prestations | 93% |

Notes: This Table shows the coverage of the estimation sample after the minimum size restriction that drops firms with a median of less than 3 workers across all years of activity.

Table G.12: Descriptive Statistics on Never and First-time Poster

| | Mean | SD | Median |
|----------------------------------|-----------|-----------|---------|
| Never Poster in 2009 | | | |
| Number of Workers | 10.2 | 23.7 | 6 |
| Hours Worked | 18,972 | 42,505 | 11,063 |
| Wage Bill | 136,507 | 487,590 | 64,461 |
| Total Assets | 1,183,463 | 7,646,896 | 221,670 |
| Turnover | 625,085 | 3,650,053 | 192,388 |
| EU Service Prestations | 0 | 0 | 0 |
| First Time Poster in 2009 | | | |
| Number of Workers | 15.9 | 87.2 | 7 |
| Hours Worked | 28,275 | 122,200 | 12,320 |
| Wage Bill | 199,854 | 722,610 | 74,670 |
| Total Assets | 726,288 | 3,488,864 | 234,949 |
| Turnover | 776,124 | 4,063,276 | 252,071 |
| EU Service Prestations | 0 | 0 | 0 |

Notes: Statistics for each variable are calculated only across the firms with non-missing values for that variable that year. All values correspond to 2009, a year that is by construction prior to all events. The upper panel presents raw summary statistics for the sample of firms active in 2009 and never observed as posting workers in the 2006 to 2017 balance-sheets data. The middle panel presents raw summary statistics for the sample of firms active in 2009 and observed as posting workers abroad for the first time sometime between 2010 and 2015. Firms observed as performing services abroad for the first time after 2016 are dropped altogether from this calculation.

Table G.13: Description of Posting Events

| Year/Event Year | 0 | +1 | +2 | +3 | +4 | +5 | +6 | +7 |
|-----------------|-------|-------|-------|-------|-----|-----|-----|-----|
| 2010 | 632 | 327 | 285 | 236 | 205 | 167 | 157 | 136 |
| 2011 | 688 | 378 | 307 | 239 | 208 | 174 | 153 | |
| 2012 | 748 | 465 | 355 | 298 | 250 | 204 | | |
| 2013 | 733 | 456 | 338 | 290 | 237 | | | |
| 2014 | 685 | 402 | 321 | 246 | | | | |
| 2015 | 665 | 395 | 299 | | | | | |
| Total | 4,151 | 2,423 | 1,905 | 1,309 | 900 | 545 | 310 | 136 |

Notes: This Table refers to all firms established in Portugal and observed as posting workers for the first time sometime between 2010 and 2015. The second columns describes the distribution of the first posting events by calendar year. In event year 0, by definition, all firms that start posting workers have to appear in the calendar year of their event-year. In the column of event year +1, I report how many of the firms who experience the event in a given calendar year are still posting workers one year after their event. The last column describes the number of firms that still post worker abroad seven years after their first posting of workers. By construction, some cells are empty. For instance, I cannot observe firms that are first posting workers in 2015 (hence have event year 0 as 2015) in event year +3, as the balance sheet data only covers 2006-2017.

H Data Appendix: DPD/SIPSI Database

In this Appendix, I describe in details the dataset for posting to France. The dataset comes from compulsory posting declarations (“*déclarations préalables de détachement*”-DPD) that are sent from foreign companies to the French administration for the period 2000-2020. France has implemented a special registration tool covering the universe of workers posted to the French territory. Before any posting of workers to France, the foreign employer is required to send a pre-posting DPD to the departmental directorate of labor (“*direction départementale du travail*”) of the place where the work mission will be performed. The DPD contains information on the identity of the company established abroad (sending firm) and of the firm established in France (receiving firm), the number of workers posted to France and the demographics of these workers (full name, age, permanent address in origin country, citizenship), information on the work mission performed (duration, sector of activity, address of the work mission) and wages paid to posted workers. The DPD is compulsory for any posted workers sent to the French territory. If this document is missing, the employer in the origin country and the company receiving the workers in France are liable to sanctions, and fines. Any missing DPD document also implies that the work mission is interrupted. French law also requires that foreign companies posting one or more employee to France have to appoint a French legal representative (Article L1262-2-1 of the Labor Code).⁸⁴

The French ministry of labor, and more specifically the DGT (“*direction générale du travail*”) centralizes the information on the number of DPD papersheet forms received by each locality since 2000.⁸⁵ From 2000 to 2015, the central administration (DGT) asked every year the local labor authorities based in each regions (DIRECCTE) to report the number of received DPD forms by province, sector, origin of sending companies and citizenship of posted workers. The received data were then centralized in a unified database: the DPD database. In the so-called DPD database, there is information on postings to France by sector of work and origin country for 2000-2004 and by French province (*département*), sector of work and country of origin of posted workers for 2005-2015. Since mid-2016, the DPD has to be filed electronically through the SIPSI online application. The SIPSI database corresponds to the disaggregated version of the DPD dataset for the period 2016-2019. The SIPSI database contains three datasets that can be linked. The first dataset within SIPSI covers all declarations (or notification) made by foreign services suppliers, and includes information on the supplier ID, the receiving firm or client ID, the sector of the task performed, the sector of the receiving firm, the duration of the service mission, the geographical location of the sending and receiving firms, whether the sending firm directly paid for housing, food and travel costs that relate to the posting mis-

⁸⁴This legal representative is the liaison between the foreign company and the French authorities. The appointment of this representative is made in writing and must be signed by both parties (the company and the legal representative). This designation has to be translated into French so that it can be valid.

⁸⁵No data on DPD have been collected before 2000, because the number of DPD was so marginal that no collection on the information was put in place according to the local labor market responsibles.

sion. The second dataset (“employees dataset”) relates to the posted workers linked to each declaration. In the employees dataset, there is extensive information on posted workers’ demographics (age, address, citizenship, gender), wage during the posting mission, and work contract (occupation, date of starting contract with the sending firm). The last dataset relates to posting mission location (“prestation dataset”) and provides information on the geographical location where the posting mission is performed (e.g., where workers can be controlled by labor authorities). The posting mission can sometimes be associated to long subcontracting chains. If a French construction firm use posted workers sent from a Polish temporary employment agency to work for a third french firm, the ID of this third firm will be associated to the location where the work mission is effectively performed.

Matching algorithm between posting registry and linked employer-employee datasets I merge the SISPI database on all posting missions to France between 2017 and 2020 with administrative data on French workers and firms for the same period. More specifically, I use the SISPI file on “posting missions” (*fichier salariés*) that contains one line per posting contract, merged with the “declaration” file that contains one line per declaration made by the foreign firm, and has information on sending and receiving firm ID. I end up with a dataset where one observation identifies a posting mission with joint information on sending firm, receiving firm, and worker identifiers.

To obtain information on domestic workers, I use matched employer-employee data based on payroll declarations filed by French companies for their domestic workers (DADS). I use the exhaustive version of DADS (*DADS postes*) that covers all employment spells in France for a given year. The DADS contains exhaustive information on wages, hours of work, occupation and other demographics, and importantly allows to observe employers’ and employee’s unique identifiers (SIREN). Since 2018, the DADS also allows to link temporary employment agency workers to the identifier of the firm where they perform their work mission, in addition of their formal employer (the temporary employment agency). The DADS contains exhaustive information for all job spells in France for two consecutive years.⁸⁶ I use DADS Postes 2018 to track job spells of French workers in 2017 and 2018: I can observe workers’ moves across employers in a given year (if employees have several jobs, or change jobs during the year), as well as between the two years.

I use the common firm identifier (SIREN) to link the posting registry with the DADS database. The SISPI dataset identifies receiving firm with a triplet of information: the SIREN, the VAT number, and the name of the company. These information are filed by the foreign supplier, and can either be partially filed (only one of three information available), or can contain mistakes. To maximize the number of observations

⁸⁶There exist a longitudinal version of the DADS that allows to track individuals for a longer period, but is based on a sample of 1/12 of the French population.

with a SIREN number, I develop a matching algorithm. I use the tax registry FICUS/FARE to select SIREN numbers and names of all companies registered in France in 2017 and 2018. I then match the SIPSI database with the FICUS/FARE registry on SIREN number first, then on several combination of the VAT number, and finally on names. For firms matched through names or combination of VAT numbers, I can then use the SIREN number present in the FICUS/FARE dataset.

After implementing this matching methodology, I am able to observe unique firm ID for respectively 78% and 74% of posting missions starting respectively in 2017 and 2018. A missing SIREN number in the SIPSI declaration can be explained by several factors: if the client is an final customer rather than a firm, if the firm that subcontracts the mission is established outside France or ultimately if the declaration has not been fully filed. With this final dataset at hand, I can finally merge the SIPSI database with the DADS database through the SIREN number. Few receiving companies in the posting registry are left unmatched: these are companies that are registered but do not have paid employees. In the end, the matched DADS-SIPSI dataset still captures 75% of posting contracts and posting wage bill. I further winsorize posted workers hourly wage at the 1% level to get rid of extreme values that may be driven by declaration mistakes made by foreign services suppliers.

I Data Appendix: IGSS Dataset

The IGSS dataset is an administrative matched employer-employee dataset that covers all corporations operating in Luxembourg since 2002. The dataset combines all monthly payroll declarations for employees, civil servants and self-employed filed in Luxembourg and all individual social security registries. The dataset therefore allows to obtain information on individuals and employers, and allows to track individuals across employers over time. It contains detailed information on workers' individual characteristics, such as age, gender, citizenship, residence and date of arrival in Luxembourg. A job in the dataset is identified through a unique identifier, and combines a unique worker, a unique employer, and a unique date of beginning and of end. The dataset allows to observe each month the universe of active jobs, with information on hourly wage, hours of work, type of contract and sector of work activity. The matched employer-employee dataset is merged at the worker-level with information on posting missions declared by companies to the Luxembourgish social security institution. I am thus able to observe the universe of posting firms located in Luxembourg, and to observe which worker is sent abroad within the firm exporting non-tradable services abroad.

The IGSS dataset is available at the monthly level for 2002-2020. More specifically, the dataset has one observation per active job each month. To obtain a dataset at the firm-year level, this is how I proceed. I first build a dataset at the month-employer-employee level: if an individual has several jobs at the same employer for a given month, I build a unique observation that takes the total of hours worked by this employee at that employer, the average monthly hourly wage, as well as the total number of posting missions performed by that employee. I then collapse the dataset at the firm-month level: for each firm each month, I compute the total number of hours worked by employees, the total number of employees working at the firm this month, the total number of employees of that firm posted abroad that month, and the average hourly wage of employees working at that firm that month. To go from the firm-month dataset to a yearly firm-level dataset, I then take for each firm the average of these variables across the 12 months of the year. The final dataset has one observation per firm and year from 2002 to 2020 and contains information on firm ID, average hourly wage at that firm, the total number of employees at that firm, the total number of posting services performed abroad by employees of that firm, and the total number of hours worked by employees of that firm.

J Data Appendix: LIMOSA Dataset

The LIMOSA dataset is a posting registry that records all posting declarations filed by foreign companies in order to post workers to Belgium. The specific posting declaration has been implemented in 2008, has to

be made before any posting of workers to Belgium (including self employed who post themselves abroad) and is mandatory. Some workers hired abroad who come to work temporarily to Belgium are exempted from a LIMOSA declaration: workers operating in the transport sector, workers coming to Belgium for a scientific event (congress, conference etc), scientists and researchers who participate to a research program, top executives who come to Belgium to participate to an event (for instance foreign executives who come to assist to a board meeting), workers who come to install goods, athletes who come to Belgium to participate to an international competition, international civil servants, workers from international organizations, and business men.

The LIMOSA dataset allows to observe the total number of posting declarations that have been filed by companies, whether they have been cancelled or not later on. Because interpreting cancelled posting declarations would require additional information and assumptions, I focus on declarations that are not cancelled by firms. The data contains an information on start and end of the posting mission, an unique ID for the posted worker, the sending company and the Belgian client. It also provides detailed characteristics on the posted worker (age, citizenship, residence country, self employed status) and the posting mission (postal code of the work mission, duration, sector of work activity). In the LIMOSA database, a posting mission is defined as the unique combination between a start and end date of the posting mission, a Belgian client, a foreign employer, an individual ID, and a declared workplace in Belgium. In cases where the posted workers are hired by a given Belgian client, but are working for a second client in Belgium, the dataset also provides the ID number of this indirect client. For instance, if a catering company established in Belgium sucontracts waiters posted from a firm established in Poland, and then use these workers to perform a service at a Belgian restaurant, the LIMOSA dataset will provide the ID numbers of the direct and indirect client. The unique ID number of the Belgian client can be associated with the Belgian fiscal number (KBO number). For posting declarations with an information on the KBO number, I can link the posting declaration to information on domestic workers of the receiving firm.

K Implications of Alternative Tax Treatments of Posting Flows

The current posting policy exempts foreign employees from labor taxes in destination countries, workers performing the same work at the same workplace pay different labor taxes, a situation that has been criticized by high-wage countries for generating unfair tax competition and dumping between EU countries.⁸⁷ As a result, the main importing countries like France and Austria have recently proposed to ad-

⁸⁷Origin-specific taxation of posted workers may also lead some firms to use the posting scheme as a tax optimization mechanism. For instance, service suppliers could have incentives to locate in low cost, low tax countries, while performing their activity in other European countries. I provide an example of this tax-competition mechanism in Figure A.53: services suppliers have established their activities in Luxembourg while posting French residents to France. In that case, on-site offshoring is used as a

ditionally impose destination-level payroll taxes on posted workers. In another hand, sending countries have protested against minimum wage requirements imposed by destination countries, arguing that this “anti dumping” clause was in fact a protectionist measure adopted by high-wage countries. In 2005, the “Bolkestein directive” thus proposed to shift to origin-based tax and regulation treatment of posting flows, which implied to abolish destination-level minimum wage requirements. This proposition led to a massive political backlash in most western European countries and the proposition was retracted.

To assess the effects of changing posting-specific labor tax rules, I base my analysis on Equation (14). Any reform regarding additional payroll taxes or labor cost imposed on workers posted from country i to j induces a change in the term $c_{ij} = w_i(1 + \tau_i + a_{ij})(m_{ij})$ that captures the total labor cost of posting workers from i to j . Denoting x' the value of the variable after the reform, the effect of the reform on bilateral posting flows, keeping multilateral resistance and income term constant, can be written as:

$$\frac{S'_{ij}}{S_{ij}}|_{\Phi'_j=\Phi_j} = \left(\frac{c'_{ij}}{c_{ij}} \right)^{-\theta} = \exp \left(-\theta \left\{ \log(c'_{ij}) - \log(c_{ij}) \right\} \right) \quad (21)$$

I use Equation (21) to simulate the direct effects of implementing a changes in the tax treatment of posting flows on overall mobility-dependent trade within the EU, abstracting from indirect effects. I view this exercise as a transparent and straightforward first-path way to approximate the effects of a labor cost reform on postings for pair of countries affected by the change in labor cost rules. I compute the change in labor cost induced by a given reform for each pair of origin-destination country, and feed these changes in Equation (21), together with my estimate of the posting elasticity θ (1.1). This provides me with yearly changes in the number of posting flows compared to the initial (observed) level of postings within the EU.

I begin by analyzing the “equal tax” reform that has been recently discussed by several receiving countries. Such *prevailing labor cost reform* aims at lowering tax dumping incentives by imposing that no posted workers can pay a level of taxes below the one that is in place in the destination country.⁸⁸ Figure A.58 shows that imposing equal payroll taxes for workers posted from countries with lowest level of labor taxes would restrict substantially internationally mobile services within the EU, with an average posting decrease of 30% over the period 2007-2017, accounting for 0.6% of current EU GDP. This overall decrease in postings following the reform masks important discrepancies in which sending countries are mostly affected by the change in posting rules. Figure A.59 shows that most of the missing posting flows after the reform come from reduced postings originating from Eastern and Southern european countries. For instance, Bulgaria would send 80% less posted workers abroad relative to the pre-reform level.⁸⁹

⁸⁸pure cost optimization instrument, as it virtually moves activity location from France to Luxembourg.

⁸⁹This reform would solely focus on non-wage component of labor cost, and would still allow for total wage costs differences between workers from different origin countries because of different origin-specific wages, even after accounting for posting allowance and minimum legal wages requirements.

⁸⁹Equation (21) evaluates the “partial trade impact” of the reform, and omits general equilibrium effects that may have addi-

I then turn to the second posting reform discussed in Europe with the Bolkestein directive proposition. I show in Figure A.59 the counterfactual number of posting missions performed in France in the absence of destination-level minimum wage requirements. Service import exposure in the French labor market would have been twice larger had foreign employees been allowed to be paid at the origin-level rather than destination-level minimum legal wage.

tional implications. Third-country effects through the adjustment of the multilateral resistance term Φ_j are not taken into account. For instance, increasing the taxes on workers posted from Poland to France may reallocate part of the demand from French customers to workers posted from other countries. Potential income and expenditures changes that follow a change in posting costs are also ignored in the partial approach. The estimates of the structural elasticity θ presented in Table 9 neutralize those reallocation and adjustment effects, capturing the pure mobility effects of wage costs on posting flows. In the counterfactual scenarios that evaluate changes in posting costs through tax reforms, the structure of the model can be used to solve for the indirect effects of the changes in costs on multilateral resistance terms and incomes.

L Labor Posting Responses Through Mobility Duration

This section shows that posting responses to fiscal incentives not only occur through changes in the number of individuals who are posted each year, but also through mobility durations of international mobility periods.

For this purpose, I investigate the distribution of posting durations around a regulatory threshold that determines the income tax residency for individuals posted abroad. This internatioanl fiscal rule, known as the 183 days rule, establishes the income tax regime that applies to the income earned abroad by posted workers, and in some cases of the total income tax regime of workers posted abroad. International tax treaties establish that individuals pay income taxes in the country where the work activity is performed. However, if the employer is not located in the country where the work mission is performed by its employee, and if the employee works less than 183 days in the country of work, the income tax can exceptionally be levied by the country of residence, and not the country of work. For instance, the general rule will thus states that a French resident who is posted for 3 months to Belgium will not be liable to the Belgian income tax on the income he will receive for the posting mission. On the other hand, if the employee works for more than 183 days in one country, the income tax on the wage received for the work mission is levied by the country of work, and not the country of residence. Beyond determining the income tax regime of part of individuals' income that is linked to the international mobility mission, the 183 days rule can also in some cases determine the overall tax residence of individuals. For taxpayers who do not keep a "central financial interest" in their origin country, staying more than 183 days in the country of work may shift their total fiscal residence abroad.

The 183 days rule thus creates some room for mobility duration manipulation that could shift individuals' tax residency, either only for the part of the wage linked to the posting abroad, either for the totality of individuals' income and wealth. The incentives to fall just below or above the duration threshold depend on individuals' income level, differences in country of work and country of origin income tax schedules, and other idiosyncratic determinants of their income tax bill. To investigate whether individuals react to these incentives, I investigate in Figure A.60 the distribution of posting missions duration in Belgium around the tax residency discontinuity created by the 183 days rule. The Figure shows a distinctive pattern around the 183 days tax residency threshold. First, there is an excessive mass of posting missions with durations around the threshold compared to the mass of posting mission durations elsewhere in the distribution. If part of this excess mass can be explained by bunching at reference points, because of the 6 months duration, the comparison with the excess mass observed at the 5 months reference point suggests that this mechanism cannot explain alone the magnitude of the observed excess mass around the 183 days threshold. Second, the shape of the distribution around the 183 days threshold takes a distinctive pattern, that is

never observable elsewhere in the duration distribution. The distribution of posting missions duration is *double-picked*, with a clear double bunching of posting durations just below and just above the threshold, while the number of people who locate at exactly 183 days is lower. This distinctive pattern of mobility duration around the tax residency threshold suggests that some individuals tend to bunch below 183 days, in order to keep their wage under the country of origin income tax schedule, while other tend bunch just above the 183 days threshold in order to shift their income tax to the country of work schedule. To better understand how postings' duration react to the tax residency threshold, more information on individuals' current and counterfactual tax liabilities is needed, and will be used when additional data will be obtained. Nevertheless, the double picked shape of the duration distribution emphasizes the existence of bunching both just below and just above the threshold, and confirms the existence of posting duration manipulation induced by the 183 days discontinuity in income tax residency rule.