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The Impact of Immigration on Firm-Level Offshoring

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The Impact of Immigration on Firm-Level Offshoring*

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April 12, 2018

Abstract

This paper studies the relationship between immigration and offshoring by examining whether an influx of foreign workers reduces the need for firms to relocate jobs abroad. We exploit a Danish quasi-natural experiment in which immigrants were randomly allocated to municipalities using a refugee dispersal policy and we use the Danish employer-employee matched data set covering the universe of workers and firms over the period 1995-2011. Our findings show that an exogenous influx of immigrants into a municipality reduces firm-level offshoring at both the extensive and intensive margins. The fact that immigration and offshoring are substitutes has important policy implications, since restrictions on one may encourage the other. While the multilateral relationship is negative, a subsequent bilateral analysis shows that immigrants have connections in their country of origin that increase the likelihood that firms offshore to that particular foreign country.

Key words: Immigration, Offshoring
JEL code: F22, F16, J61, F23, F66

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1 Introduction

Immigration and offshoring are two of the most contentious components of globalization.[1] A protectionist backlash against globalization is occurring in many countries, in part due to concerns about immigration and offshoring. While there are numerous studies examining the determinants and economic implications of each of these global forces, there is little research investigating the relationship between the two. This is unfortunate since restricting immigration could have important implications for offshoring and visa versa. Our paper fills this gap by exploring whether an exogenous influx of immigrants into a municipality affects the offshoring decisions of local firms.

Offshoring, or the relocation of domestic jobs abroad, is often motivated by the firm's desire to reduce labor costs, to move production closer to foreign consumers, or to utilize a foreign workforce with a different skill set.[2] The firm weighs these benefits against the inherent challenges associated with offshoring, which include the difficulty of monitoring production activities abroad, the need to transport intermediate goods between countries, and the foreign connections and familiarity with foreign business environments required to offshore. Immigration into a municipality may influence the local firm's decision to offshore in a couple of ways.

First, an influx of foreign workers may reduce the need for domestic firms to relocate jobs abroad. Specifically, firms located in areas that have an abundant supply of new immigrant workers may have less incentive to offshore. Rather than employing foreign workers abroad through offshore production, which is logistically difficult, the firm can instead hire immigrant workers domestically. In a fundamental sense, the foreign workers have migrated to the domestic jobs rather than the jobs being relocated abroad. According to this view, which we will refer to as the labor supply effect, immigration and offshoring are substitutes.

There is anecdotal evidence supporting this hypothesis. For instance, there were concerns that the restrictions to H1B visas proposed in the 2013 U.S. Immigration Bill would have the unintended consequence of forcing U.S. firms to offshore jobs abroad.[3] Similarly, Brexit may limit the inflow of European Union (EU) migrant workers into the U.K. which could inadvertently encourage British firms to offshore production activities abroad.[4] In Denmark the pork industry has offshored much of its production due in part to their reluctance, compared to the their German competitors, to hire immigrant workers (Wagner and Refslund, 2016). While these sentiments and concerns are common, there is limited evidence showing that immigration and offshoring are substitutes.

Second, immigration can influence offshoring decisions through the information and connections

[1] American workers list offshoring and immigration as the two factors of greatest concern to them ("Public Says American Work Life is Worsening, But Most Workers Remain Satisfied with Their Jobs," Pew Research Center, 2006.)

[2] Offshoring can occur within or outside the boundaries of the firm (i.e. outsourcing). However, this distinction between offshoring to foreign affiliates or foreign arms-length suppliers is less important for our purposes than the simple fact that production is being relocated abroad. Our main offshoring measure will include both types of offshoring, but we also find similar results using an FDI-based measure of offshoring that only includes offshoring within the boundaries of the firm (see Table 10).

[3] "Why India is Irked by the U.S. Immigration Bill" Knowledge@Wharton, July 8, 2013.

[4] As The Economist says in their article "Brexit's Labour Pains" (January 14, 2017): "If Britain's firms cannot import enough workers, the country may simply export their jobs."

that immigrants often have with their country of origin. Local firms may utilize this expertise and these networks to offshore stages of production to the immigrant's country of origin. Thus, at the bilateral level immigration may actually encourage offshoring. According to this view, which we will refer to as the bilateral network effect, immigration and offshoring will be complements. A positive bilateral relationship and a negative multilateral relationship between immigration and offshoring are not incompatible since network effects are country specific while labor supply effects are strongest at the multilateral level.[5]

We study the relationship between immigration and offshoring in Denmark, which provides an appealing quasi-natural experiment for researchers. First, 'push factors' in a number of foreign countries led to a rapid and exogenous increase in the flow of immigrants into Denmark. For instance, unrest in Iraq, Afghanistan, Somalia, and the former Yugoslavia in the 1990s, and the European Union enlargement in the 2000s both increased Danish immigration. Second, once immigrants were in Denmark they were often allocated to municipalities according to the refugee Spatial Dispersal Policy, which had little regard for immigrant preferences or local economic conditions (Damm and Dustmann, 2014; Foged and Peri, 2016). Third, subsequent waves of immigrants often settled in the randomly assigned Danish municipalities that their countrymen were initially allocated to based on the Spatial Dispersal Policy. These features of Danish immigration provide a unique opportunity to identify exogenous shocks to immigration within municipalities.[6]

An added benefit of focusing on Denmark is that it has a detailed employer-employee matched data set covering the universe of firms and the entire population of workers within Denmark over the years 1995-2011. This data is well-suited for our analysis since it contains comprehensive information about the individual characteristics of workers, including their country of birth. Furthermore, it also has detailed employer information which, among other things, allows us to measure offshoring at the firm-level within municipalities. This represents a significant improvement over industry-level measures of offshoring that are common in the literature, since offshoring tends to be highly firm-specific (Hummels et al., 2014). In sum, the unique features of Danish immigration and the availability of this detailed data set offer an ideal opportunity to examine how immigration shocks affect firm-level offshoring decisions.

The results show that an increase in the share of non-EU immigrants within a municipality reduces firm-level offshoring, after accounting for a variety of firm, industry, municipality, and workforce characteristics.[7] To address endogeneity concerns, we employ a 'shift share' instrumental variable approach that identifies an exogenous source of variation in immigration based on the tendency for immigrants to settle in municipalities where their countrymen previously located (Card, 2001). The

[5]Immigration may also lead to a "productivity effect" (Ottaviano et al., 2018) which refers to the cost saving (or productivity enhancing) effects of immigration, which in turn may influence offshoring decisions. The direction of this effect is ambiguous since more productive firms may be more successful at overcoming the fixed costs of offshoring or they may be less likely to offshore since their domestic production is now less costly. We control for firm productivity throughout our analysis, which allows us to carefully focus on the labor supply and network effects of interest.

[6]Typically European labor markets are relatively rigid, however Denmark has one of the most flexible labor markets in the world, on par with the U.S. (Hummels et al., 2014; Foged and Peri, 2016).

[7]Given the exogenous 'push factors' and the dispersal policy we focus on non-EU immigration, but results obtained using broader or narrower immigrant groups are similar (see section 6.2).

specific features of Danish immigration during this period, including exogenous 'push factors' and the Spatial Dispersal Policy, make this common instrumental variable approach even more appealing in our context. We find immigration reduces both the extensive margin of offshoring (i.e. the likelihood that the firm offshores at all) and the intensive margin of offshoring (i.e. how much the firm offshores). Specifically, a one standard deviation increase in the share of immigrants within a municipality reduces the extensive margin of offshoring by 12.7% and reduces the intensive margin of offshoring by 2.1%. Additional results show that these findings differ in sensible ways across sectors, with immigration having a larger impact on offshoring in labor intensive industries and in those industries where offshoring is more feasible.[8] Overall, these findings confirm the labor supply effect by showing that an exogenous influx of immigrants into a municipality reduces the need for firms to offshore jobs abroad.

While these multilateral results show that immigration and offshoring are substitutes, we also examine whether immigrants possess knowledge or connections that help local firms offshore to the immigrant's country of origin. Consistent with our network effect hypothesis, we find that an exogenous influx of immigrants increases the likelihood that a firm in that municipality will begin offshoring to the immigrant's country of origin (i.e. the extensive margin of offshoring). However, there is no impact of bilateral immigration on the intensive margin of offshoring, which is consistent with the idea that immigrants help the firm overcome the fixed costs associated with initially relocating production abroad but have little impact on offshoring volumes once the firm has already established business connections of it's own in the foreign country. While bilateral offshoring increases with immigration from the same foreign country, we confirm that it decreases with immigration from all other countries, which reconciles our bilateral and multilateral findings. Overall we find evidence that immigration substitutes for offshoring at the multilateral level due to the labor supply effect but complements offshoring at the bilateral level due to the network effect.

While our primary focus is on immigration and offshoring, we also explore the relationship between immigration and international trade. Our findings show that immigration has no impact on imports into a municipality, which confirms that our offshoring results are not simply due to a general relationship between immigration and imports. We also find that immigration has no impact on exports from a municipality. However, our results do show that bilateral immigration increases both imports from and exports to the immigrant's country of origin. The network effect that encourages offshoring to the immigrant's country of origin is also, not surprisingly, useful in facilitating trade.

Our paper makes a number of important contributions. First, our findings support a growing body of evidence showing that immigration influences firm behavior. For instance, research has found that immigrant-induced labor supply shocks can cause firm's to use more labor intensive technologies or to expand production activities in response (Acemoglu, 1998; Lewis, 2011; Olney, 2013; Dustmann and Glitz, 2015). We contribute to this literature by showing that firm-level offshoring, at both the intensive and extensive margins, declines in response to immigration. This reduction in offshoring increases local labor demand, which together with the direct immigrant-induced increase in labor supply, could explain why immigration is found to have no negative impact on wages in Denmark

[8] In addition, our results are robust to measuring offshoring in a variety of different ways as shown in section 6.3.

(Foged and Peri, 2016) and in other contexts (Card, 2005).

Second, our results contribute to an existing literature that finds that immigrants help facilitate trade to their country of origin through knowledge, language, contacts, and networks (Gould, 1994; Head and Ries, 1998; Rauch and Trindade, 2002; Peri and Requena-Silvente, 2010). Not only do we confirm these trade findings in our context, but we show that immigration also increases offshoring to the immigrant's country of origin. However, these bilateral results are only part of the story. In addition to the complementary effects at the bilateral level, we find that immigration and offshoring are substitutes at the multilateral level.

Third, our examination of arguably the two most important and contentious components of globalization is similar in spirit to Ottaviano et al. (2013) and Olney (2012) who also look at immigration and offshoring in a unified framework but focus on the employment and wage ramifications for natives. Ottaviano et al. (2013) also find that immigration reduces the employment share of offshoring in U.S. manufacturing industries, which suggests that the two are substitutes at the multilateral level. However in contrast to their earlier results, Ottaviano et al. (2018) find using a sample of U.K. service firms that immigration and offshoring are complements at the multilateral level but substitutes at the bilateral level. Our analysis attempts to clarify these conflicting findings in the literature by exploiting the unique features of Danish immigration and using our detailed employer-employee matched data set covering the universe of firms and workers in all industries. We find that immigration generates a labor supply effect that reduces offshoring, which is consistent Ottaviano et al. (2013) but in contrast to Ottaviano et al. (2018). We also find that bilateral immigration generates a network effect that increases bilateral offshoring, which is not pursued by Ottaviano et al. (2013) and differs from Ottaviano et al. (2018) who focus on the offshoring of service tasks which may be more country-specific.[9]

The paper is organized in the following manner. In section 2 we discuss the data and the unique features of the Danish immigration experience which make this an appealing quasi-natural experiment to study. We also define and present descriptive statistics of our key measures of immigration and offshoring. Our empirical approach is explained in section 3, which also includes a discussion of our identification strategy. Section 4 presents evidence showing that immigration generates a labor supply effect which reduces offshoring at both the intensive and extensive margins. We complement this key finding by showing in section 5 that immigration also generates a bilateral network effect which increases the likelihood that firms offshore to the immigrant's country of origin. Finally, we examine the impact of immigration on international trade in section 6, and also show that our results are robust to alternate measures of immigration, alternate measures of offshoring, and to the use of different samples of firms and municipalities.

2 Data

Our empirical analysis examines the relationship between immigration and offshoring using an employer-employee matched data from Statistics Denmark. In this section we provide an overview of

[9] These differences are discussed in greater detail in section 5.

the data sources and we document how immigration and offshoring have evolved over time and across geographic municipalities within Denmark.

2.1 Data Sources

Our data set is constructed by merging information from three different sources. First, firm-level data comes from the Firm Statistics Register (FirmStat henceforth), which covers the universe of private-sector firms over the years 1995-2011. FirmStat has detailed information on the industry[10] and location of the firm within Denmark, which is important for our analysis.[11] In addition, FirmStat has detailed information on a variety of firm characteristics, such as productivity, capital intensity, and foreign ownership.[12] Accounting for these time varying firm-specific characteristics allows us to more carefully isolate the impact of immigration on offshoring.[13]

Second, worker-level data is provided by the Integrated Database for Labor Market Research (IDA henceforth) which covers the entire Danish working population over the period 1980-2011. Importantly, IDA provides information on each individual's country of birth, which allows us to measure the immigrant share of the workforce within a municipality. In addition, IDA provides a number of useful workforce characteristics such as average education, age, tenure, gender, and work experience of employees. Using the Firm-Integrated Database for Labor Market Research (FIDA) every worker in IDA is linked to every firm in FirmStat data using a unique identifier. This generates an employer-employee matched data set covering the universe of private-sector firms and the population of Danish workers.

Third, trade data comes from the Foreign Trade Statistics Register and consists of two parts, the Intrastat (within EU trade) and the Extrastat (trade with non-EU countries). Exports and imports are measured at the firm-level for the years 1995-2011, which will be used to construct our offshoring measure and offers immediate advantages over industry-level trade data often used in the literature. Furthermore, this trade data is available by foreign country and detailed product level (8-digit Combined Nomenclature), which is useful for our bilateral and industry level analyses. The Foreign Trade Statistics data is linked to the FirmStat and FIDA data using the same unique firm identifier.

[10] The firms industry is classified according to the 2-digit Danish code ($http://www.danmarksstatistik.dk/da/Statistik/dokumentation/nomenklaturer/dansk-branchekode-db07$). Statistics Denmark assigns an industrial code based on the main (core) activity performed by the firm. The industry code can vary over time within a firm.

[11] In the dataset, the location of multi-establishment firms is determined by the municipality of the headquarter establishment. Multi-establishment firms constitute only 9% of our sample, we control for them throughout, and we confirm in Table 11 that our results are similar if these firms are dropped from the sample entirely.

[12] Labor productivity is calculated as sales per employee in logarithmic scale. The capital stock comprises the sum of land, buildings, machines, equipment and inventory (in Danish kroner). Foreign ownership is a binary variable based on the company's ownership form provided by the Central Business Register (found here https://www.dst.dk/da/Statistik/dokumentation/Times/generel-firmastatistik1/gf-virkfkod-1). We deflate all monetary values using the World Bank's GDP deflator with 2005 as the base year.

[13] FirmStat imputes some balance sheet variables for a limited number of small firms with fewer than 50 employees. Our results are robust to either excluding just these observations or excluding all firms with fewer than 50 employees (results available upon request).

Combining these different data sources generates an unbalanced panel of approximately 35,000 firms and 1 million workers, spanning 70 different industries and 97 Danish municipalities over the period 1995-2011.[14] The ability to link firm-level trade data with an employer-employee matched data set provides a unique opportunity to examine how immigration into a local labor market affects offshoring decisions of firms within that municipality.

2.2 Immigration

We begin by calculating the the share of foreign-born workers in Denmark and document how this share has evolved over time. Figure 1 shows that in 1994 the immigrant share of the workforce in Denmark was about 2.5 percent but by 2011 it had increased to over 6 percent. The fact that the share of foreign workers more than doubled in Denmark in a relatively short period represents a unique opportunity to examine the economic implications of immigration.

Our empirical analysis focuses on non-EU immigrants, who for a number of reasons are an appealing segment of the immigrant population to study.[15] First, Figure 1 shows that nearly all of the increase in immigration over this period is driven by an influx of foreign workers from non-EU countries, while EU immigration has remained relatively flat. For instance, in 1994 EU and non-EU immigrants comprised the same share of the workforce (slightly more than 1 percent) but by the end of our sample the non-EU immigrant share was double that of the EU share (more than 4 percent compared to less than 2 percent). Non-EU immigration is the driving force behind the rapid increase in the share of foreign workers in Denmark.

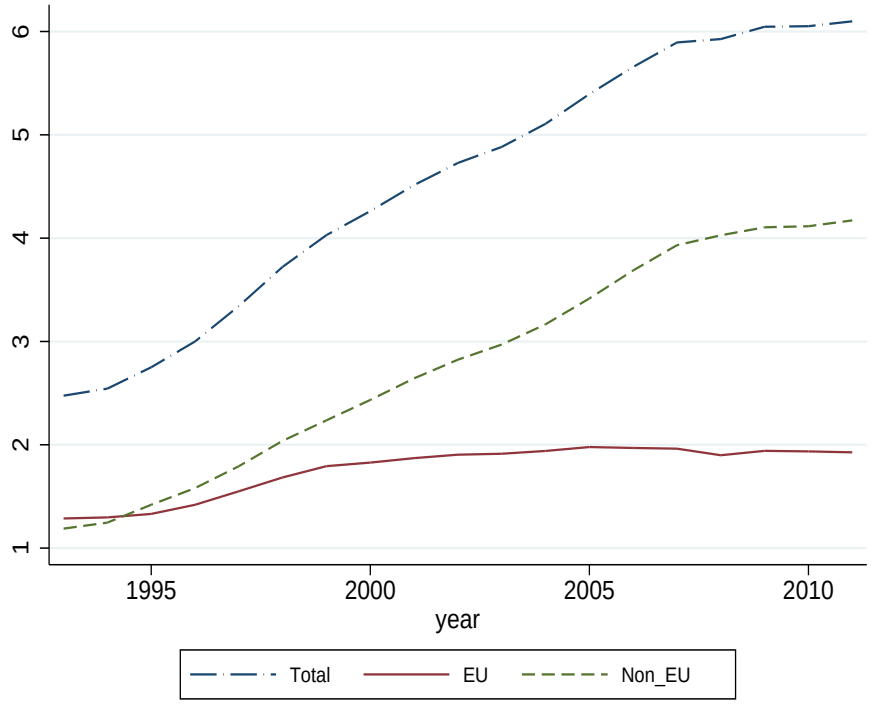
Second, the growth in non-EU immigration into Denmark during this period was largely driven by exogenous factors, such as conflict and unrest in some foreign countries during the 1990s and by European Union enlargement in the 2000s. To illustrate this point, Figure 2 shows the growth rate in immigration from a variety of non-EU countries since 1995. There was a rapid increase in immigrants from countries experiencing instability in the 1990s, such as Afghanistan, Somalia, Iraq, and the former Yugoslavia. However, immigrant inflows from these countries plateaued during the 2000s. We also see that immigration inflows increased from countries that joined the European Union. For instance, immigration from Poland increased after the country joined the EU in 2004 and immigration from Romania and Bulgaria increased after 2007 when both countries joined the EU. The country-specific variation illustrated in Figure 2 indicates that the rapid growth in non-EU immigration does not appear to be motivated by domestic economic conditions in Denmark, which could be correlated with offshoring decisions. Instead, this evidence suggests that the growth in Danish immigration during this period is driven by external 'push-factors' in foreign countries.[16]

[14] We exclude firms with only 1 employee, to avoid self-employment. We also exclude firms that relocate within Denmark. However, the inclusion of these mobile firms in our analysis does not affect our findings, as shown in Table 11. Our analysis focuses on 97 Danish municipalities, which combines Frederiksberg and Copenhagen following Foged and Peri (2016).

[15] Our definition of non-EU immigrants includes foreign workers from all countries outside the EU15 (not counting Denmark itself the EU15 countries are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and the United Kingdom).

[16] Figure 10 provides additional details on the origin countries of Danish immigrants and the destination countries of

Figure 1: Foreign Born Share in Denmark by Area of Origin



Notes: Share of migrant workers by area of origin calculated using data from Danish Integrated Database for Labor Market Research.

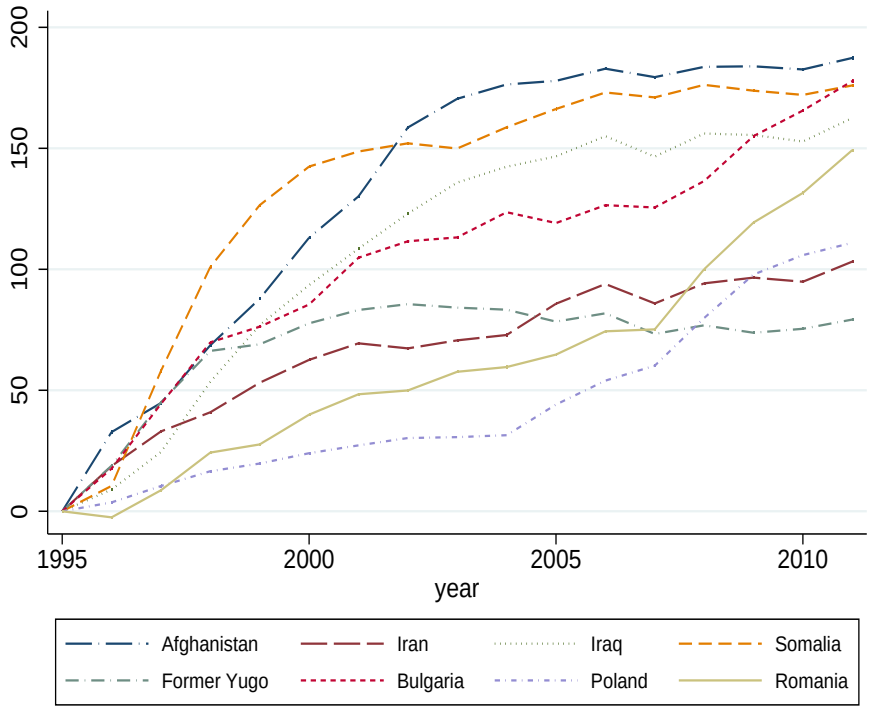
Third, since offshoring often, although not always, entails the relocation of routine, lower-skilled tasks abroad (Hummels et al., 2014; Ebenstein et al., 2014; Becker et al., 2013), firm-level offshoring decisions may be more responsive to non-EU immigration. Demographic characteristics reported in Table 1 show that non-EU immigrant workers are on average younger, have less education, and are more likely to work blue-collar routine jobs compared to natives and EU immigrants. For instance, non-EU immigrants are on average 38 years old while EU immigrants are 44 years old. Similarly, 30 percent of non-EU immigrants have a primary education (14 percent for EU immigrants) and 80 percent work blue collar jobs (66 percent for EU immigrants).

Fourth, a significant portion of the growth in non-EU immigration was due to inflows of immigrants from refugee countries that were experiencing instability in the 1990s (see Figure 2). The Danish Government followed a Spatial Dispersal Policy which randomly allocated these refugees to municipalities within Denmark over a thirteen year period from 1986-1998 (see Damm (2009) and Damm and Dustmann (2014) for additional details about this program). The goal of this policy was to evenly disperse immigrants across the country roughly in proportion to the number of existing inhabitants.[17] The program asked immigrants to provide their birth date, family size, and nationality, but importantly the ultimate location decision was not influenced by the skill-level of the immigrant,

Danish offshoring.

[17]This type of spatial distribution policy has been used in other countries as well, such as Germany (Glitz, 2012)

Figure 2: Growth Rate of Immigrants by Country of Origin since 1995



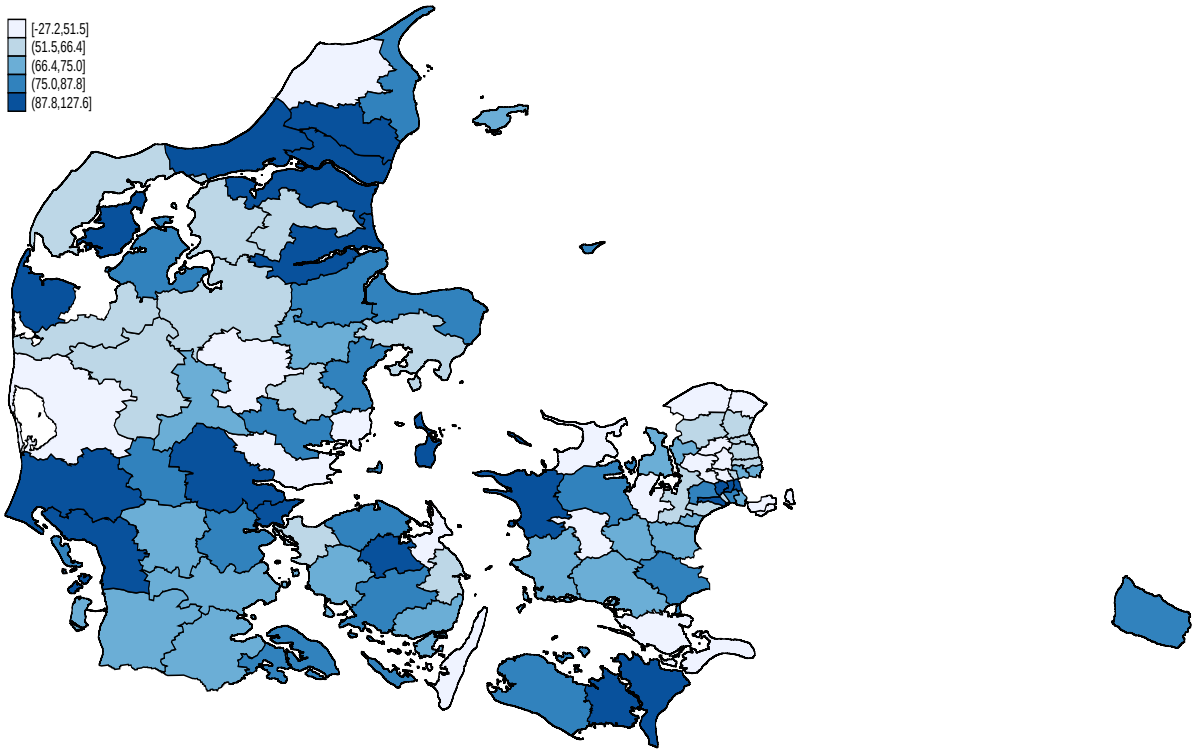
Notes: Growth rate from 1995 in the number of migrant workers from each foreign country calculated using data from the Danish Integrated Database for Labor Market Research.

their geographic preferences, or the economic conditions of the Danish municipality. While national clusters of immigrants did emerge, this was largely due to the random timing of immigrant inflows and the availability of housing in that year (Foged and Peri, 2016). Thus, the Spatial Dispersal Policy generates variation in immigration across municipalities that is independent of local economic conditions, which could be endogenous. Immigrants were encouraged to stay in their assigned municipality and had strong incentives to do so since they received social assistance and language courses there, however there were no formal restrictions on subsequent relocation (Damm and Dustmann, 2014). Furthermore, even after the Spatial Dispersal Policy officially ended, new immigrants had connections that often led them to locate in the randomly assigned municipalities that their countrymen were initially allocated to (Bartel, 1989).

Figure 3 shows the percent change in the non-EU immigrant share across municipalities over our sample period. First note that there is substantial geographic variation in immigration which is important for our empirical analysis. We also see that new immigrants dispersed across Denmark in a more or less random way, which is consistent with the goals of the Spatial Dispersal Policy. For instance, the municipality of Lemvig on the west coast of Denmark saw their non-EU immigrant share increase by 126 percent, while the similar neighboring municipality of Hostelbro saw it's share increase by half as much (61 percent). It is not the case that immigration increased more rapidly in urban areas, like Copenhagen in the east, which would be concerning if offshoring is also more common in

these municipalities. The historical features of Danish immigration, including both the exogenous 'push factors' and this random geographic variation, represent a unique quasi-natural experiment which allows us to examine the causal impact of immigration on firm-level offshoring decisions. Our subsequent instrumental variable approach more carefully isolates these useful sources of variation in the data.

Figure 3: Percent Change (1995 to 2011) in the Share of Non-EU Immigrants by Municipality



Notes: Share of non-EU migrant workers calculated using data from the Danish Integrated Database for Labor Market Research.

Our empirical analysis focuses on the variation in the supply of immigrants across local labor markets, illustrated in Figure 3, rather than on immigrant employment shares within the firm.[18] This approach exploits the exogeneity of the dispersal policy, which allocated immigrants across municipalities, and it avoids endogenous hiring decisions of the firm.[19] Thus, we measure the non-EU immigrant share of employment in municipality m and year t. Specifically, our immigration measures Img_{mt}^{non-EU} is calculated as F_{mt}^{nonEU}/P_{mt}, where F_{mt}^{non-EU} is the stock of immigrant workers of non-EU origin and P_{mt} is total employment in municipality m and year t. Our empirical specification will examine how changes this share immigrants within a municipality effects the offshoring decisions of local firms. Additional results show that our findings are robust to a variety of other ways of constructing this immigration variable, including as the share of total immigrants, the refugee and new-EU immigrant

[18] Measuring immigration within local labor markets is preferable even when firm-level data on immigration is available (Foged and Peri, 2016; Dustmann and Glitz, 2015).

[19] Offshoring decisions likely respond to the pool of available workers within a local labor market and not just the workers that the firm ultimately chooses to hire. While using the municipality as our unit of analysis is preferable, we confirm in Table 9 that the results are similar if we use the share of non-EU immigrant workers at the firm instead.

share, the non-EU low-skilled immigrant share, or the firm-level non-EU immigrant share (see section 6.2 and Table 9).

2.3 Offshoring

Using data from the Foreign Trade Statistics Register, we construct a firm-level measure of offshoring. We follow the well-established method of measuring offshoring using detailed import data first proposed by Feenstra and Hanson (1999) at the industry-level and then measured at the firm-level by Hummels et al. (2014). This approach is supported by survey data which indicates that 95 percent of Danish firms that offshore to a particular region also import from that region (Bernard et al., 2017a).[20] Another appealing aspect of this measure is that it captures offshoring within and outside the boundaries of the firm, by including imports from both arms-length suppliers and from foreign affiliates.

We construct a "narrow offshoring" measure that is defined as the summation of imports in the same HS4 category as firm production.[21] Focusing on imports within the same detailed product code, increases the likelihood that the firm could have previously produced these products domestically which is consistent with the concept of offshoring. For instance, this narrow measure of offshoring does not include imported raw materials that may be used in domestic production but are obviously less compatible with standard definitions of offshoring.

Measuring offshoring at the firm-level is appealing. First, there is significant heterogeneity in offshoring across otherwise similar firms within the same industry (Hummels et al., 2014). This suggests that an industry-level measure of offshoring constructed using input-output tables is missing important variation in the data. Furthermore, firm-level offshoring allows us to control for observed and unobserved firm characteristics that could be related to both offshoring and immigration. Our offshoring measure can also be constructed for each foreign destination country, which will be exploited in our bilateral analysis. For all of these reasons, firm-level measures are considered the "gold standard" of offshoring variables (Hummels et al., 2016).

Our results are similar using other offshoring measures, such as a "broad offshoring" measure or a conceptually distinct foreign-direct-investment based measure of offshoring (see Table 10). We also show that our results are similar when examining offshoring in manufacturing and service industries separately, but they are stronger in labor intensive industries and in industries where offshoring is more feasible (see Table 6). Furthermore, in section 6.1 we show that our measure of offshoring is not driven by a more general relationship between immigration and aggregate imports. All of these findings indicate that our measure of offshoring is accurately capturing firm-specific offshoring decisions.

Our analysis will focus on two dimensions of offshoring. First, we are interested in the firm's initial decision to offshore production activities abroad (i.e. the extensive margin of offshoring). This

[20] While these imports are often final goods rather than intermediate inputs (Bernard et al., 2017a), for our purposes the type of imports matter less than the simple fact that the firm has offshored production activities abroad. To the extent that Danish firms offshore production and then sell the output in foreign markets, our import-based measure of offshoring will be an underestimate.

[21] Given the richness of the data, for multi-product firms we are able to sum imports across all of the HS4 products that the firm produces.

requires the firm to weigh the benefits of lower foreign labor costs, for instance, against the drawbacks associated with coordinating and monitoring production abroad. To measure these extensive margin adjustments we define offshoring as a binary variable equaling one if the firm offshores to any foreign country. Second, we are in interested in whether the firm's volume of offshoring changes (i.e. the intensive margin of offshoring). We measure this dimension of offshoring using the natural log of offshoring volumes, conditional on the firm offshoring.

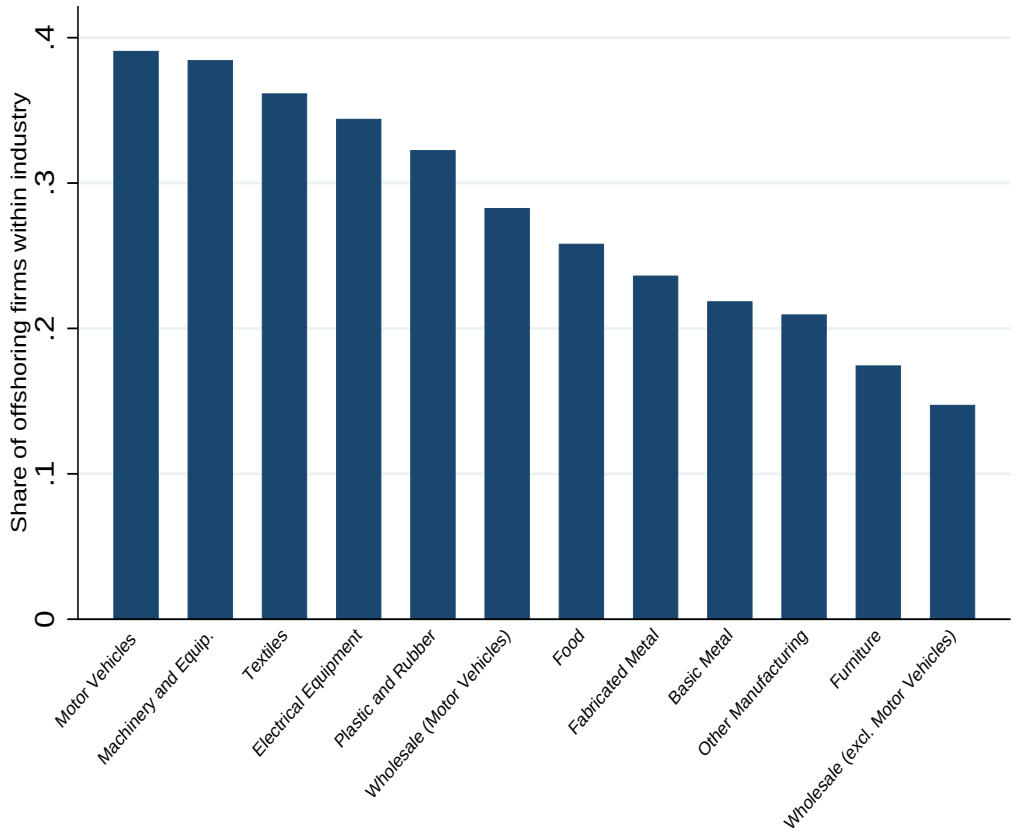
We expect that the labor supply effect will cause immigration to reduce both the extensive and intensive margins of offshoring. After an immigrant-induced increase in labor supply within the municipality, firms will have less incentive to offshore since the foreign workers have migrated to them.[22] However, the bilateral network effect likely influences the extensive and intensive margins of offshoring differently. Firms will find the immigrant's connections with their country of origin useful when they initially begin to offshore. However, if the firm already has offshored to the foreign country, they will have business connections of their own, and thus the intensive margin of offshoring should be less sensitive to immigration.

Figure 4 presents evidence on the prevalence of offshoring across Danish industries. We find that offshoring is common in industries such as Motor Vehicles, Machinery and Equipment, and Textiles where almost forty percent of firms offshore. This is consistent with evidence showing that offshoring of routine, blue-collar jobs is relatively common (Hummels et al., 2014; Ebenstein et al., 2014; Becker et al., 2013). Using a totally different measure of offshoring based on survey data, Bernard et al. (2017a) also find that offshoring is relatively common in these three industries which provides external validity for our offshoring measure. Our results also indicate, not surprisingly, that offshoring is uncommon in industries such as Health Care and Accommodation and Food Services. This is consistent with Ottaviano et al. (2018) who find very little trade in these two service industries, which again provides an external check of our offshoring measure. Ultimately, we find this industry variation sensible, it is consistent with existing evidence, and it indicates that our measure is successfully capturing useful variation in offshoring.

Figure 5 shows basic time-series variation in the share of non-EU immigration (top panel) and the share of offshoring firms (bottom panel) over the last twenty five years in Denmark. While the variation in non-EU immigration is familiar from Figure 1, the bottom panel shows a long-run upward trend in Danish offshoring, which increases from about 11 percent in 1998 to about 15 percent in 2011. However, around this trend there are interesting fluctuations. For instance, in two periods (1995-1998 and 2004-2006) there is an increase in the share of non-EU immigrants due to foreign push factors while at the same time offshoring appears to decline. Of course strong inferences are challenging in basic time-series figures, but this suggests that immigration and offshoring may be related even at the national level.

[22] In addition, immigration may initially reduce domestic wages, which undermines the cost-saving motivation of offshoring. However, a reduction in offshoring in turn increases local labor demand, which implies that equilibrium wages ultimately may not decrease in response to immigration (as found in Foged and Peri (2016)). Alternatively, if the motivation for offshoring is to locate production closer to foreign consumers, then firms' offshoring decisions will be less responsive to immigration which will work against our findings.

Figure 4: Offshoring by Industry



Notes: Share of offshoring firms (narrow definition) within each 2-digit Danish industry code (1995-2011) calculated using data from the Danish Foreign Trade Statistics Register.

We now turn to the geographic variation in offshoring, as we did with immigration. Figure 6 shows how the prevalence of offshoring changed from 1995 to 2011 across different Danish municipalities. First, note that there is substantial geographic variation in offshoring across Denmark, which is useful for our empirical analysis. Second, the municipalities that experienced the largest increase in offshoring do not, for instance, seem to be clustered around Copenhagen. Furthermore, it appears in Figures 3 and 6 that those municipalities which saw a substantial long-run increase in immigration do not experience long-run increases in offshoring. This points to a negative relationship which will be tested more formally in the analysis that follows.

2.4 Descriptive Statistics

Descriptive statistics of our main offshoring, workforce, and firm variables over the period 1995-2011 are presented in Table 2. Thirteen percent of firms engage in offshoring according to our narrow measure, while twenty six percent do so according to our broad measure. Focusing on the intensive margin of offshoring, we see that the average volume of offshoring is about 90,000 Danish Krone.

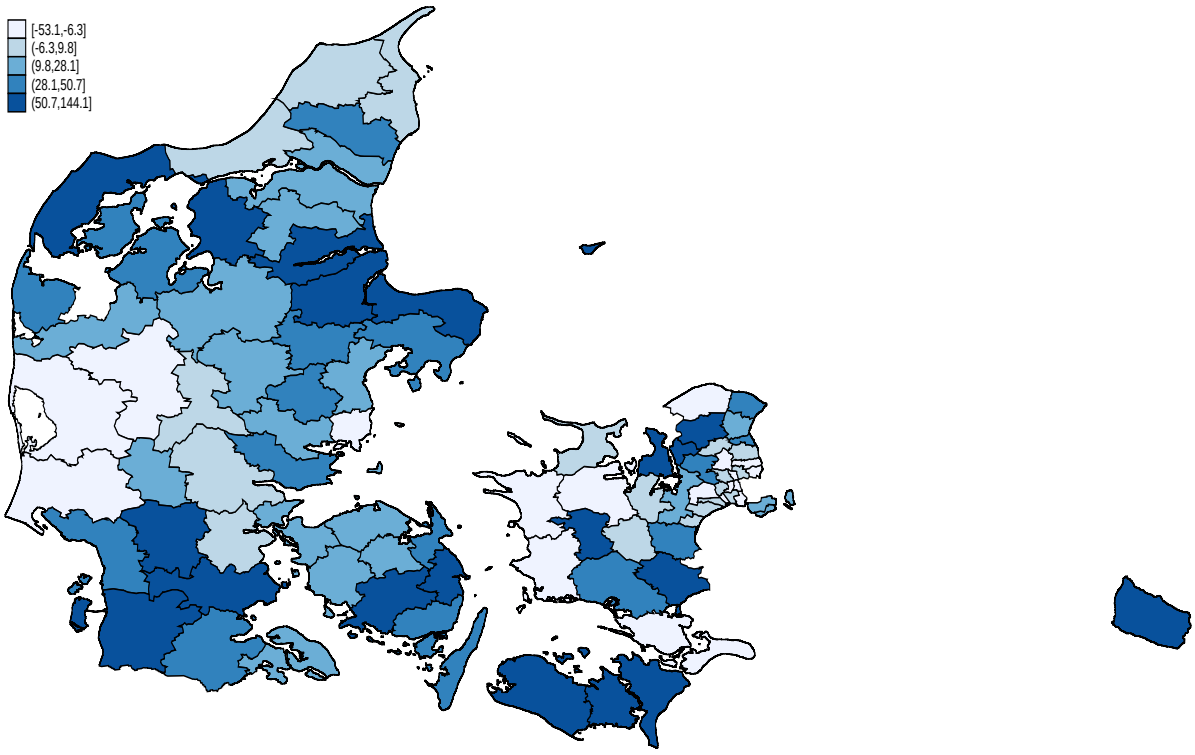
Figure 5: Immigration and Offshoring Time-Series Variation

Notes: Share of non-EU migrant workers calculated using the Danish Integrated Database for Labor Market Research and share of firms that offshore (narrow definition) calculated using data from the Danish Foreign Trade Statistics Register.

Our key independent variable is the share of non-EU immigrant workers in the municipality, which over our sample represents slightly more than 3 percent of the workforce. However, this masks substantial variation over time and across municipalities. For instance, the non-EU immigrant share ranges from about 1 percent in 1994 to over 4 percent in 2011 and from 0.005 percent in the municipality of Morsø to 12.35 percent in the municipality of Ishø. Both this time-series variation (seen in Figure 1) and the geographic variation (seen in Figure 3) in immigration will be useful for our empirical analysis.

Given the detailed employer-employee data set we are also able to account for many relevant workforce and firm characteristics. Specifically, we account for the average gender, age, education, tenure, and work experience of employees at the firm. As reported in Table 2, workers are 72 percent male (men are more heavily concentrated in the private sector) and are on average 39.5 years old with 11.8 years of education and 13.5 years of experience, which includes 5.6 years at their current firm. We also account for a variety of firm characteristics, such as productivity, size, capital intensity, multi-establishment status, and foreign ownership status. We see in Table 2 that 10 percent of firms

Figure 6: Percent Change (1995 to 2011) in the Share of Firms that Offshore by Municipality

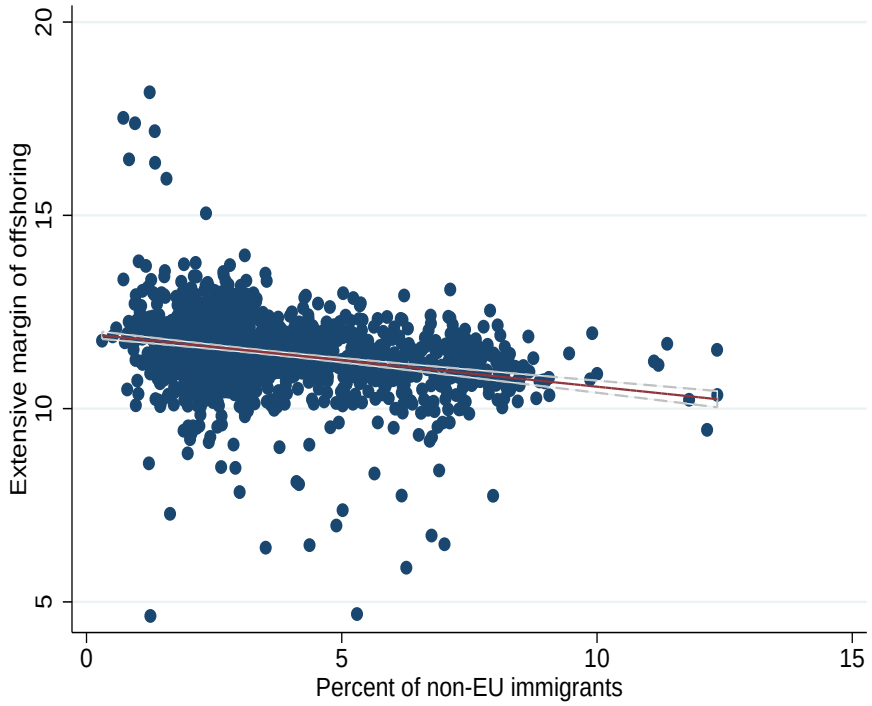


Notes: Share of firms that offshore (narrow definition) calculated using data from the Danish Foreign Trade Statistics Register.

have more than fifty employees, 9 percent are multi-establishment firms, and 0.3 percent are foreign owned.

To provide preliminary insight into the main relationship of interest, we plot the share of non-EU immigrants against offshoring at the extensive (Figure 7) and intensive (Figure 8) margins within the municipality. In both scatter plots, a statistically significant negative relationship is evident. Consistent with the predictions from the labor supply effect, an increase in the share of non-EU immigrants is associated with a decline in both the likelihood that a firm offshores and the volume of firm offshoring within that municipality. It is encouraging that significant negative relationships emerge in such raw cuts of the data. We now examine whether this relationship holds in a more rigorous empirical specification.

Figure 7: Extensive Margin of Offshoring and Share of Non-EU Immigrants



Notes: Share of firms that offshore (narrow definition) in a given municipality and year is reported on the vertical axis. Share of non-EU migrant workers in a given municipality and year is reported on the horizontal axis.

3 Empirical Strategy

This sections outlines our estimation approach and identification strategy used to test for the labor supply effect. Later in section 5 we will discuss how this specification is altered in order to test for the bilateral network effect.

3.1 Specification

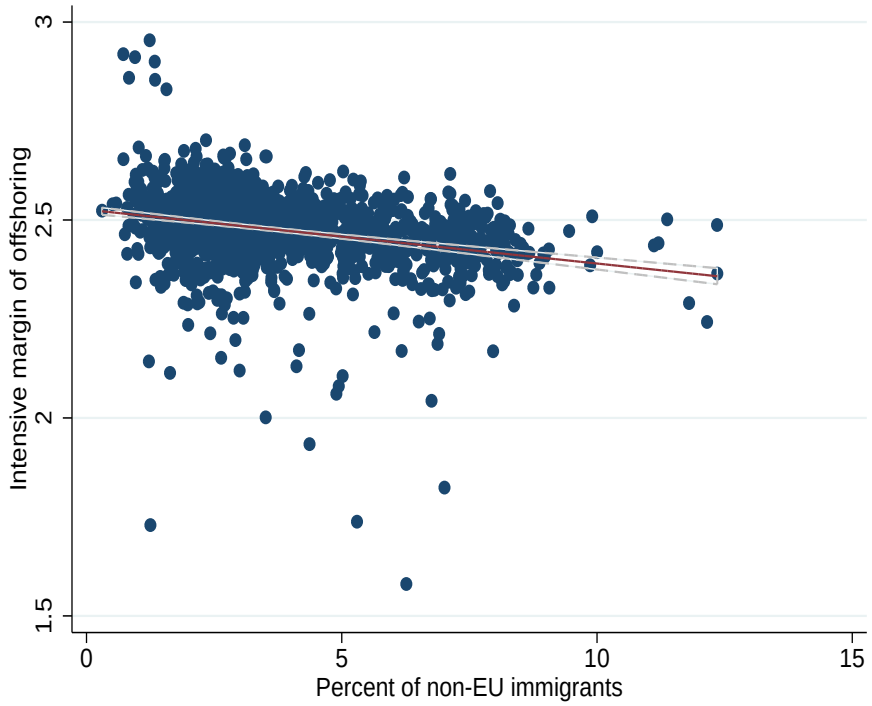
Our estimation strategy examines how a firm's offshoring decisions respond to the share of immigrants within the municipality. Specifically, we estimate the following equation:

$$Off_{ijmt} = \beta_0 + \beta_1 Img_{mt-1}^{non-EU} + X'_{ijmt-1}\delta_1 + W'_{ijmt-1}\delta_2 + \gamma_i + \gamma_j + \gamma_m + \gamma_t + \epsilon_{ijmt} \quad (1)$$

where the dependent variable, Off_{ijmt}, is offshoring at firm i, in industry j, located in municipality m, and in year t. Our analysis initially focuses on narrow offshoring at both the extensive and intensive margin, but also uses other measures of offshoring in section 6.3.

Our main independent variable, Img_{mt-1}^{non-EU}, is the non-EU immigrant share of the workforce in municipality m and year $t-1$. Immigration and the other independent variables are lagged to account

Figure 8: Intensive Margin of Offshoring and Share of Non-EU Immigrants



Notes: Log of offshoring (narrow definition) from a given municipality and year is reported on the vertical axis. Share of non-EU migrant workers in a given municipality and year is reported on the horizontal axis.

for the fact that companies cannot immediately adjust offshoring decisions in response to changing economic conditions.[23] According to the labor supply effect, an influx of foreign workers will reduce the need for firms to relocate jobs abroad ($\beta_1 < 0$).[24]

The vector X_{ijmt-1} includes a set of firm characteristics that could influence offshoring decisions. Specifically, we include firm-level productivity, capital intensity, and foreign ownership, as well as firm size dummies and a multi-establishment dummy.[25] We anticipate that offshoring will increase with productivity, capital intensity, size, and foreign ownership.

The vector W_{ijmt-1} includes detailed workforce characteristics, such as average education, age, tenure, work experience, and gender. Since some of these factors could be correlated with immigration itself, we report findings with and without these additional demographic characteristics. Finally, we incorporate a comprehensive set of fixed effects including firm fixed effects (γ_i), industry fixed effects

[23] Our results are similar using longer lag structures or assuming a non-linear impact of immigration on offshoring (results available upon request).

[24] Native outflow could also increase the immigrant share. However, this would reduce the labor supply within the municipality, which should encourage offshoring and thus work against our findings. To the extent that natives leave in *response* to immigration, then the local labor supply will not change, offshoring decisions will be unaffected, and our results will be attenuated.

[25] The inclusion of productivity in our estimating equation controls for the potential "productivity effect" associated with immigration (Ottaviano et al., 2018) and allows us to focus more carefully on the labor supply and network effects.

(γ_j), municipality fixed effects (γ_m), and year fixed effects (γ_t).[26] Finally, the standard errors are clustered at the municipality level.

3.2 Identification

Unobserved municipality-specific shocks could be correlated with both immigration and offshoring. For instance, municipalities that are becoming more cosmopolitan and global may experience an influx of immigrants and be more likely to offshore production activities abroad. This most obvious source of endogeneity will, if anything, introduce a spurious positive bias in our immigration coefficient which will attenuate our negative findings. Nonetheless, we pursue an instrumental variable approach that identifies the causal effect of immigration on firm-level offshoring by isolating plausibly exogenous variation in immigration.

As discussed, three historical features of Danish immigration during this period inform our instrumental variable approach. First, the majority of new Danish immigrants came from non-EU countries where conflict, instability, or policy changes (i.e. EU membership) led them to migrate. Importantly, it was not features of the Danish economy that caused these new immigrant inflows. Second, once in Denmark, the Spatial Dispersal Policy (Damm, 2009; Damm and Dustmann, 2014) randomly assigned many non-EU refugees to Danish municipalities. Thus, these new immigrants were not choosing a municipality based on local economic conditions. Third, through official family reunification policies and informal networks, subsequent waves of immigrants often settled in municipalities where family and friends from the same source country were initially randomly located (Foged and Peri (2016)).

Our instrumental variable approach exploits these features of this quasi-natural experiment. The instrument takes advantage of the fact that foreign shocks led to an exogenous increase in the number of non-EU immigrants arriving in Denmark in each year. The instrument then allocates these immigrants to municipalities where previous immigrants from the same country lived in 1990, when immigrant location decisions were often determined by the Spatial Dispersal Policy.[27] More specifically, the predicted non-EU immigrant share is calculated as follows:

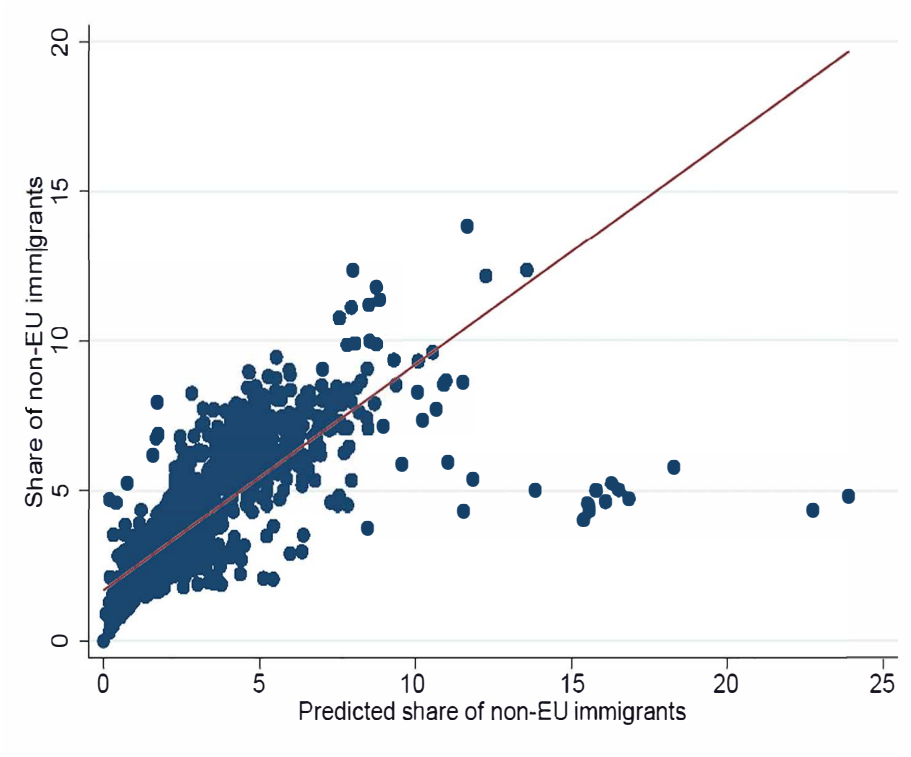
$$ImgIV_{mt}^{non-EU} = \sum\nolimits_d \frac{F_{dt} * (F_{md90}/F_{d90})}{P_{m90}} \tag{2}$$

where F_{dt} is the national stock of immigrants from a non-EU country d in year t. These immigrants are allocated to municipalities based on the share of migrants from the same country d in year 1990 (i.e., F_{md90}/F_{d90}). The instrument is exploiting the exogenous shock to aggregate immigrant inflows, variation in the initial random dispersion of immigrants in 1990, and the subsequent tendencies for new migrants to locate in migrant enclaves. By construction, the instrument is not a function of changing local economic conditions. This product is then normalized by total employment in the municipality in 1990 (P_{m90}) and summed across all foreign countries d to generate predicted immigration at the

[26] Since we exclude firms that relocate domestically, many of the results are identical if just firm fixed effects are included rather than firm fixed effects and municipality fixed effects.

[27] Of course the dispersal policy did not apply to all non-EU immigrants, however immigrant location decisions that were determined by this program are even more exogenous than is typically assumed by common 'shift share' instrument.

Figure 9: Immigration and the Immigration Instrument



Notes: The share of non-EU migrant workers in a given municipality and year is reported on the vertical axis. The predicted share (IV) of non-EU migrant workers in a given municipality and year is reported on the horizontal axis.

municipality-year level.[28]

Figure 9 plots the share of non-EU immigrants within a municipality against the immigration instrument. A significant positive relationship is evident which verifies that our instrument is a strong predictor of immigration within a municipality. This provides preliminary visual confirmation of the standard first-stage IV results reported later.

The threats to this common 'shift share' instrumental variable approach are less relevant in the Danish context. First, typically there are concerns that the national stock of immigrants from country d, F_{dt}, could be driven by domestic conditions that are endogenous. However, in Denmark, as discussed, the large inflow of non-EU immigrants during this period was largely driven by instability and policy changes in $foreign$ countries.

Second, it is possible that the initial distribution of immigrants across municipalities in the pre-sample year could have been driven by endogenous economic conditions that then persisted over time. While this seems unlikely in the Danish context due to the random Spatial Dispersal Policy, we nonetheless test for this potential violation of our exclusion restriction in Table 3. We find that long-run changes in our immigration instrument are uncorrelated with pre-sample trends in offshoring

[28]See Foged and Peri (2016) for additional details and the benefits of using this common approach in the Danish setting.

within a municipality. In particular, the change in the instrument from 1995 to 2011 is unrelated to the pre-1995 trend in the extensive margin of offshoring (column 1) or the pre-1995 trend in the intensive margin of offshoring (column 2). Consistent with the stated goals of the Spatial Dispersal Policy, we find no evidence that the geographic distribution of predicted immigration was driven by pre-sample trends in economic conditions within a municipality.

We do find, however, that changes in our instrumental variable are correlated with changes in the share of non-EU immigration in column 3. Specifically, long-run changes in the instrument have a statistically significant positive impact on long-run changes in the share of non-EU immigration within the municipality. This provides additional evidence that the instrument is successful at predicting actual immigration inflows. As a placebo test, column 4 confirms that long-run changes in our $non-EU$ immigrant instrument are orthogonal to long-run changes in the share of EU immigration. Not surprisingly, predicted immigration from non-EU countries is a poor indicator of actual immigration from EU countries.

The final two columns of Table 3 pursue a reduced form specification, which examines the relationship between the immigration instrument and the extensive and intensive margins of offshoring. These findings show that exogenous long-run changes in predicted immigration has a significant negative impact on long-run changes in the extensive (column 5) and intensive (column 6) margins of offshoring. This provides preliminary evidence of the labor supply effect which will be tested more formally in the next section.

Overall the results in Table 3 support the validity of our exclusion restriction, they verify that the instrument is a good predictor of non-EU immigration but not of EU immigration, and they provide preliminary evidence that immigration does influence offshoring decisions. The unique features of the Danish immigration experience provides an appealing quasi-natural experiment and makes this relatively common instrumental variable approach even more compelling.

4 Aggregate Labor Supply Results

This section discusses our results that test for the labor supply effect. First, we examine whether an influx of immigrants decreases the likelihood that firms begin to offshore jobs abroad (i.e. the extensive margin). Then we focus on whether immigration decreases offshoring volumes, conditional on the firm offshoring at all (i.e. the intensive margin). A subsequent subsection then focuses on whether immigration has a heterogeneous impact on offshoring across different types of Danish industries.

4.1 Extensive Margin

We begin by estimating the impact of non-EU immigration on the extensive margin of offshoring, after controlling for industry, municipality, and year fixed effects. Even in this relatively basic specification reported in column 1 of Table 4, we see that an increase in the share of non-EU immigration within a municipality leads to a significant decrease in the probability that a firm within that municipality

will offshore. The immigration coefficient of -0.303 implies that a one standard deviation increase immigration leads to a subsequent decrease in the probability that a firm will offshore by 4.7 percent.[29] This implied effect is reported in brackets beneath the standard error, which for ease of interpretation we list in all of our subsequent specifications.

Before proceeding with even more sophisticated linear probability models, we first quickly verify that similar results are obtained using an alternate probit specification.[30] Column 2 reports the estimated marginal effect from this probit specification. Reassuringly, we see that the immigration coefficients in the linear probability model (column 1) and the probit model (column 2) are both negative, significant, and similar in magnitude (4.7 percent versus 3.2 percent). With our results confirmed using this alternate probit specification, we now return to our preferred linear probability specification.

Columns 3-5 of Table 4 sequentially add firm fixed effects, additional firm-level characteristics (including productivity, capital intensity, foreign ownership, size, and multi-establishment), and then finally workforce composition characteristics (including gender, education, age, tenure, and experience) to the estimation equation. The key immigration coefficient of interest in columns 3-5 remains similar after controlling for these numerous firm and the workforce characteristics. Specifically, the immigration point estimates fall within the narrow range of -0.334 to -0.349 and are precisely estimated. The immigration coefficient of -0.349 in the most rigorous specification in column 5 implies that a one standard deviation increase in immigration leads to a 5.4 percent decrease in the probability of offshoring (see the coefficient in brackets).

The estimated impact of the other firm-level characteristics are sensible. For instance, in columns 4 and 5 we see that more productive firms are more likely to offshore. This is consistent with abundant evidence that shows that only the most productive firms can overcome the fixed costs associated with globalization (Melitz, 2003; Helpman et al., 2004). Furthermore, by explicitly accounting for productivity in Table 4 we control for the possibility that immigration can alter firm productivity which in turn could influence offshoring decisions. Note that the estimated impact of immigration on offshoring is similar regardless of whether productivity and other firm characteristics are included (compare columns 3 and 4). We also find, not surprisingly, that offshoring is increasing with the capital intensity of the firm and the foreign ownership of the firm, as well as our firm size and multi-establishment binary variables (unreported).

In column 6, we turn to our instrumental variable approach to address endogeneity concerns. The first-stage results, which are reported in the bottom panel of column 6, show that the instrument has a significant positive impact on immigration. The first stage f-stat is above 10 indicating a relatively

[29] Multiplying the standard deviation of immigration by the estimated coefficient generates a -0.006 (=0.020*-0.303) change in offshoring. This change represents a 4.7 percent decrease in the extensive margin of offshoring relative to the mean of the dependent variables (0.13) which is reported in the bottom panel of Table 4.

[30] Following the existing literature (Damm and Dustmann, 2014; Miguel et al., 2004) we prefer the flexibility of the linear probability model, especially since our analysis includes a large number of fixed effects (over 20,000 firm fixed effects) and instruments for immigration, both of which are more challenging in a probit specification. The linear probability model is unbiased and consistent as long as few of the predicted probabilities lie outside the unit interval (Horrace and Oaxaca, 2006). Moreover, Angrist and Pischke (2010) deem the linear probability model as a preferable approach especially when the nature of the non-linear model is unknown.

strong first stage which is consistent with the results in Figure 9 and Table 3. Variation in immigration driven by foreign 'push factors', the Spatial Dispersal Policy, and the enclave hypothesis are strong predictors of actual immigration within Denmark. The second-stage results again show that immigration significantly reduces the likelihood of offshoring, but they now carry a causal interpretation. Specifically, a one standard deviation in immigration leads to a subsequent 12.7 percent decline in the probability that a firm within that municipality will offshore. This is a sizable effect which is comparable in magnitude to the impact of a one standard deviation increase in firm productivity which leads to a 9.8 percent increase in offshoring.[31] Thus, we find that immigration is actually one of the most important determinants of offshoring.[32]

The immigration coefficient in the IV specification in column 6 is larger in magnitude than the analogous OLS coefficient reported in column 5. This is consistent with the most obvious source of endogeneity, which predicts that as some municipalities become more global they will attract more migrant workers and local firms will be more likely to offshore. As a result there is a spurious positive bias in the OLS coefficient reported in column 5. Our instrumental variable approach addresses this issue and thus in column 6 the causal impact of immigration on offshoring is more negative. Overall, Table 4 confirms that the labor supply effect is important by showing that immigration has a significant negative impact on the extensive margin of offshoring.

4.2 Intensive Margin

We also examine the impact of immigration on the intensive margin of offshoring. Table 5 uses as the dependent variable the logarithm of offshoring volumes, conditional on the firm offshoring at all. In column 1 we find that an increase in the share of non-EU immigrants in a municipality significantly reduces the volume of offshoring, after accounting for only industry, municipality, and year fixed effects. Columns 2-4 then sequentially include firm fixed effects, firm characteristics, and workforce characteristics as well. In all of these specifications, the results show that immigration significantly reduces the intensive margin of offshoring. The range of point estimates in columns 2-4 is narrow (varying from -5.9 to -6.2) and they are all precisely estimated. The interpretation of this coefficient, reported in brackets, is that a one standard deviation increase in immigration leads to a 1.0 - 1.1 percent decline in the amount of firm-level offshoring within that municipality. Productivity is found to increases the intensive margin of offshoring while capital intensity and foreign ownership are insignificant.

While the numerous controls and fixed effects reduce endogeneity concerns, they do not eliminate them entirely and thus we now turn to our instrumental variable approach in Column 5. The IV results show that immigration has a significant negative impact on offshoring volumes.[33] A one standard

[31] Given the estimated coefficient on productivity (0.015), a one standard deviation increase in productivity (0.852) is associated with a 9.8 percent increase in the probability of offshoring.

[32] Section 6.2 and Table 9 show that these results are similar if other measures of immigration are used, including total immigration, refugee and new-EU immigration, non-EU low-skilled immigration, or non-EU firm-level immigration.

[33] The first-stage coefficient on the instrument is significant and positive as expected (see the bottom panel of column 5), but the first-stage F-stat on the instrument is weaker.

deviation increase in immigration decreases the intensive margin of offshoring by 2.1 percent.[34] This is a sizable effect that is consistent with the impact of productivity, which is found to increase the intensive margin of offshoring by 1.9 percent.

The immigration coefficient in the IV specification (column 5) is larger than the analogous OLS coefficient (column 4), which is again consistent with a spurious positive bias in the OLS coefficient. Once this source of endogeneity is accounted for with our instrumental variable approach, we find a more negative impact of immigration on offshoring. We also find that immigration has a stronger impact on the extensive margin of offshoring compared to the intensive margin. A one standard deviation increase in immigration increases the extensive margin of offshoring by 12.7 percent (see column 6 of Table 4) and increases the intensive margin of offshoring by 2.1 percent (see column 5 of Table 5). These findings are consistent with evidence showing that extensive margin adjustments are crucial in understanding firms' participation in global markets (Bernard et al., 2007).

Overall the results reported in Table 4 and 5 provide compelling evidence that immigration and offshoring are indeed substitutes. An exogenous influx of immigrants reduces both the likelihood that firms will begin to offshore production activities abroad (Table 4) and the volume of offshoring, conditional on the firm already offshoring (Table 5). These findings confirm the labor supply effect, by showing that firms located in municipalities that experience an exogenous influx of foreign workers have less need to relocate domestic production activities abroad. In a fundamental sense, the foreign workers are migrating to the firms rather than the jobs being relocated abroad.

4.3 Industry Specific Results

Our analysis includes firms in all private-sector industries to capture as broad a segment of the Danish economy as possible, which we view as an important contribution relative to existing studies which often focus on either manufacturing or service industries. In this section, we examine whether the observed relationship between immigration and offshoring differs systematically across various sectors of the economy.

First, we examine whether immigration differentially affects offshoring in service and manufacturing industries (see Hummels et al. (2014) for a discussion of how offshoring could vary across these sectors).[35] While the industry fixed effects in our main analysis should account for time-invariant differences across industries, Table 6 goes further by separately reporting results for manufacturing and service industries. Exogenous immigrant inflows lead to a significant decrease in the likelihood

[34] Multiplying the standard deviation of immigration (0.02) by the estimated coefficient (-12.064) generates an effect of -0.241. This represents a 2.1 percent decrease in the intensive margin of offshoring relative to the mean of the dependent variable (11.409) which is reported at the bottom of Table 5.

[35] Another interesting issue is that former manufacturing firms may offshore most or all of their production activities and thus be classified as a service firm. These "factoryless goods producing" firms (FGPFs) are companies that no longer control production and assembly in-house but are still involved in design, R&D, engineering, supervision of third-party production, branding, marketing and distribution (Bernard and Fort, 2015). Firms switching from manufacturing to service industries is important in explaining the decline in Danish manufacturing employment (Bernard et al., 2017b). This type of extreme offshoring is not necessarily problematic for our analysis but it does provide an additional incentive to separately examine the impact of immigration on offshoring at manufacturing firms and at service/FGP firms.

that both manufacturing firms (column 1) and service firms (column 2) will offshore.[36] While the immigration coefficients differ (-1.117 in columns 1 and -0.647 in column 2), the implied magnitude of this effect is comparable across the two sectors given the different means of the dependent variables. As seen in brackets, a one standard deviation increase in immigration reduces the probability of offshoring by 12.8 percent for manufacturing firms and by 13.5 percent for service firms.

Second, we examine whether the offshoring decisions at firms in labor intensive industries are more sensitive to an exogenous influx of foreign workers. We suspect that the offshoring decisions of firms that rely on capital intensive production methods will be less responsive to an immigrant-induced labor supply shock. Thus in columns 3 and 4 we split industries according to their labor intensity, as an additional check on the plausibility of our results.[37] Although the immigration coefficient is similar in both columns, the implied magnitude of this effect is quite different. As seen in brackets, a one standard deviation increase in immigration reduces the probability of offshoring by 38.1 percent for firms in labor intensive industries but by only 8.1 percent for firms in capital intensive industries. This confirms that the offshoring decisions of firms in labor-intensive industries are more sensitive to an influx of foreign workers.

Third, the feasibility of offshoring likely differs across industries as well. Offshoring is easier in industries that are more codifiable and routine like Motor Vehicles and Machinery and Equipment than in industries that require more face-to-face contact like Health Care and Accommodation and Food Services (Levy and Murnane, 2006; Becker et al., 2013). While similar in spirit to our previous analysis, rather than focusing on the labor to capital distinction, here we focus on the types of tasks that workers do and how susceptible these tasks are to offshoring. Thus, in columns 5 and 6 we explore whether offshoring is more responsive to immigration in some high-offshoring sectors than in others.[38] The results indicate that a standard deviation increase in immigration leads to a 13.5 percent increase in offshoring in sectors where offshoring is more feasible but only a 5.5 percent increase in other low-offshoring sectors.

Overall, Table 6 shows that the impact of immigration on offshoring varies in sensible ways across different sectors. We find that immigration has a similar impact on offshoring in manufacturing and service industries, which is consistent with the fact offshoring is possible in both manufacturing and service industries (Blinder, 2006). However, we also find that immigration disproportionately effects offshoring in labor intensive industries and in industries where offshoring is more feasible. The fact that our results are strongest in the anticipated places is reassuring.

[36] In Table 6 (and in subsequent tables) we focus on our preferred IV results and use the extensive margin of offshoring (narrow definition) as the dependent variable. Other specifications generate similar results.

[37] Labor (capital) intensive industries are those with an average capital intensity below (above) the mean in 2003 (i.e. the midpoint of our sample). The results are robust to other definitions of labor and capital intensive industries.

[38] High offshoring industries are those with average offshoring volumes that are above the mean in 2003 (i.e. the midpoint of our sample). The results are robust to other definitions.

5 Bilateral Network Results

We are interested in whether immigration also generates a network effect which should increase offshoring to the immigrant's country of origin. Although we find that immigration and offshoring are substitutes at the multilateral level, they may be complements at the bilateral level. Immigrants often have connections and knowledge of the business environment in the foreign country that could prove useful for Danish companies. The firm may draw this expertise and these networks in order to help facilitate offshoring to the immigrant's country of origin.

To investigate this hypothesis we first present descriptive evidence showing the origin countries of Danish immigrants and the destination countries of Danish offshoring. Specifically, the top panel of Figure 10 shows the non-EU countries with the largest percent increase in immigration from 1995 to 2011. As we saw in Figure 2 there are large influxes of immigrants from countries experiencing conflict and instability (such as Afghanistan, Somalia, and Iraq) and from new-EU countries (like Bulgaria, Romania, and Poland). We then compare these high-immigrant countries to those countries with the largest percent increase in offshoring from 1995 to 2011. The bottom panel of Figure 10 shows the important destinations of Danish offshoring over this period, which includes countries like Romania and Bulgaria.

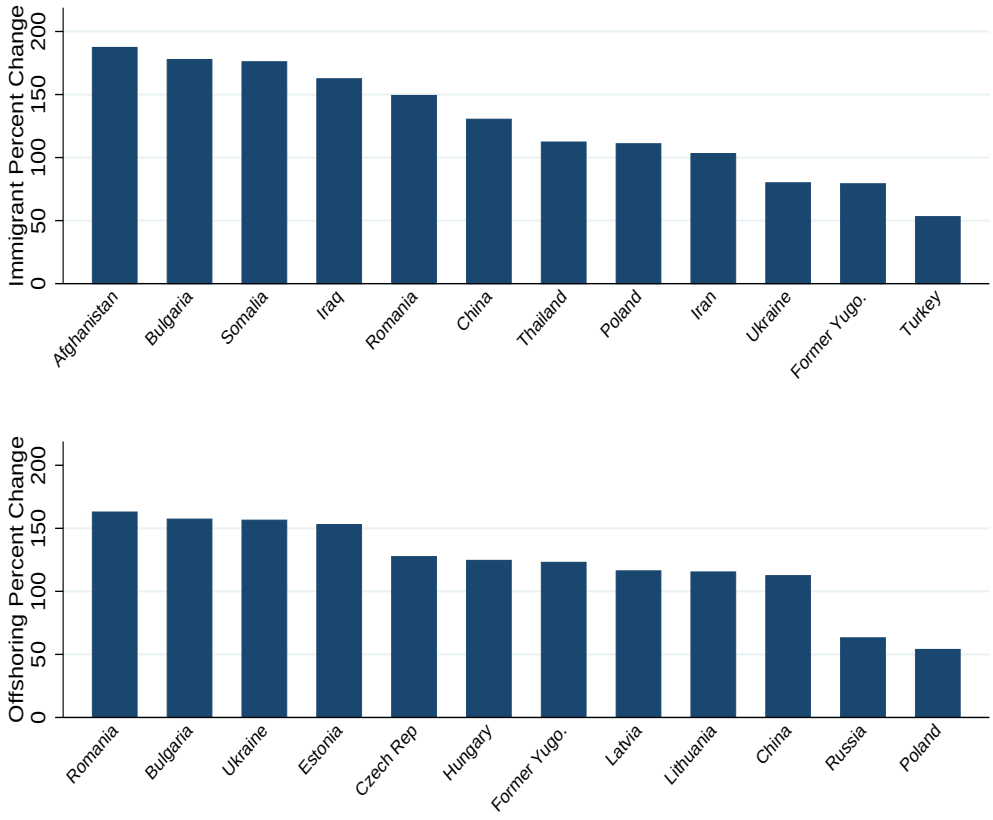
Many top immigrant source countries are also important destination countries of offshoring, which suggests that there may be a bilateral relationship between these two global forces. For instance, six countries (i.e. Romania, Bulgaria, Ukraine, former Yugoslavia, China, and Poland) are both top immigration and top offshoring countries. To explore this relationship more carefully, Figure 11 plots bilateral offshoring against bilateral immigration after accounting for foreign country fixed effects and year fixed effects. A statistically significant positive relationship is evident, indicating that immigration from a particular foreign country is positively associated with offshoring to the same non-EU country. This provides preliminary evidence suggesting that immigration generates a network effect that increases offshoring to the immigrant's country of origin.

To test for the bilateral network effect more formally we adopt a similar empirical specification to the one outlined in Equation (1). However, instead of examining the impact of multilateral immigration on multilateral offshoring, we now focus on the impact of bilateral immigration on bilateral offshoring. Thus, we estimate the following equation, where offshoring and immigration now also vary at the foreign country level:

$$Off_{ijmdt}^{non-EU} = \beta_0 + \beta_1 Img_{mdt-1}^{non-EU} + X'_{ijmt-1}\delta_1 + W'_{ijmt-1}\delta_2 + \gamma_i + \gamma_j + \gamma_m + \gamma_t + \gamma_d + \epsilon_{ijmdt} \quad (3)$$

The dependent variable, Off_{ijmtd}, is now offshoring to a particular destination country d by firm i, in industry j, located in municipality m, and in year t. Img_{mdt-1}^{non-EU} represents the immigrant share of workers from country d in municipality m and in year t. Given our focus on exogenous non-EU immigration, offshoring is also restricted to non-EU countries in this bilateral specification.

Figure 10: Immigration and Offshoring at the Bilateral Level



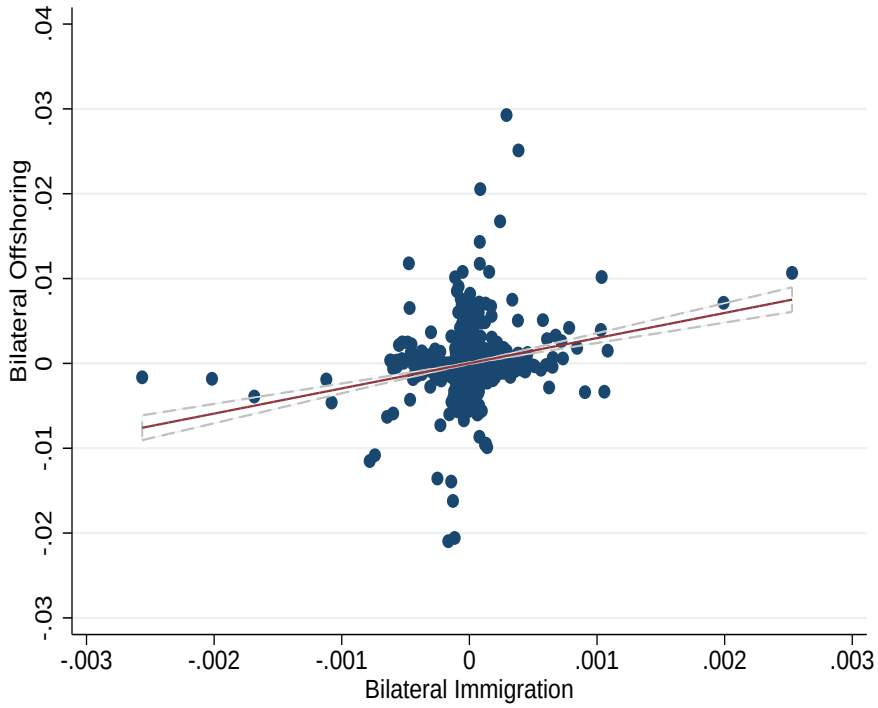
Notes: The percent change between 1995 and 2011 in the number of migrant workers is reported in the top panel by non-EU country. The percent change between 1995 and 2011 in the share of offshoring firms is reported in the bottom panel by non-EU country.

Destination country fixed effects (γ_d) are now included in addition to the full set of firm characteristics (X_{ijmt-1}), workforce characteristics (W_{ijmt-1}), and fixed effects (γ_i, γ_j, γ_m, and γ_t) from before. The immigration instrument is constructed in the manner outlined in equation (2), except that it is now calculated at the bilateral level, and we continue to cluster our standard errors at the municipality level.[39]

Equation (3) is well-suited to test for the bilateral network effect. For instance, this specification examines whether Polish immigrants within a municipality lead to a subsequent increase in the likelihood that local Danish firms offshore to Poland. However, in this bilateral specification the labor supply effect identified previously will be weaker since immigration from any one foreign country is unlikely to increase the local labor supply enough to influence offshoring decisions. In contrast, in equation (1) the labor supply effect is strong since multilateral immigration can have an important impact on local labor supply but the potential network effects are diluted. For instance, immigrants

[39]The instrument is the same as before expect that we do not sum across foreign countries (d) as we did in equation (2)

Figure 11: Immigration and Offshoring at the Bilateral Level (Controlling for FE)



Notes: Bilateral offshoring is plotted against bilateral immigration after accounting for foreign country fixed effects and year fixed effects. Offshoring is measured as the share of Danish firms that offshore to a particular foreign country and immigration is measured as the share of migrant workers within Denmark from the same non-EU country.

from any one country (i.e. Poland) are unlikely to have networks that prove useful in offshoring to other foreign countries (i.e. China). Pursuing both multilateral and bilateral empirical strategies allows us to disentangle the labor supply and network effects, which provides a more complete picture of how immigration impacts offshoring.

Results from estimating equation (3) are reported in Table 7.[40] The bottom panel of column 1 indicates that our instrumental variable remains a strong predictor of actual immigration at the bilateral level (the first-stage f-stat is above 20). The second-stage results, reported above, indicate that immigration from a particular foreign country significantly increases the likelihood that firms within that municipality will offshore to the same foreign country. A one standard deviation increase (0.003) in bilateral immigration increases the probability that a firm offshores to the immigrant's country of origin by 24.4 percent (see the bracketed term). This provides compelling evidence that immigration and offshoring are indeed complements at the bilateral level, as predicted by the network effect.

We are interested in the underlying cause of this positive bilateral effect. Perhaps immigrants

[40]This is a more data intensive specification with the number of observations rising to over 20 million since the unit of analysis now also varies by destination country.

possess language skills that are useful for firms that wish to offshore or maybe immigrants have networks and connections that help facilitate offshoring. We examine whether there is empirical evidence supporting either of these explanations. Specifically, we estimate whether offshoring to country X responds to immigration from countries that share the same language as country X (not including country X itself). For example, Argentinian immigrants may have Spanish language skills that help Danish firms offshore to Mexico.[41] In addition, we examine whether offshoring to country X responds to immigration from countries that are in the same geographic region as country X (not including country X itself). For example, Argentinian immigrants may have networks or knowledge of the business environment that help facilitate offshoring to Brazil.[42]

Column 2 of Table 7 reports results showing the impact of immigrant language skills and regional networks on offshoring. The findings show that bilateral offshoring is unresponsive to immigration from countries that speak the same language. However, bilateral offshoring does increase with immigration from the same geographic region. Specifically, a one standard deviation increase in immigration from other countries within the same region increases the likelihood that firms offshore to that specific country by 26.8 percent. These results suggest that the positive bilateral relationship between immigration and offshoring is more likely driven by networks and knowledge of the business environment than by linguistic advantages.[43]

Is it possible to reconcile the negative relationship between immigration and offshoring found at the multilateral level (see column 6 of Table 4) with the positive relationship found at the bilateral level (see column 1 of Table 7)? We examine this issue by including in column 3 the bilateral immigrant share from country X and the immigrant share from all other foreign countries (not including country X itself). We find that offshoring to country X is increasing with immigration from country X consistent with the network effect but it is decreasing with immigration from all other foreign countries consistent with the labor supply effect. The magnitude of the bilateral network effect is similar (21.8 percent in column 3 versus 24.4 percent in column 1) and the magnitude of the aggregate labor supply effect is also similar (7.6 percent in column 3 versus 12.7 percent in column 6 of Table 4).[44] Overall, the results in column 3 verify that at the bilateral level immigration generates a network effect which complements offshoring, while at the multilateral level immigration generates a labor supply effect that substitutes for immigration.

These results contribute to the existing literature by clarifying and reconciling some conflicting findings. Our findings are consistent with the substitutability of multilateral immigration and off-

[41] Immigrants are classified into one of 32 linguistic groups corresponding to the third level of the linguistic family tree in the Ethnologue data. We identify employees' linguistic background with the dominant language spoken in their country of origin (see Parrotta et al. (2016) for more details).

[42] Immigrants are grouped according to the World Bank geographical areas: North Africa; West Africa; Central Africa; East Africa; South Africa; Sub-saharan Africa; Caribbean; North America; Central America; South America; Central Asia; East Asia; South Asia; South-East Asia; West Asia; Eastern Europe; and Oceania.

[43] Simultaneously instrumenting for bilateral immigrant shares (from column 1) along with the linguistic and regional shares (from column 2) not surprisingly weakens the first stages. Thus, we do not attempt to instrument for all three endogenous variables at the same time.

[44] The magnitude of the labor supply effect here in Table 7 is smaller presumably because this specification only estimates the impact of multilateral immigration on offshoring to a single foreign country rather than offshoring to all foreign countries as in Table 4.

shoring found in Ottaviano et al. (2013). However, our results differ from Ottaviano et al. (2018) who find that immigration and offshoring are complements at the multilateral level but substitutes at the bilateral level. Their findings indicate, for instance, that Pakistani immigrants reduce offshoring only to Pakistan but actually increase offshoring to India and other foreign countries via a productivity effect. They explain this result by assuming that service tasks can only be carried out by either Pakistani immigrants domestically or by offshoring to Pakistan, which generates a substitution effect at the bilateral level. In contrast, we implicitly assume a more flexible production process that does not require tasks to be country-specific. Our findings support this assertion by showing, for instance, that Pakistani immigrants reduce the need for firms to offshore to other countries (due to the new supply of immigrant workers within the municipality) but increase offshoring to Pakistan (due to immigrant networks).[45]

The extensive margin results in columns 1-3 of Table 7 indicate that bilateral immigration helps domestic firms overcome the fixed costs associated with initially offshoring to the immigrant's country of origin. Immigrants' knowledge and connections are apparently useful for the firm in setting up stages of the production process abroad. However, once the Danish firm is already producing in the foreign country, we anticipate that additional immigration from this country will have little impact on the intensive margin of offshoring because the firm has already made business connections abroad. Thus, as a quasi-placebo test, we replicate our bilateral specifications but use as the dependent variable the logarithm of the volume of offshoring. The results from this exercise are reported in columns 4-6 of Table 7 and show that the intensive margin of offshoring to country X is not sensitive to immigration from country X. This verifies that once the firm has already set up production activities in a particular foreign country, additional immigration from that country has no discernible impact on offshoring. However, in column 6 immigration from all other countries does still reduce the intensive margin of bilateral offshoring and the magnitude of this effect (2.5 percent shown in brackets) is similar to our previous results (2.1 percent found in column 5 of Table 5). We find it reassuring that our results are significant in the anticipated places but insignificant along other sensible dimensions. Overall the results in Table 7 verify that immigration generates a bilateral network effect that increases the extensive margin of offshoring but has no impact on the intensive margin of offshoring.

6 Extensions

6.1 Immigration and International Trade

While our primary interest is to examine the relationship between immigration and offshoring, this section explores how immigration affects another component of globalization, namely international trade. We begin by examining the multilateral impact of immigration on exports and imports and then we focus on the bilateral relationship. We anticipate that the immigrant connections that en-

[45]The discrepancy between our findings and Ottaviano et al. (2018) may be driven by their focus on the offshoring of service tasks at a sample of firms in U.K. service industries, where they argue there is a high degree of country specificity in service tasks. In contrast, we focus on the offshoring of production tasks at the universe of firms across all industries.

couraged offshoring may also increase bilateral imports and exports, which will be a useful check of our network effect results. Furthermore, confirming in our context existing findings that show that bilateral immigration increases bilateral trade (Gould, 1994; Head and Ries, 1998; Rauch and Trindade, 2002; Peri and Requena-Silvente, 2010) will lend credibility to our new offshoring results.

In addition to it's impact on offshoring, multilateral immigration may also increase consumption and thus imports, simply due to the larger population in the municipality. This will lead to an increase in a broad range of imported goods, and not just those specific products that happen to be produced by firms within the municipality, which is the focus of our offshoring measure. The negative offshoring effect coupled with this potentially positive consumption-based impact, means that the impact of immigration on total imports is ambiguous. It is also possible that multilateral immigration generates a 'productivity effect' which can increase exports from a particular municipality (Ottaviano et al., 2018). However, since we control for firm productivity we expect that immigration will have a minimal impact on total exports.

To test these predictions, we examine whether an exogenous influx of immigrants leads to an increase in total imports into a municipality or total exports from a municipality. In column 1 of Table 8, we find that an exogenous increase in immigration has no significant impact on imports. Given that imports decrease due to a decline in offshoring but they can rise with an immigrant-induced increase in population, this insignificant result is not surprising. More importantly this result indicates that our import-based measure of offshoring does indeed reflect offshoring decisions and is not simply capturing a more general relationship between immigration and total imports.[46] Column 2 of Table 8 shows that an exogenous influx of immigrants into a municipality does not influence total exports either. We conclude that there is little evidence that immigration influences multilateral imports or exports within municipalities in Denmark.

As we did with offshoring, we now focus on the impact of bilateral immigration on imports and exports to the immigrant's country of origin. We suspect that the knowledge and connections that help domestic firms offshore to the immigrant's country of origin (see Table 7) may also help facilitate trade with this foreign country as well. Furthermore, immigrants often prefer familiar goods that they grew up consuming, which may also increase imports from the immigrant's country of origin (Atkin, 2016).

We test these predictions by examining how municipality-level trade with country X is effected by an increase in immigration from country X or an increase in immigration from all other countries (excluding country X). Consistent with our network effect hypothesis, column 3 of Table 8 shows that an exogenous influx of immigrants from country X increases municipality imports from country X. Specifically, a one standard deviation increase immigration from country X leads to a 16.6 percent increase in the volume of imports from the same country. We also find in column 3 that immigration from other countries has no bearing on imports from country X, which is consistent with the findings in column 1. The results in column 3 confirm that while the network effect increases imports from the

[46] To the extent that our offshoring measure does inadvertently capture broader consumption-based increases in imports, this will attenuate our negative results in Tables 3 and 4

immigrant's country of origin it does not influence imports from other foreign countries.

In column 4 of Table 8 we find that the network effect also increases exports to the immigrant's country of origin. Specifically, a one standard deviation increase in the share of immigrants from country X increases exports to the same country by 13.7 percent. However, we find that immigrants from other countries have no bearing on exports to country X which is consistent with the findings in column 2. This indicates that immigrant's knowledge and connections are useful in facilitating trade with their country of origin but not with other foreign countries. This former result confirms evidence on the bilateral relationship between immigration and trade found in a variety of other settings (Gould, 1994; Head and Ries, 1998; Rauch and Trindade, 2002; Peri and Requena-Silvente, 2010) and it makes our new offshoring results even more compelling.[47]

Overall, Table 8 provides insight into the relationship between immigration and international trade at both the multilateral and bilateral level. We find little evidence that immigration influences multilateral imports or exports. However, bilateral immigration does increase imports and exports to the immigrant's country of origin, which confirms that the network effect not only leads to more offshoring (Table 7) but also increases trade (Table 8). We are encouraged that the results in Table 8 are sensible and consistent with existing findings.

6.2 Immigration Measures

Given exogenous 'push factors' in many non-EU countries and the Spatial Dispersal Policy which exclusively effected non-EU refugees, our analysis focuses on the non-EU immigrant population (see section 2.2). This section examines whether our results hold using narrower or broader groups of Danish immigrants. Specifically, column 1 of Table 9 uses as the independent variable the share of all foreign workers in the municipality, including both EU and non-EU immigrants. We construct an analogous instrument using predicted immigration from all foreign countries. This represents a more comprehensive measure of immigration within a Danish municipality but sacrifices the exogenous features of non-EU immigration. Nonetheless, the first-stage and second-stage IV results in column 1, are similar to the non-EU results re-reported in column 2 for comparison purposes. Specifically, offshoring increases by 14.8 percent in response to a one standard deviation increase in total immigration and by 12.7 percent in response to a one standard deviation increase in non-EU immigration (see the bracketed coefficients in columns 1 and 2). The similarity of these results is consistent with the fact that non-EU immigration is the driving force behind changes in total immigration over this period, as shown in Figure 1.

The remaining specifications in columns 3-5 of Table 9 focus on narrower definitions of immigration. In column 3, we focus on migrants from either refugee countries or new European Union member countries.[48] This more carefully identifies foreign workers that migrated to Denmark due to exoge-

[47] While most studies find that immigration increases both bilateral imports and exports, Ottaviano et al. (2018) find that immigrant networks increase bilateral exports but not bilateral imports in U.K. service industries.

[48] Our refugee countries include Afghanistan, Somalia, Iraq, Iran, Vietnam, Sri Lanka, Lebanon, and the former Yugoslavia (following Foged and Peri (2016)) and the new-EU countries include Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic, Slovenia, Cyprus, and Malta who joined the EU in 2004 and Bulgaria,

nous foreign shocks and that were allocated to municipalities based on the Spatial Dispersal Policy. However, it narrows the set of immigrants within a municipality that can potentially influence a firm's offshoring decision. The results in column 3 show that immigration, defined in this way, still has a significant negative impact on offshoring which is similar in magnitude to the results reported in column 2 (12.2 percent versus 12.7 percent). Similar findings are also obtained if the non-EU immigrant share is instrumented with the refugee and new-EU immigrant IV.[49]

We also examine how Danish firms respond to lower-skilled immigration in particular.[50] Since offshoring often entails the relocation of routine, blue-collar tasks abroad (Hummels et al., 2014; Ebenstein et al., 2014; Becker et al., 2013), the offshoring decisions of Danish firms may be more sensitive to an influx of lower-skilled foreign immigrants. The results in column 4 confirm that an exogenous influx of lower-skilled non-EU immigrants significantly reduces the likelihood that Danish firms within that municipality will offshore. As expected, the magnitude of this effect (17.6 percent in column 4) is slightly larger than findings using all non-EU immigrants (12.7 percent in column 2).

Finally, column 5 focuses on the share of non-EU immigrants within the firm rather than within the municipality. The instrument, however, still measures exogenous changes in non-EU immigration at the municipality level. Using firm-level immigrant shares is more specific but the downside is that firm hiring decisions are endogenous. In addition, immigration may influence offshoring decisions without necessarily increasing the immigrant share at all firms, since some firms in equilibrium may hire more natives. The weaker first-stage results in column 5, suggests that this latter concern may be empirically relevant. However, the second-stage results indicate that an increase in immigrant workers within the firm significant reduces firm-level offshoring. Overall, these findings show that exogenous immigration shocks within a municipality influence firm-level immigrant shares within that municipality, which in turn reduce the likelihood that firms offshore production activities abroad. Ultimately, the results in Table 9 demonstrate that our findings are robust to a variety of alternate definitions of immigration.

6.3 Offshoring Measures

We are encouraged by the fact that our offshoring measure is consistent with a totally different survey-based measure of offshoring (see Figure 4 and Bernard et al. (2017a)) and that it does not appear to be picking up broader effects of immigration on imports more generally (see section 6.1). As a further check, this section examines the extent to which our results are robust to alternate offshoring measures. We begin by utilizing a "broad offshoring" measure which, as discussed in section 2.3, is defined using firm imports in all product categories not just those within the same HS4 code as firm production. As shown in column 1 of Table 10, using this alternate offshoring variable generates similar results. A standard deviation increase in immigration leads to a subsequent 12.3 percent decrease in the probability that a firm within that municipality will offshore.

and Romania who joined in 2007.

[49] These results are available upon request.

[50] Lower-skilled workers are defined as those with either a primary education or two years of vocational education.

Second, we construct a conceptually distinct measure of offshoring using a completely different data set administered by the National Bank of Denmark (Esperian). This data has firm-level information on outward foreign direct investment (FDI) of Danish multinationals in both manufacturing and service industries. An analogous extensive margin offshoring measure is defined as whether the Danish firm has any majority owned foreign affiliates abroad. The benefit of this measure is that it captures offshoring whose output is sold back to Denmark as well as offshoring whose output is sold in foreign markets (our main measure of offshoring does not include this latter component). However, the downside of this approach is that it misses offshoring to foreign arms-length suppliers that are outside the boundaries of the firm (which is a component of offshoring that our main approach does capture). In addition, foreign direct investment data is not available for all the firms in our sample which is a potential drawback. The second column of Table 10 reports results using this alternate FDI-based offshoring measure. Consistent with our earlier results, we find that an exogenous influx of immigrants leads to a significant decrease in the likelihood that firms within that municipality offshore. While the magnitude of this effect is smaller, it is negative and statistically significant. Overall, the fact that we arrive at qualitatively similar results using a conceptually distinct measure of offshoring provides external validity for our findings.

Columns 3 and 4 of Table 10 shift the focus to the intensive margin of offshoring. Specifically, in column 3 we use as the dependent variable the log of offshoring per employee, which scales offshoring to firm size. We see that the impact of immigration on offshoring in column 3 (an effect of 3.4 percent) remains similar to our main findings (an effect of 2.1 percent in column 5 of Table 5). This should not be surprising given our analysis already controls for firm size and productivity. Column 4 explores whether our intensive margin results, which conditions on the firm offshoring, could be influenced by firm entry or exit from the sample. To address this concern we restrict the sample of firms to those that offshore in all years. Despite the decrease in sample size, the estimated impact of immigration on the intensive margin of offshoring remains significant and similar in magnitude to our main findings (2.6 percent versus 2.1 percent). Overall, the results in Table 10 show that the impact of immigration on the extensive and intensive margins of offshoring are robust to a variety of alternate definitions of offshoring.

6.4 Additional Sensitivity Results

We are sensitive to concerns that outlier municipalities or firms may be influencing our results. For instance, as the capital and largest city in Denmark, Copenhagen is likely to be an outlier along a number of dimensions. While we already include municipality fixed effects, as an additional check of our findings, column 1 of Table 11 excludes Copenhagen (and Frederiksberg) entirely from the analysis. Reassuringly, the immigration coefficient remains negative, significant, and similar in magnitude (10.8 percent versus 12.7 percent) after Copenhagen is excluded from the sample.

In the second column of Table 11 we exclude firms with multiple establishments. Identifying the geographic location of these firms is more challenging and using the headquarter municipality as a proxy may introduce measurement error into our analysis. However, multi-establishment firms account

for only 9 percent of our sample and we do include a multi-establishment binary variable as a control in all of our specifications. As we see in column 2, the immigration point estimate remains significant and similar in sign and magnitude after dropping these multi-establishment firms from the sample. A one standard deviation increase in immigration reduces the likelihood that single-establishment firms offshore by 15.9 percent (compared to 12.7 percent for all firms).

Our main analysis excludes firms that moved from one municipality to another within Denmark. This ensures that changes in the share of non-EU immigrants captures variation over time within the same municipality and does not reflect the possibility that the firm has relocated. However, in column 3 we include these firms relocated and find similar results. If anything, the impact of immigration on offshoring is now a bit larger (18.1 percent versus 12.7 percent). Overall, a one standard deviation increase in immigration leads to a 11-18 percent increase in offshoring across the different specifications shown in Table 11. We conclude that our results are robust to different samples of municipalities and firms.

7 Conclusion

This paper examines the impact of immigration on firm-level offshoring decisions. We utilize a detailed employer-employee matched data set covering the universe of Danish firms and workers over the period 1995-2011. A number of features of Danish immigration during this period provide a unique opportunity to identify the causal impact of immigrant inflows on subsequent firm-level offshoring decisions. Our results provide new insights into the relationship between arguably the two most controversial components of globalization.

First, we find that an exogenous increase in immigration leads to a significant decrease in firm-level offshoring at both the extensive and intensive margins. Consistent with our aggregate labor supply effect, this result indicates that an influx of foreign immigrant workers reduces the need for firms to relocate production activities to foreign countries. In other words immigration and offshoring are substitutes. As expected, this relationship is stronger in industries that are more labor intensive and in industries where offshoring is more feasible.

Second, a bilateral analysis confirms that immigration increases the likelihood that firms offshore to the immigrant's country of origin. Consistent with our network effect, this result indicates that immigrants have connections in their country of origin that help the firm initially offshore to that particular foreign country. However, once the firm has already set up production activities abroad and made it's own business connections, additional immigration from that country does not increase the intensive margin of offshoring. Additional results reconcile our positive bilateral findings with our negative multilateral results, by showing that bilateral offshoring is increasing with immigration from the same country but decreasing with immigration from all other countries. Overall, we find that immigration and offshoring are complements at the bilateral level but substitutes at the multilateral level.

These findings carry important policy implications at a time when many countries are increasingly

skeptical of both immigration and offshoring. Our key finding that immigration and offshoring are substitutes, suggests that policies aimed at reducing immigration would have the unintended consequence of encouraging firms to offshore jobs abroad and visa versa. Policy makers should be cognizant of this important trade-off: either foreign workers immigrate to perform the jobs domestically or the jobs themselves are offshored to be performed by foreign workers abroad.

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Table 1: Descriptive Statistics of Natives and Immigrants

Variables	**Natives**		**Non-EU Immigrants**		**EU Immigrants**	
	Mean	*S.D.*	*Mean*	*S.D.*	*Mean*	*S.D.*
Age	39.685	11.664	37.566	11.133	43.616	10.755
Skill0 (1, if with Primary Education)	0.265	0.441	0.303	0.450	0.137	0.344
Skill1 (1, if with Secondary Education)	0.607	0.448	0.578	0.500	0.607	0.488
Skill2 (1, if with Tertiary Education)	0.127	0.333	0.122	0.389	0.254	0.435
Manager and middle manager	0.299	0.453	0.201	0.400	0.342	0.474
Blue collar	0.710	0.453	0.799	0.400	0.657	0.474
N	15,581,790		443,951		257,860	

Notes: All descriptive statistics are calculated as averages over the period 1995-2011 for employed individuals.

Table 2: Descriptive Statistics

Variables	Definition	Mean	S.D.
Offshoring variables			
Extensive margin of offshoring (narrow)	1, if the firm offshores (narrow definition)	0.130	0.316
Intensive margin of offshoring (narrow)	log of offshoring volumes, conditional on offshoring (narrow definition)	11.409	3.298
Extensive margin of offshoring (broad)	1, if the firm offshores (broad definition)	0.264	0.426
Workforce variables			
Non-EU Immigrant Share	share of employees from non-EU countries (municipality level)	0.031	0.020
Male	male employees as a proportion of all employees	0.715	0.294
Age	average employees' age	39.536	7.144
Years of Education	average employees' years of education	11.847	1.869
Tenure	average employees' tenure	5.565	3.924
Work Experience	average employees' work experience	13.523	4.842
Firm variables			
Labor Productivity	log of sales per employee	14.387	0.852
Size1	1, if the number of employees is smaller than 50	0.895	0.360
Size2	1, if the number of employees is between 50 and 100	0.063	0.254
Size3	1, if the number of employees is langer than 100	0.042	0.185
Capital Intensity	log of capital stock per employee	12.465	1.322
Multi-establishment	1, if the firm is a multi-establishment company	0.090	0.286
Foreign	1, if the firm is foreign owned	0.003	0.056
N			439,627
Number of firms			34,812

Notes: All descriptive statistics are calculated as averages over the period 1995-2011. Trade and accounting variables are in real Danish Kroner (using 2005 as the base year).

Table 3: Pre-Sample Trends and Long-Run Changes in Immigration and Offshoring

	Δ Ext. Margin Offshoring (1993-1995)	Δ Int. Margin Offshoring (1993-1995)	Δ Share of Non-EU Img (1995-2011)	Δ Share of EU Img (1995-2011)	Δ Ext. Margin Offshoring (1995-2011)	Δ Int. Margin Offshoring (1995-2011)
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Non-EU Img IV (1995-2011)	0.035	2.374	0.220**	-0.015	-0.015**	-1.511*
	(0.020)	(1.927)	(0.104)	(0.016)	(0.006)	(0.801)
N	97	97	97	97	97	97
R-sq	0.722	0.243	0.731	0.270	0.801	0.293

Notes: In columns 1 and 2 the dependent variable is the pre-sample trend (i.e. the change from 1993 to 1995) in offshoring at the municipality level. In column 3 the dependent variable is the long-run change (1995 to 2011) in the share of non-EU immigrants at the municipality level, while in column 4 it is the long-run change in the share of EU immigrants. In columns 5 and 6 the dependent variable is the long-run change in offshoring (1995 to 2011) at the municipality level. The explanatory variable in all regressions is the long-run change (1995 to 2011) in the immigration instrument. Regressions also include 1995 municipality averages of all of the other control variables (including labor productivity, the log of capital stock per employee, whether the firm is foreign-owned, a multi-establishment dummy, size dummies, share of male and foreign workers, firms average age, work experience, tenure and years of education). Regressions are weighted by the local labor force in 1995. Robust standard errors in parentheses. Significance levels: ***1%, **5%, *10%.

Table 4: Immigration and the Extensive Margin of Firm Offshoring

	Extensive Margin (Narrow Definition)					
	OLS	**Probit**	**OLS**	**OLS**	**OLS**	**IV**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Non-EU Immigrant Share$_{t-1}$	-0.303**	-0.206**	-0.342**	-0.334**	-0.349**	-0.826**
	(0.150)	(0.085)	(0.170)	(0.159)	(0.171)	(0.335)
	[-0.047**]	[-0.032**]	[-0.053**]	[-0.051**]	[-0.054**]	[-0.127**]
Labor Productivity$_{t-1}$				0.015***	0.015***	0.015***
				(0.002)	(0.002)	(0.002)
Capital Intensity$_{t-1}$				0.062**	0.062**	0.067**
				(0.028)	(0.028)	(0.028)
Foreign$_{t-1}$				0.002*	0.002*	0.001
				(0.001)	(0.001)	(0.001)
Industry, Municipality and Year Fixed Effects	yes	yes	yes	yes	yes	yes
Firm Fixed Effects	no	no	yes	yes	yes	yes
Firm Size Dummies and Multi-establishment Dummy	no	no	no	yes	yes	yes
Workforce Characteristics	no	no	no	no	yes	yes
Mean Y	0.130	0.130	0.130	0.130	0.130	0.130
First Stage: F-stat on Instrument	.	.	.	.	.	12.643
First Stage: Non-EU Img IV Coeff	.	.	.	.	.	0.179*** (0.064)
R-sq	0.254	0.375	0.003	0.005	0.006	0.005
N	439,627	439,627	439,627	439,627	439,627	439,627

Notes: The dependent variable is a binary variable equal to 1 if the firm offshores (narrow definition). The non-EU immigrant share$_{t-1}$ is the lagged share of non-EU foreign workers within the municipality. Worforce composition characteristics include the lagged share of male workers, and average years of education, age, tenure and work experience. Robust standard errors clustered at the municipality level in parentheses. The coefficients shown in brackets report the percent change in the outcome variable due to a one standard deviation increase in immigration. Significance levels: ***1%, **5%, *10%.

Table 5: Immigration and the Intensive Margin of Firm Offshoring

	Intensive Margin (Narrow Definition)				
	OLS	**OLS**	**OLS**	**OLS**	**IV**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Non-EU Immigrant Share$_{t-1}$	-7.085**	-6.235**	-5.866**	-6.249**	-12.064**
	(3.437)	(2.797)	(2.800)	(3.032)	(5.339)
	[-0.012**]	[-0.011**]	[-0.010**]	[-0.011**]	[-0.021**]
Labor Productivity$_{t-1}$			0.268***	0.259***	0.253***
			(0.040)	(0.040)	(0.040)
Capital Intensity$_{t-1}$			0.587	0.573	0.465
			(0.514)	(0.517)	(0.529)
Foreign$_{t-1}$			0.010	0.009	0.007
			(0.021)	(0.021)	(0.021)
Industry, Municipality and Year Fixed Effects	yes	yes	yes	yes	yes
Firm Fixed Effects	no	yes	yes	yes	yes
Firm Size Dummies and Multi-establishment Dummy	no	no	yes	yes	yes
Workforce Characteristics	no	no	no	yes	yes
Mean Y	11.409	11.409	11.409	11.409	11.409
First Stage: F-stat on Instrument	.	.	.	.	7.829
First Stage: Non-EU Img IV Coeff	.	.	.	.	0.186** (0.083)
R-sq	0.047	0.006	0.008	0.008	0.003
N	59,399	59,399	59,399	59,399	59,399

Notes: The dependent variable is the natural log of firm-level offshoring volumes (narrow definition) conditional on offshoring. The non-EU immigrant share$_{t-1}$ is the lagged share of non-EU foreign workers within the municipality. Worforce composition characteristics include the lagged share of male workers, and average years of education, age, tenure and work experience. Robust standard errors clustered at the municipality level in parentheses. The coefficients shown in brackets report the percent change in the outcome variable due to a one standard deviation increase in immigration. Significance levels: ***1%, **5%, *10%.

Table 6: Immigration and Firm Offshoring by Industry

	Manufacturing	**Services**	**Labor Intensive Industries**	**Capital Intensive Industries**	**High Offshoring Industries**	**Low Offshoring Industries**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Non-EU Immigrant Share$_{t-1}$	-1.117***	-0.647**	-1.104**	-0.839**	-2.169**	-0.124**
	(0.231)	(0.272)	(0.537)	(0.355)	(0.854)	(0.059)
	[-0.128***]	[-0.135**]	[-0.381**]	[-0.083**]	[-0.135**]	[-0.055**]
Industry, Municipality and Year Fixed Effects	yes	yes	yes	yes	yes	yes
Firm Fixed Effects	yes	yes	yes	yes	yes	yes
Firm Characteristics	yes	yes	yes	yes	yes	yes
Workforce Characteristics	yes	yes	yes	yes	yes	yes
Mean Y	0.279	0.096	0.058	0.201	0.322	0.045
First Stage: F-stat on Instrument	7.443	13.848	12.425	12.620	11.720	12.109
First Stage: Non-EU Img IV Coeff	0.191** (0.073)	0.176*** (0.065)	0.181*** (0.071)	0.175*** (0.065)	0.195*** (0.072)	0.172*** (0.053)
R-sq	0.015	0.013	0.003	0.006	0.008	0.004
N	83,611	355,651	217,872	221,181	136,570	302,367

Notes: The dependent variable is a binary variable equal to 1 if the firm offshores (narrow definition). The non-EU immigrant share$_{t-1}$ is the lagged share of non-EU foreign workers within the municipality. Labor intensive industries are those with average labor intensity above the sample mean in the middle of the period (i.e. 2003). High offshoring industries are those with average offshoring volumes above the sample mean in the middle of the period (i.e. 2003). Robust standard errors clustered at the municipality level in parentheses. The coefficients shown in brackets report the percent change in the outcome variable due to a one standard deviation increase in immigration. Significance levels: ***1%, **5%, *10%.

Table 7: Immigration and Firm Offshoring at the Bilateral Level

	Extensive margin			**Intensive margin**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Bilateral Non-EU Immigrant Share$_{t-1}$	2.357***		2.103***	18.365		16.428
	(0.890)		(0.179)	(10.716)		(9.395)
	[0.244***]		[0.218***]	[0.005]		[0.005]
Immigrant Share from Same Linguistic Group$_{t-1}$		0.010			0.383	
		(0.025)			(2.604)	
		[0.012]			[0.001]	
Immigrant Share from Same Region$_{t-1}$		0.134**			0.476	
		(0.050)			(1.435)	
		[0.268**]			[0.003]	
Other Non-EU Immigrant Share$_{t-1}$			-0.100**			-12.006*
			(0.046)			(6.634)
			[-0.076**]			[-0.025*]
Industry, Municipality and Year Fixed Effects	yes	yes	yes	yes	yes	yes
Firm Fixed Effects	yes	yes	yes	yes	yes	yes
Firm Characteristics	yes	yes	yes	yes	yes	yes
Workforce Characteristics	yes	yes	yes	yes	yes	yes
Destination Fixed Effects	yes	yes	yes	yes	yes	yes
Mean Y	0.029	0.029	0.029	10.515	10.515	10.515
First Stage: F-stat on Instrument(s)	20.378	7.640; 19.771	20.654; 8.512	32.838	26.810; 54.081	35.623; 11.471
First Stage: Bil Non-EU Img IV Coeff	0.257** (0.108)		0.253** (0.108)	0.504*** (0.077)		0.497*** (0.076)
First Stage: Same Linguistic Img IV Coeff		0.218*** (0.065)			0.235*** (0.057)	
First Stage: Same Region Img IV Coeff		0.244*** (0.053)			0.098*** (0.049)	
First Stage: Other Non-EU Img IV Coeff			0.152** (0.069)			0.179** (0.072)
R-sq	0.011	0.011	0.012	0.024	0.024	0.023
N	20,306,958	20,306,958	20,306,958	103,025	103,025	103,025

Notes: The dependent variable is bilateral offshoring to foreign country (X) measured at the extensive margin in columns 1-3 and at the intensive margin in columns 4-6. The Bilateral Non-EU Immigrant Share variable is also now foreign country (X) specific. The Linguistic Group variable includes foreign countries that speak a language belonging to the same linguistic group as country X, not including country X itself. The Same Region variable includes countries within the same World Bank region as country X, not including country X itself. Finally, the Other Non-EU Immigrant Share variable includes immigrants from all other countries, not including country X. Robust standard errors clustered at the municipality level in parentheses. The coefficients shown in brackets report the percent change in the outcome variable due to a one standard deviation increase in immigration. Significance levels: ***1%, **5%, *10%.

Table 8: Immigration and International Trade

	Multilateral		**Bilateral**	
	Imports	**Exports**	**Imports**	**Exports**
	(1)	**(2)**	**(3)**	**(4)**
Non-EU Immigrant Share$_{t-1}$	7.786	-49.674		
	(54.637)	(56.932)		
	[0.007]	[-0.049]		
Bilateral Non-EU Immigrant Share$_{t-1}$			791.161***	641.377***
			(251.723)	(230.531)
			[0.166***]	[0.137***]
Other Non-EU Immigrant Share$_{t-1}$			-81.666	-58.169
			(80.593)	(48.591)
			[-0.114]	[-0.082]
Municipality and Year Fixed Effects	yes	yes	yes	yes
Average Firm Characteristics	yes	yes	yes	yes
Destination Fixed Effects	no	no	yes	yes
Mean Y	21.332	20.224	14.243	14.058
First Stage: F-stat on Instrument(s)	28.316	28.316	22.549; 7.643	22.549; 7.644
First Stage: Non-EU Img IV Coeff	0.212** (0.094)	0.212** (0.094)	0.135** (0.062)	0.135** (0.062)
First Stage: Bil Non-EU Img IV Coeff			0.232** (0.110)	0.232** (0.110)
R-sq	0.107	0.201	0.344	0.441
N	1,552	1,552	114,063	114,063

Notes: In column 1 the dependent variable is the log of total imports into the municipality. In column 2 the dependent variable is the log of total exports from the municipality. In column 3 the dependent variable is the log of bilateral imports, while in column 4 it is the log of bilateral exports. Robust standard errors clustered at the municipality level in parentheses. The coefficients shown in brackets report the percent change in the outcome variable due to a one standard deviation increase in immigration. Significance levels: ***1%, **5%, *10%.

Table 9: Immigration and Firm Offshoring, Using Alternate Immigration Variables

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Total Immigrant Share	-0.874**				
	(0.364)				
	[-0.148**]				
Non-EU Immigrant Share		-0.826**			
		(0.335)			
		[-0.127**]			
Refugee and New-EU Immigrant Share			-1.007**		
			(0.493)		
			[-0.122**]		
Non-EU Low-Skilled Immigrant Share				-1.274**	
				(0.630)	
				[-0.176**]	
Non-EU Immigrant Firm Share					-1.308**
					(0.650)
					[-0.322**]
Industry, Municipality and Year Fixed Effects	yes	yes	yes	yes	yes
Firm Fixed Effects	yes	yes	yes	yes	yes
Firm Characteristics	yes	yes	yes	yes	yes
Workforce Characteristics	yes	yes	yes	yes	yes
Mean Y	0.130	0.130	0.130	0.130	0.130
First Stage: F-stat on Instrument	13.011	12.643	7.825	7.527	5.534
First Stage: Total Img IV Coeff	0.166** (0.075)				
First Stage: Non-EU Img IV Coeff		0.179*** (0.081)			0.113*** (0.036)
First Stage: Refugee & New-EU Img IV Coeff			0.192** (0.097)		
First Stage: Non-EU Low-Skilled Img IV Coeff				0.132** (0.063)	
R-sq	0.005	0.005	0.005	0.005	0.005
N	439,627	439,627	439,627	439,627	439,627

Notes: The dependent variable is a binary variable equal to 1 if the firm offshores (narrow definition). In column 1, the endogenous variable is the share of all (EU and non-EU) immigrants in the municipality, while the instrument is the predicted share of all immigrants. In column 2 the endogenous variable is the share of non-EU immigrants in the municipality, while the instrument is the predicted share of non-EU immigrants. In column 3 the endogenous variable is the share of refugee or new-EU immigrants in the municipality, while the instrument predicted share of refugee and new-EU immigrants. In column 4 the endogenous variable is the share of non-EU low-skilled immigrants in the municipality, while the instrument is the predicted share of non-EU low-skilled immigrants (where low-skilled immigrants are defined as those with either primary or vocational education). In column 5 the endogenous variable is the share of non-EU immigrants at the firm, while the instrument is the predicted share of non-EU immigrants in the municipality. Robust standard errors clustered at the municipality level in parentheses. The coefficients shown in brackets report the percent change in the outcome variable due to a one standard deviation increase in immigration. Significance levels: ***1%, **5%, *10%.

Table 10: Immigration and Firm Offshoring, Using Alternate Offshoring Variables

	Broad Offshoring	**FDI-Based Offshoring**	**Offshoring per Employee (Intensive Margin)**	**Firms Offshoring in All Years (Intensive Margin)**
	(1)	**(2)**	**(3)**	**(4)**
Non-EU Immigrant Share$_{t-1}$	-1.618**	-0.302**	-14.676**	-16.328*
	(0.711)	(0.143)	(7.163)	(9.628)
	[-0.123**]	[-0.034**]	[-0.034**]	[-0.026*]
Industry, Municipality and Year Fixed Effects	yes	yes	yes	yes
Firm Fixed Effects	yes	yes	yes	yes
Firm Characteristics	yes	yes	yes	yes
Workforce Characteristics	yes	yes	yes	yes
Mean Y	0.264	0.153	8.683	12.623
First Stage: F-stat on Instrument	12.643	12.833	7.829	6.987
First Stage: Non-EU Img IV Coeff	0.179*** (0.076)	0.195*** (0.048)	0.186** (0.083)	0.125**(0.061)
R-sq	0.013	0.035	0.003	0.005
N	439,627	67,517	56,399	20,925

Notes: In column 1 the dependent variable is a binary variable equal to 1 if the firm offshores (broad definition). In column 2 the dependent variable is a binary FDI-based measure of offshoring indicating whether the firm has a foreign affiliate. In column 3 the dependent variable is the log of offshoring volumes per employee (narrow definition). In column 4 the dependent variable is the log of offshoring volumes (narrow definition) and the sample is restricted to firms that offshore in all years. Robust standard errors clustered at the municipality level in parentheses. The coefficients shown in brackets report the percent change in the outcome variable due to a one standard deviation increase in immigration. Significance levels: ***1%, **5%, *10%.

Table 11: Immigration and Firm Offshoring, Additional Sensitivity Results

	Excl. Copenhagen	**Excl. Multi-Establishment Firms**	**Incl. Firms that Relocate**
	(1)	**(2)**	**(3)**
Non-EU Immigrant Share$_{t-1}$	-0.746**	-0.678**	-1.142***
	(0.351)	(0.337)	(0.184)
	[-0.108**]	[-0.159**]	[-0.181***]
Industry, Municipality and Year Fixed Effects	yes	yes	yes
Firm Fixed Effects	yes	yes	yes
Firm Controls	yes	yes	yes
Workforce Characteristics	yes	yes	yes
Mean Y	0.117	0.094	0.139
First Stage: F-stat on Instrument	10.351	9.68	14.643
First Stage: Non-EU Img IV Coeff	0.213*** (0.090)	0.173*** (0.048)	0.269*** (0.001)
R-sq	0.005	0.004	0.006
N	403,137	394,354	488,164

Notes: In column 1 we exclude from the sample the municipality of Copenhagen (and Frederiksberg). In column 2 we exclude multi-establishment firms. In column 3 we include firms that relocate from one Danish municipality to another. Robust standard errors clustered at the municipality level in parentheses. The coefficients shown in brackets report the percent change in the outcome variable due to a one standard deviation increase in immigration. Significance levels: ***1%, **5%, *10%.