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DISCUSSION PAPER SERIES

IZA DP No. 12885

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ABSTRACT

Building Bridges and Widening Gaps: Wage Gains and Equity Concerns of Labor Market Expansions*

We exploit the construction of the Öresund bridge, which connects a medium-sized city in Sweden to the capital of Denmark, to study the labor market effects of gaining access to a larger labor market. Using unique cross-country matched registry data that allow us to follow individuals across the border, we find that the bridge led to a substantial increase in cross-country commuting among Swedish residents. This effect is driven both by extensive and intensive margin employment responses, and translates into a 15% increase in the average wage of Swedish residents. However, the wage effects are unevenly distributed: the effect is largest for high-educated men and smallest for low-educated women. Thus, the wage gains come at the cost of increased income inequality and a widening of the gender wage gap, both within- and across-households. We show that these inequality effects are driven not only by differences in the propensity to commute, but also by educational specialization.

JEL Classification: J3, J61

Keywords: labor market expansions, wages, distributional consequences

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1 Introduction

Improving and expanding the transportation infrastructure of a region can have substantial labor market effects on peripheral regions. Specifically, such expansions may increase the job market opportunities of individuals through agglomeration effects (Overman and Puga, 2010), raising the career prospects of individuals and improving the quality of employer-employee matches (Greenstone, Hornbeck, and Moretti, 2010; Heuermann and Schmieder, 2018; Gibbons, Lyytikäinen, Overman, and Sanchis-Guarner, 2019). However, these benefits might not be equally distributed: High-educated workers and men are more likely to commute long distances for the same job compared to low-educated workers and women (Le Barbanchon, Rathelot, and Roulet, 2019). Access to larger labor markets could therefore have substantial effects on income inequality and the gender wage gap. As labor markets have grown rapidly in size during the past decades, both due to improved transportation infrastructure and reduced commuting costs, such effect heterogeneity could represent an overlooked obstacle to income and gender equality.[1] Lack of exogenous variation in labor market size has made it difficult to comprehensively study the benefits and costs of labor market expansions.

In this paper, we ask how access to a larger labor market affects wages, and how these potential wage gains are distributed across workers. To obtain exogenous variation in access to a larger labor market, we exploit the opening of the Öresund bridge, which connects two of the largest cities in Scandinavia: the capital of Denmark, Copenhagen, and the third largest city of Sweden, Malmö.[2] The 16km long road and rail link over the Öresund strait was completed in 2000 and led to a massive expansion of the labor market opportunities available to individuals on the Swedish side of the strait.[3] Specifically, a city of 250,000 inhabitants gained access to a much larger labor market with substantially higher wages.[4] Armenter, Koren, and Nagyy (2014) argue that bridges have historically had a connecting role and that the economic developments on both sides of a bridge have traditionally converged. This makes the opening of the Öresund bridge a well-suited laboratory for answering our question of interest.[5]

Using unique cross-country matched registry data from Statistics Sweden and Statistics Denmark, we can trace Swedes across the border and observe their employment and income histories

[1] For an overview of other potential drivers of the gender gap and income inequality, see Blau and Kahn (2007) and Goldin (2014).

[2] The Öresund bridge became famous after the 2011-2018 Scandinavian television series *The Bridge*, shown in more than 100 countries.

[3] As both Sweden and Denmark are part of the European Union, workers can move freely across the bridge and do not require work visas to find employment across the border. Temporary ID controls were introduced in 2016 in response to the European refugee crisis, but this does not coincide with our analysis period (1997-2008).

[4] Using the 1999 Danish-Swedish exchange rate (1:1.16) and publicly-available wage information on Copenhagen from Statistics Denmark, the average wage in Copenhagen in 1999 was 155,000 SEK. The average wage in Copenhagen was thus 13 percent higher than the average wage in Malmö in 1999, shown in Appendix Table A4.

[5] There are many large bridge openings across the world every year, serving the purpose of connecting local labor markets (e.g. the Bogibeel bridge in India in 2018 and the Hong Kong-Zhuhai-Macau bridge in 2018).

both in Sweden and in Denmark. Using a non-parametric event study design, we leverage this data to study the labor market effects of the bridge, comparing the outcomes of individuals in Malmö with individuals in non-affected municipalities before and after the opening of the bridge. The results from this study help us better understand the labor market effects of access to a larger labor market. In addition, the rich data give us a unique opportunity to disentangle how these effects are distributed across workers. Complementing our main analysis with aggregate regional data from Denmark, we are also able to provide some suggestive evidence on the labor market effects also in the receiving country.

When studying income equality and the gender wage gap, the Nordic model is often portrayed as a success story. The model is based on a redistributive tax system with comprehensive public social insurance, cash benefits to poor families, generous family policies, and equality-targeting interventions such as board quotas and non-transferable paternal leave. Several aggregate statistics support this view: men and women have almost identical labor market participation rates and intergenerational income mobility is among the highest in the world. On the other hand, there are also some statistics that do not fit with this image. First, the labor markets are highly gender segregated, and even though the gender wage gap has decreased substantially during the past century, there is a non-negligible and persistent wage difference between men and women. Second, while somewhat smaller than in countries such as the UK, the US, Germany, and France, there are also large child penalties for mothers both in Denmark and Sweden (Kleven, Landais, Posch, Steinhauer, and Zweimüller, 2019). Third, while income inequality is low compared to other countries, it has increased over the past decade. Concurrently with these developments, the local labor markets in Scandinavia have expanded in size, and the average commuting distance has increased. For example, the share of cross-municipality commuters in Sweden has doubled, and the number of unique local labor markets have declined from 112 to 70, over the past 30 years. Understanding whether the expansion of local labor markets drive some of the observed trends in income inequality and the gender wage gap is important for understanding why societies—even those committed to equality— fail to close the gaps.

We present four main results. First, we show that the bridge led to a large increase in the cross-country commuting behavior of Swedes. This effect is largest for individuals in Malmö, but also extends to neighboring municipalities within the county of Scania. Second, we demonstrate that the bridge had a positive effect on the wages of Swedish residents residing close to the bridge. In terms of magnitude, we find that individuals in Malmö experienced a 15 percent increase in their wages eight years after the opening of the bridge.[6] Complementing our primary data with aggregate regional data from Denmark, we find little evidence that this had a negative impact on natives. On the contrary, we find a small positive effect also for individuals in Copenhagen. Third, we demonstrate that the wage effect for Swedes is largest among high-educated men and

[6] We find a similar effect for individuals born in Scania and individuals not born in Scania. In section 5, we carefully document that selection of migrants is not the main driver of the wage effects.

smallest for low-educated women.[7] This differential impact across skill groups and genders led to an increase in both across- and within-household wage inequality. Finally, we show that these inequality effects likely are driven not only by gender differences in the propensity to commute, but also by educational specialization. Specifically, female commuters are more likely to have service-oriented educational backgrounds where the gains from access to a larger labor market are smaller, while men are more likely to have business and STEM-related degrees with much higher returns to commuting. A battery of robustness checks support these findings.

This paper makes several contributions to the literature. First, we contribute to the large literature on agglomeration economies.[8] One key source of agglomeration is the reduction of transportation costs of people that may, for example, enable workers to switch jobs more easily without moving residence (Krugman, 1991; Overman and Puga, 2010).[9] In addition, we are the first to analyze how potential wage gains are distributed across workers within a region. These findings advance the large literature on drivers of income inequality (see Alvaredo, Chancel, Piketty, Saez, and Zucman, 2018, for a recent world inequality report with key references) and help understand why better economic opportunities might be in conflict with societal goals of income and gender equality (Blau and Kahn, 2007; Le Barbanchon, Rathelot, and Roulet, 2019). Second, we expand the literature on the effects of access to transportation infrastructure. The consequences of infrastructure on interregional trade flows are well-documented (Michaels, 2008; Banerjee, Duflo, and Qian, 2012; Donaldson, 2018; Gibbons, Lyytikäinen, Overman, and Sanchis-Guarner, 2019), and Heuermann and Schmieder (2018) demonstrates that a reduction in travel time raises the number of commuters across regions. We complement this literature by expanding the set of outcomes to not only examine the effect on commuting, but also on wages, and by studying the distributional impact of such labor market expansions across workers. Third, our paper is related to a small but growing empirical literature on the labor market effects of cross-border commuting. While Dustmann, Schönberg, and Stuhler (2017) studies East German natives' employment opportunities and wages after an unexpected inflow of Czech cross-border migrants, Beerli, Ruffner, Siegenthaler, and Peri (2018) examines the effect of an inflow of cross-border workers on Swiss natives' labor market outcomes as well as firm productivity and innovation. Both these papers are complementary to our work as they focus on labor market outcomes among natives while we are, to the best of our knowledge, the first to study labor market effects among cross-border commuters and stayers in the sending country. Moreover, we show that migration to and from impacted areas are not a main mechanism in our setting. This is different from earlier work (e.g., Dustmann, Schönberg,

[7] While we do not have data for Denmark by skill level, we can study the wage by gender and we find no differences for males and females on the Danish side.

[8] See Glaeser (2010), for an excellent overview of agglomeration economics.

[9] The reduced transportation costs holding residency constant is very similar to our setting where the bridge opened up a large market for new jobs within commuting distance from current residency. We will indeed show that mobility between the two cities are low, especially few Swedes move to Copenhagen. This also makes our setting different from for example the re-unification of east and west Germany which led to large migration flows from the east to west (see, e.g., Fuchs-Schündeln and Schündeln, 2009).

and Stuhler, 2017) and allows to identify the direct labor market effects of increased access to international commuting.

2 Background

The Öresund bridge (OB) opened on July 1, 2000. This large-scale infrastructure project involved the construction of an underwater tunnel, an artificial island, an artificial peninsula, and a bridge. It is the longest combined road and rail bridge in Europe and connects two major metropolitan areas: the Danish capital, Copenhagen, and the third largest city of Sweden, Malmö.[10] The construction of the bridge was motivated by a need to improve Northern European transportation links, regional development, and airport communications.[11] The agreement between Denmark and Sweden was signed in 1991, and construction began in 1995, five years prior to the inauguration.[12] Despite a number of unexpected setbacks, such as the discovery of 16 unexploded bombs from the Second World War on the seafloor, the bridge was completed three months ahead of schedule. The total cost of bridge was about 4 billion Euro and is entirely user-financed though E-passes and railway tickets.[13]

The Öresund region represents one of the largest metropolitan area of Northern Europe. Administratively, it consists of 33 Swedish municipalities (the county of Scania) and 46 Danish municipalities (the Capital Region and Region Zealand); Appendix Figure A3 provides a visual illustration. The Öresund region has a combined landmass of 21,000 square kilometers, a population of 4 million people, and makes up slightly more than a quarter of the countries' combined GNP.[14]

Individuals can travel across the bridge with car, train and bus. There are no border controls as both Sweden and Denmark are part of the EU and the Schengen Agreement.[15] It takes approximately 10 minutes to cross the bridge, and the average travel time from the center of Malmö to the center of Copenhagen is 27 minutes by train and 35 minutes by car. Between 2000 and 2010, there were approximately 80 train crossings per day.[16] The cost of crossing the bridge is 12 Euros by train, 5 Euros by bus and between 5 and 53 Euros by car (depending on the number of trips an individual makes a year, and whether the individual has purchased an E-pass or not).[17] While the

[10]The OB link consists of an 8 kilometer long bridge, a 4 kilometer long artificial island, and a 4 kilometer long tunnel. It is more than three times the length of the Golden Gate Bridge.

[11]The main airport of the region, Kastrup, is located just across the strait on the Danish side.

[12]However, the concept of the bridge was discussed already in 1936.

[13]The full cost of the bridge is expected to be recouped by 2023, 4 years ahead of schedule.

[14]While the Swedish side makes up the largest part of the region as measured by surface, more than two-thirds of the residents in the region live on the Danish side.

[15]Passport controls were introduced on the Swedish side in response to the European refugee crises of 2016, and Denmark implemented limited controls in 2019. However, this does not coincide with our analysis period.

[16]2011 marked the completion of a substantial train infrastructure project in Malmö, which increased capacity and made it possible to increase the number of train crossings from 80 to 150 per day.

[17]For buses, see https://global.flixbus.com. For cars, see https://oresundsbron.com/en/prices. For trains, see https://sj.se.

bridge led to an immediate increase in cross-border traffic between Sweden and Denmark (up 61 percent in the year following the opening of the bridge), traffic flows remained below expectations until 2005 when it began to rapidly increase. In 2007, almost 40 million individuals travelled across the bridge.

Before the bridge opened, the time investment to commute between Denmark and Sweden was high. The Helsingborg-Helsingör ferry line (the HH link) was the predominant mode of transport across the strait, and it took more than 90 minutes to travel from Malmö to Copenhagen via the HH link. In addition, there was boat traffic between Malmö and Copenhagen. However, these ferries had a limited number of departures (usually one every two hours), did not run during nights, and took approximately one hour. The bridge therefore drastically reduced commuting time to Copenhagen. To get an idea of how commuting time changed for individuals in the Malmö region we compared the time it takes to travel from the center of Copenhagen to the center of Malmö by car (35 minutes) to other commuting routes within the greater Malmö region. The average commuting time from municipalities around Malmö to the center of Malmö is in the same ballpark. However, for individuals who lived and worked in the center of Malmö before the opening of the bridge, if they started to work in Copenhagen following the opening of the OB, the commuting time likely increased.[18]

Appendix Figure A5 demonstrates that there was an average of 50,000 daily crossings over the strait prior to the completion of the bridge. This number had more than doubled 8 years after the opening of the bridge, with approximately 100,000 individuals crossing the strait on any given day. While the boat traffic from Malmö to Denmark was discontinued following the construction of the bridge, the Helsingborg-Helsingör ferry line (grey bars in Appendix Figure A5) remains an important route for commercial goods trade from Central Europe to Sweden and Norway (Knowles, 2006). This is mainly due to the cost of crossing the bridge, resting times for drivers, restrictions on goods that can be transported in the Öresund tunnel, and the shorter distance for individuals traveling between Denmark and non-Scania municipalities of Sweden. After a small decline in the year that the bridge opened, traffic along the Helsingborg-Helsingör route remained stable until the financial crisis of 2008.

There were more than 18,000 individuals who commuted across the strait on a daily basis in 2008, up from about 2,500 in the year before the bridge (Steenstrup, 2012). Commuting peaked in 2005-2007 due to Danish labor shortage and a significant wage level differential. Commuting activity dropped in the wake of the financial crisis in 2008 and the subsequent recession. The annual contribution from commuters to the Danish economy is estimated at around 740 million Euros in value added (Steenstrup, 2012).

More than 90% of commuters live in Sweden and work in Denmark. A back-of-the-envelope calculation made by *Öresundsbro Konsortiet* suggests that Swedes (family living and working in

[18]With some exceptions for those living very close to the bridge.

Sweden) gain an average of USD 6000 per year if starting to work in Denmark due to wage level differences. Danes on the other hand (family living and working in Denmark), gain on average USD 13,000 per year if moving to Sweden, but continuing to work in Denmark, due to a large house price differential (OBK, 2005). The *Öresundsbro Konsortiet* documents that individuals commuting over the strait generally are young and well educated; around 45% have university degrees compared to 35% in the general population. The majority of commuters are male: for every three male commuters there are two female commuters.[19] Among the Malmö commuters in our sample, the average commuting stint is 2.6 years: 38 % commutes for one year only, 25 % for two years, and the remaining 37 % for three years or more (Appendix Table A1). This suggests that the commuters is a mixture of individuals with short- and long-term employment spells in Denmark.

To better understand the financial incentives for working in Denmark compared to Sweden, we have compared the exchange rates and the tax schedules of the two countries. The exchange rate is provided in Appendix Figure A1. While there is some volatility in the period prior to the opening of the bridge, the exchange rate is fairly constant during our analysis period. Income tax is paid in the country of employment.[20] Appendix Figure A2 compares the tax schedules in Copenhagen and Sweden for commuters in 2004. Appendix Figure A2 demonstrates that there is some variation in the marginal tax rates of the two countries depending on earnings level. For earnings between approximately SEK 50,000 - SEK 300,000, Denmark has a higher marginal tax rate. For earnings above SEK 300,000, the marginal text rates in the two countries are more similar. It should be noted that there were a couple of changes to the tax schedules during our analysis period. In Section 5, we adjust the wage information using the relevant yearly tax schedules of the two countries to study the robustness of our results to netting out tax differences.

3 Data

The primary data we use come from population-wide administrative registries at Statistics Sweden. These data provide annual demographic and socioeconomic information on all individuals living in Sweden aged 16 through 65, for each year between 1997 and 2014. In our main analysis, we focus on individuals aged 18 or older. Further, we restrict attention to the 1997-2008 period to prevent the financial crisis of 2008, the subsequent recession, and the large fluctuations in exchange rates, from affecting our results. In auxiliary analyses (Section 5.4), we relax this restriction and use the recession to examine how volatile the wage and equity effects are to large economic shocks.

The socioeconomic data from Statistics Sweden include detailed information on educational

[19] Note that these numbers are different from our sample as the Öresundsbro Konsortiet compares all Swedish commuters to Denmark with the general population of Sweden whereas we are analyzing only individuals living in Malmö.

[20] There is one exception to this rule: For Swedes working in the Danish public sector, any work performed for the Danish public sector while in Sweden (e.g. telecommuting) is classified as Swedish income and is therefore taxed in Sweden. In our data, this will show up as Swedish wage.

attainment, employment, and wages. While we use the wage and employment information as outcome variables in the analysis, we use educational attainment as a stratification variable in our heterogeneity analyses.[21] The demographic data include detailed information on municipality of residence, family composition, immigration status, and county of birth. The municipality of residence is critical for identifying treatment and control units; the family composition information enables us to explore effect heterogeneity by family status; and the immigration status as well as the county of birth are important for several of our robustness and sensitivity analyses described in the next section.

Crucial to our analysis is the ability to observe the cross-border labor market activity of Swedish residents. The official data registries of Statistics Sweden only contain information on individual labor market activity within the country, and data on labor market involvement (earnings and employment) in Denmark is therefore not included. However, through an agreement between the governments of Sweden and Denmark, a separate database on cross-border commuting was established in 2009. This data contain detailed individual-level information on all labor market activities of Swedish residents in Denmark between 1997 and 2014, including information on employment and earnings as well as on which industry and sector the individual has been active in.[22] By linking this data to our primary data from Statistics Sweden through unique individual identifiers, we are able to construct a novel data set with detailed information on all Swedish residents and their employment histories in Denmark and Sweden over a large number of years. To the best of our knowledge, we are the first to use these data for the purpose of applied microeconomic research.

Our core outcomes consist of wages and employment in Sweden and Denmark. Our wage measures come from administrative tax records in both Denmark and Sweden and includes total yearly wages in each of these countries. Wages are measured in thousands of SEK, where 1 SEK is approximately USD 0.1. We include individuals with zero wages in our main analysis. With respect to employment, we define individuals as employed in Denmark if they have positive wages from Denmark, as employed in Sweden if they have positive wages from Sweden, and as employed in both countries if they have positive wages from both countries.

In addition to our core outcomes, we also examine the probability of receiving unemployment benefit from the Swedish government and the probability of holding more than one job. Unemployment benefits are provided to individuals who do not currently have a job, but are actively looking for one and are registered with the government's unemployment office. While we focus on the probability of obtaining unemployment benefits in the paper, the results are robust to studying this variable in levels as well.

We perform a number of auxiliary analyses in which we split the sample based on the education level and family composition of the individuals. We define low-educated individuals as those with

[21] Note that we do not observe occupations.

[22] The cross-country data cooperation was discontinued in 2015 due to disagreements concerning data protection regulations, and is therefore no longer updated.

no more than a high school degree, and high-educated individuals as those with more than a high school degree. In terms of education specialization, we follow Statistic Sweden's broad education classification system and divide high-educated individuals into eight mutually exclusive education specializations: pedagogy and teacher education; humanities and arts; social science, law and public administration; natural science, math and information technology; technology - industry and manufacturing; farming, land science and animal science; health and social care; and services. With respect to family composition, we look separately at married couples and at individuals who have at least one child under the age of 18 still living at home.

In our main analysis, we compare individuals residing in Malmö with individuals residing in non-Scania border municipalities (see Appendix Figure A6).[23] Appendix Table A4 provides summary statistics of treatment and control individuals in the year prior to the opening of the bridge, using all variables discussed above. Looking across the columns in Appendix Table A4, individuals in Malmö are less likely to be employed, earn slightly less, are more likely to be foreign-born, and are less likely to be married and have children. Appendix Table A4 also provides summary statistics of all individuals residing in Sweden. As shown in the table, individuals in Sweden as a whole are very similar to those in our main control group. It is worth noting that our identification strategy—a difference-in-difference design—does not require that our treatment group is similar to our control group on observable characteristics.

In addition to the individual-level microdata that we use for our main analysis, we have collected aggregate wage data from Statistics Denmark by gender and across regions. This wage measure is slightly different from that in the Swedish microdata. Most notably, the labor force in Denmark includes individuals aged 15 and older. While not directly comparable with the microdata we use in the main analysis, and even though it is not possible to perform the full econometric analysis described in the next section on the Danish side, these data are helpful for providing suggestive evidence on the effect of the bridge on individuals in the receiving city. This part of the paper complements existing research on labor market effects of commuters on the native workforce in Germany (Dustmann, Schönberg, and Stuhler, 2017) and Switzerland (Beerli, Ruffner, Siegenthaler, and Peri, 2018). For this part of the paper, we compare aggregate means in Copenhagen with aggregate means in East-Jutland, a region that is relatively close in size to Copenhagen but sufficiently far away from Copenhagen such that commuting to Copenhagen from the region is low (see Appendix Figure A4 for a map of the regions in Denmark).

4 Identification Strategy

To study the impact of the Öresund bridge on the labor market outcomes of individuals in Malmö, we rely on a difference-in-difference approach that compares the labor market outcomes of indi-

[23]Note that we provide a number of robustness checks in Section 5.3 in which we alter the control group to ensure that our effects are not dependent on a particular set of control municipalities.

viduals in Malmö with the labor market outcomes of individuals in other municipalities and cities of Sweden. In our main analysis, the control group consists of all municipalities in the counties bordering Scania; Appendix Figure A6 provides a visual illustration.

The labor market effects of the Öresund bridge are likely to vary over time. First, Swedish residents may be tied up in long-term employment contracts, such that there is a lag in the supply response to the expansion. Second, frictions in the labor market may prevent instantaneous matching of Danish employers and potential Swedish employees. Finally, the effects may vary across years due to time variation in the local labor market conditions in Copenhagen. Our preferred empirical method is therefore to estimate event study models that allow us to nonparametrically identify time-varying treatment effects. Our baseline empirical model can be described by the following equation:

$$Y_{imt} = \alpha + \sum_{t=1997}^{t=2008} [\delta_t(Treat_m)] + X_{mt} + \gamma_t + \rho_m + \phi_c + \varepsilon_{imt}, \tag{1}$$

where Y_{imt} is one of the labor market outcomes listed above for individual i in municipality m and time t. $Treat_m$ is a dichotomous variable taking the value of one if the individual resides in Malmö, and zero otherwise. The δ_t coefficients nonparametrically trace out pre-treatment relative trends (for δ_{1997} to δ_{1999}) as well as time-varying treatment effects (for δ_{2000} to δ_{2008}). In practice, we omit δ_{1999} such that all δ estimates are relative to the year prior to the opening of the bridge. Standard errors are clustered at the municipality level.

Equation (1) also includes municipality (ρ_m), year (γ_t) and birth year (ϕ_c) fixed effects. The birth year fixed effects control for any systematic differences across cohorts in each calendar year that may be correlated with the labor market expansion and the outcomes of interest. The municipality fixed effects control for variation in outcomes that are common across all birth cohorts within a municipality, and the year fixed effects account for national shocks that impact all birth cohorts in the same year. Given the difference in the immigrant share in Malmö compared to the rest of the country (Appendix Table A4), we also control for the fraction of immigrants in each municipality and year. This variable is denoted by X_{mt} in Equation (1).

The parameters of interest in Equation (1) are δ_{2000} to δ_{2008}, which trace the effect of the OB on the labor market outcomes of Malmö residents across years. While we show the full set of δ_t coefficients in our figures, we focus on effects eight years after the opening of the bridge (δ_{2008}) in the tables.

Conditional on the fixed effects and controls included in Equation (1), the variation we exploit comes from exposure to the bridge as proxied by living in Malmö over time. The assumptions underlying our identification of δ_{2000} to δ_{2008} are that the opening of the bridge are not correlated with prior trends in outcomes over time in Malmö relative to the control municipalities, and that there are no municipality-specific shocks concurrent with the opening of the bridge that differentially affect individuals in Malmö compared to individuals in the control municipalities.

δ_{1997} to δ_{1999} in Equation (1) explicitly test for pre-treatment relative trends. If the δ_{1997} to δ_{1999} estimates are economically small and statistically indistinguishable from zero, that implies that there likely is no selection on fixed trends over time that bias our results. To further investigate this assumption, we note that even though the Swedish data can only be linked to the Danish registries starting in 1997, our Swedish data begins already in 1995. We use this data to extend the pre-bridge period and test for pre-treatment relative trends starting already in 1995 for certain labor market outcomes (employment status and earnings in Sweden). In Section 5, we discuss the pre-treatment trends for each outcome in detail, and use figures to demonstrate that the outcomes are trending similarly across the treatment (Malmö) and control areas (non-Scania border municipalities) in the years before the bridge opened.

The possible existence of local labor market shocks that occur concurrently with the opening of the bridge and that differentially affect individuals in Malmö compared to individuals in the control municipalities is a threat to identification that is more difficult to examine. However, we note that the fraction of individuals residing in Sweden and working in Denmark was negligible prior to the bridge, and that no other local policies were implemented in 2000 that could plausible explain the rapid rise of cross-border commuters that we observe. In addition, in Section 5.3 we perform a number of robustness checks in which we alter the control group to ensure that our effects are not dependent on a particular set of control municipalities. Specifically, we study the sensitivity of our results to using the thirty largest labor market regions excluding the Stockholm area,[24] and a synthetic control method based on all municipalities of Sweden (outside of Scania), as control groups.

It is important to note that the regression underlying the results produced by Equation (1) does not condition on pre-bridge municipality of residence, such that the effects we identify are both due to those who already lived in Malmö prior to the bridge opened and those who moved to Malmö following the opening of the bridge. To disentangle which of these groups that are driving our results, we estimate a set of regressions where we condition on the individuals' place of birth in Section 5. Note that restricting our sample to individuals based on where they lived in 1999 – the year before the bridge opened – would exclude all younger individuals entering the work force between 2000 and 2008. As these individuals represent a substantial share of the work force, we prefer to stratify the sample based on birh place instead. We also explore potential selective migration to Malmö as a function of the opening of the bridge in Section 5.

[24]The labor market outcomes in Malmö and the labor market outcomes in and around Stockholm are on very different trends in our time period, violating the parallel trend assumption required for causal inference based on a difference-in-difference approach. We therefore do not use the Stockholm labor market region as a control region.

5 Results

In this section, we present our findings on the effect of the bridge on the labor market outcomes of Malmö residents (Section 5.1) as well as on how these effects differ across different types of workers (Section 5.2). All results in this section are based on estimations of Equation (1), and for each of our outcomes we provide both event study plots as well as tables in which we more parsimoniously summarize the results. In Section 5.3, we document the sensitivity of our results to the use of alternative control groups. In Section 5.4, we provide evidence on the importance of the Danish labor shortage in 2005-2008 for our main outcomes and we use the financial crisis of 2008 and the subsequent recession to examine how volatile the wage effects and equity effects are to large economic shocks.

5.1 Commuting, wages and other labor market outcomes

Cross-border commuting. Panel (a) of Figure 1 graphically illustrates the nonparametric difference-in-differences estimates before and after the opening of the bridge on the probability of working in Denmark. Each dot is an estimate of relative time parameter δ_t in Equation (1) for the given year. The bars extending from each point show the bounds of the 95% confidence intervalss. The dashed vertical line marks the opening of the bridge (July 1, 2000).

Three observations are worth highlighting. First, the probability of working in Denmark is trending similarly across the treatment area (Malmö) and the control areas (non-Scania border municipalities) in the years prior to the opening of the bridge, supporting the parallel trend assumption required for causal inference. Second, the treatment and control areas begin to diverge immediately after the opening of the bridge, with Malmö residents being significantly more likely to work in Denmark already in the first complete post-opening year. Third, the treatment effect grows considerably over time and in 2008 Malmö residents were 5.3 percentage points more likely to work in Denmark than residents in non-Scania border municipalities. The substantial increase in the number of cross-border commuters after 2005 is likely driven, in part, by the labor supply shortage in Denmark relative to Sweden after 2005 (see Appendix Figure A7). The commuting effect in 2008 represents an increase of 1760 percent relative to the pre-opening mean, and is parsimoniously summarized in Column (1) of Panel A in Table 1.[25,26]

Having established a positive commuting effect of the OB on Malmö residents, a natural next question to ask is whether this effect is offset by a reduction in the probability of Malmö residents

[25]Dividing the sample in three age bins, 18-29, 30-49, and 50-64 years of age, reveals that the two younger age groups drive most of the effect. While the older age group also experiences a significant increase in the probability of commuting to Denmark, it is very small (1.5 percentage points); see Appendix Table A2.

[26]To get a better understanding of where in Denmark Malmö residents work, Appendix Figure A8 provides information on the number of Malmö residents working in each of the Danish municipalities in the Öresund region in 1999, 2004 and 2008. The figure documents that the majority of individuals who work in Denmark choose regions very close to the bridge, such as Tårnby and Copenhagen.

working in Sweden. Panel (b) of Figure 1 examines this question, showing the nonparametric difference-in-differences estimates on the probability of working in Sweden. The results demonstrate that the probability of working in Sweden declined among Malmö residents following the opening of the bridge, but this decline (approximately 1 percentage point) is much smaller than the increase in Danish employment. Thus, even though the positive commuting effect identified in Panel (a) had a crowd-out effect on employment in Sweden, this crowd-out effect was very small.[27] This becomes apparent when comparing Columns (1) and (2) in Panel A of Table 1.

Given the size of the labor market expansion, it is likely that not only Malmö residents increased their commuting to Denmark, but also that individuals in areas just outside of Malmö experienced an increase in commuting. To explore this question, we estimate Equation (1) separately for each municipality in the county of Scania (again compared to non-Scania border municipalities). The results from this exercise are provided in Figure 2, which shows the estimate of relative time parameter δ_{2008} in Equation (1) for each of the municipalities in Scania. Consistent with our priors, this figure reveals that distance from the bridge likely was a major factor in the individuals' commuting decisions: while individuals who resided in municipalities close to Malmö experienced increases in the probability of working in Denmark by 2.3–3.2 percentage points (compared to 5.3 in Malmö), the estimates are lower further away from the bridge. In the municipalities furthest from Malmö, but still within the borders of Scania county, there was no significant effect on the probability of working in Denmark.[28]

Wages. The identified commuting effects shown in Panels (a) and (b) of Figure 1 suggest that the bridge likely led to an increase in the average wage of Malmö residents; would Malmö residents not have benefited financially from begining to work in Denmark, it is highly unlikely that we would observe cross-border commuting effects. Panels (c) through (e) of Figure 1 explore this question in detail, graphically depicting the nonparametric difference-in-differences estimates on the wage from employment in Denmark (c), the wage from employment in Sweden (d), and the total wage from employment in both countries (e). The effects eight years after the opening of the bridge are parsimoniously summarized in Columns (3) through (5) in Panel A of Table 1.

Looking across the panels in Figure 1, the dynamics of the wage effects are very similar to the cross-border commuting effects. First, there is no indication of relative trends in outcomes across individuals in our treatment and control groups prior to the opening of the bridge. Second, the treatment and control areas begin to diverge relatively quickly after the opening of the bridge, with a statistically significant positive effect on wages from Danish employers starting in 2001 (the

[27] There are alternative explanations for the increased Danish employment that we will carefully study in subsequent subsections, including extensive margin employment responses, intensive margin employment (multiple jobs) responses, and whether the bridge changed the inflow and outflow of people to Malmö such that the composition of the work force in Malmö changed.

[28] Appendix Figure A9 provides information on which Danish municipalities in the Öresund region individuals living in Scania work in both before and after the opening of the bridge. This figure is similar to Appendix Figure A8 which presents the work municipality in Denmark of Malmö residents.

first full post-opening year), and a statistically significant negative effect on wages from Swedish employers starting in 2003. Third, the effects grow substantially over time, and in 2008 the average wage from employment in Denmark had increased by over 3000 percent compared to a very low pre-bridge mean of 821 SEK among Malmö residents. The average wage from employment in Sweden, on the other hand, declined by 3 percent during the same period compared to a pre-bridge mean of 137,000 SEK. Finally, the magnitude of the positive effect on the wage from employment in Denmark is significantly larger than the negative effect on the wage from employment in Sweden, such that the net effect of the bridge on the individual wages of Malmö residents is large and positive. In terms of magnitude, the total wage increased by almost 15 percent compared to the pre-bridge mean of 138,267 SEK.[29] This is a substantial average increase in the wages of Malmö residents compared to the wages of individuals residing in areas not affected by the bridge.[30] Hence, these findings illustrate that the bridge, which gave individuals on the Swedish side of the strait access to a much larger labor market, led to large average wage gains among Malmö residents.[31]

Extensive and intensive margin responses. Panels (a) and (b) of Figure 1 show that the positive commuting effect of the OB on Malmö residents is not fully offset by a reduction in the probability of working in Sweden. To better understand the drivers of the identified commuting effect, we probe the data further and examine both extensive as well as intensive margin employment effects. The results from this exercise are presented in Panel A of Table 2.

With respect to extensive margin effects, Column (1) shows that there is a substantial increase in the probability of working among Malmö residents compared to the control group as a function of the bridge opening, with an effect size of 3.6 percentage points in 2008. In other words, the opening of the bridge led to an increase on the extensive margin of employment among individuals in Malmö. Consistent with this extensive margin employment response, Column (3) shows an economically meaningful and statistically significant reduction in unemployment insurance take-up among individuals in Malmö. Column (2) studies the joint probability of employment and not receiving unemployment insurance, and shows that most of the extensive margin effect is due to substitution from unemployment insurance to employment.

We construct two proxy variables to capture the intensive margin response. The first is the probability of earning above mean annual SEK wage, which we consider a crude proxy for full

[29] We obtain similar results when using log wage as the outcome, with a coefficient estimate of 0.153 and a standard error of 0.013.

[30] Dividing the sample in three age brackets, 18-29, 30-49, and 50-64 years of age, shows that the middle age group experiences the biggest gain in wages, followed by the younger age group (also relative to the pre-treatment means). The oldest age group experiences no significant wage gain. See Appendix Table A2.

[31] While we do not have data on labor market outcomes in Denmark prior to 1997, we do have information on labor market outcomes in Sweden starting already in 1995. We exploit this data and extend the pre-opening period with two years for the outcomes that look at the probability of working in Sweden and wages earned in Sweden. We perform this analysis to ensure that there are no relative pre-treatment trends in outcomes prior to the start of our analysis period. The results from this exercise are shown in Appendix Figure A10, and provide additional support for the parallel trend assumption required for causal inference.

time work. The second is the probability of having multiple jobs.[32] The results from estimating Equation (1) using these proxies as dependent variables are shown in Columns (4) and (5) of Panel A in Table 2. These results demonstrate that the bridge led to statistically significant and economically meaningful intensive margin effects as well. Specifically, Column (4) shows that the probability of earning more than the mean annual SEK wage increased by 6.4 percentage points following the opening of the bridge. This effect represents a 12 percent increase relative to the pre-bridge mean. Column (5) shows that there is no effect on the probability of holding multiple jobs, suggesting that people substitute from lower paid jobs to higher paid jobs on the intensive margin.

Selective migration and commuters vs. non-commuters. The results presented above do not condition on where individuals lived prior to the opening of the bridge. Those effects are therefore driven both by individuals who lived in Malmö prior to the bridge opening, and by individuals who moved to Malmö following the opening of the bridge.

To understand how much of the above effects are driven by individuals moving into Malmö rather than by individuals who already lived in Malmö prior to the bridge, we begin by restricting our sample to migrants and estimate an augmented version of Equation (1). In this specification, we compare the demographic characteristics of in-migrants to the demographic characteristics of out-migrants in Malmö over time relative to that same difference in our control areas. This specification is thus akin to a triple difference specification, and allows us to identify the change in the net flow of individuals in Malmö compared to our control areas as a function of the bridge opening. Results from this exercise are provided in Figure 3. We present results separately for males and females, as we will start to show different patterns for males and females in effects on commuting and total wages starting in the next section.

Panels (a) through (d) of Figure 3 study a set of core demographic characteristics to see if there was a change in the type of individuals moving into Malmö following the opening of the bridge. The characteristics we look at are age (a), education (b), the probability of having children (c), and the probability of being married (d). The results demonstrate that the composition of the population in Malmö changes after the bridge opens. Specifically, the population gets slightly younger and more educated, and Malmö residents become less likely to have children. There is no clear pattern with respect to the probability of being married. Interestingly, the changes in net flows are very similar for males and females. This suggests that compositional changes cannot explain the gender-specific results we discuss in Section 5.2.

In addition to examining the composition of individuals moving to - and from - Malmö, we also look at the effect of the bridge on net migration. Results from this exercise are shown in Panel (e) of Figure 3, and are obtained by estimating our baseline Equation (1) using a categorical variable which takes the value of -1 if the individual moves out of the municipality in the given year, 0 if the

[32] Note that we know the number of employers in Sweden but not in Denmark. This should thus be interpreted as a lower bound of the total number of employers.

individual remains in the municipality, and 1 if the individual moves in to the municipality in the given year, as our dependent variable. The results indicate a short-run reduction in the number of individuals moving to Malmö compared to our control municipalities following the opening of the bridge. However, this effect disappears in the long run.[33]

The above analysis suggests that the employment and earnings effects identified in Sections 5.1 and 5.2 are unlikely to exclusively be driven by individuals migrating to Malmö following the opening of the bridge. To explore this question in greater detail, we first control for all the observed characteristics discussed above to get understand how our results are affected by controlling for these compositional changes in education, marriage rates, and the presence of children.[34] Appendix Table A3 shows that the effects are still large and significant, though the total wage effect is about 20% lower than in the baseline specification, suggesting that some of the wage gains can be explained by the bridge-induced compositional changes.

As discussed in Section 4, restricting our sample to individuals based on where they lived in 1999 – the year before the bridge opened – would exclude all younger individuals entering the work force between 2000 and 2008. To keep the age profiles constant, we therefore focus on individuals who were born in Scania and individuals who were born outside of Scania separately and re-estimate Equation (1) for our core outcomes.[35] This is the strictest definition of birth place we can utilize in our data.[36] The results from this exercise are shown in Figure 4 (Panels (a) and (b)). We find that individuals born in Scania start commuting to Denmark right after the opening of the bridge while we estimate a positive effect on cross-border commuting for individuals born outside of Scania from 2003 onwards. In the long run, there is no differential effect of the bridge on Scania natives compared to non-Scania natives. These findings suggest that the identified wage gains are shared approximately equally between locals and newer migrants to the region.

As discussed above, the results presented in Figure 1 are average effects across all Malmö residents. Are these wage effects isolated to individuals in Malmö who choose to commute to Denmark, or do individuals who reside in Malmö but choose not to commute to Denmark also benefit from the bridge through general equilibrium and spillover effects (e.g. through higher wage offers provided by Swedish firms in order to retain workers in Malmö, or through new possibilities to sell services across the strait)? Results obtained from estimating Equation (1) separately for commuters and non-commuters are presented in the Panels (c) and (d) of Figure 4. The results show that while the total wage effect is much larger for cross-border commuters, there is also a

[33]Appendix Figure A11 show where the in-migrants to Malmö come from and where the out-migrants of Malmö move to from 1998 to 2008. Municipalities bordering Scania refers to the municipalities in our main control group. Large cities not bordering Scania refers to the ten largest non-Scania non-bordering municipalities of Sweden.

[34]Note that these characteristics may be endogenous to the opening of the bridge. Therefore, we do not use this as our main specification.

[35]Individuals born outside of Sweden are classified as non-Scania born.

[36]Note that we have information on county of birth, not municipality of birth. We are therefore unable to restrict the sample to individuals born in Malmö. However, restricting our sample to individuals born in Scania allows us to rule out the possibility that individuals are moving from our control municipalities to our treatment municipality.

gain for the bigger group of non-commuters. This suggests that on average all Malmö residents, including those who choose not to commute to Denmark, are positively affected by the opening of the bridge. However, it is important to note that commuting is endogenous, such that we have to interpret these findings carefully. However, since there is likely negative selection into the group that chooses not to commute, we believe that these results are of independent interest.

Additional results on house prices, after-tax income and wages of Danish residents. In this section, we perform supplemental analyses to examine to what extent the identified wage gains among Malmö residents represent a real increase in income, or if these wage gains are offset by cross-country differences in tax schedules and differential growth in house prices. We will also show that we find no evidence of the bridge having a negative effect on the wages of Copenhagen residents.

With respect to house prices in the regions of interest during our analysis period, Appendix Figure A14 show the development of the house price index in the greater Malmö region and in our control municipalities during the analysis period (1997=100). The figure demonstrates that the house price index developed similarly in Malmö and in our control municipalities in the first several years after the opening of the bridge. However, the figure also shows that the house prices grew significantly faster in the Malmö region after 2004. Assuming that the average price of a house is 1 million SEK in 2000 (calculated based on two times the average income in 2000 times a debt-income ratio of 3.5), we can calculate the difference in the interest rate payments of a loan of 2 million SEK in Malmö versus 1.8 million SEK in control areas at 5 % interest rate (average interest rate for house loans in 2008).[37] This provides us with suggestive evidence on how much more residents in Malmö pay for housing in 2008 relative to the control municipalities. Using the above (conservative) values, the yearly costs in Malmö is approximately SEK 6,000 higher than in the control areas in 2008 compared to 2000. The average gain in wages (approximately SEK 20,000) is thus much higher than the additional housing cost in the region.

With respect to differences in the Danish and Swedish tax schedules, we do not have data to conduct a full after-tax analysis. However, we can apply the marginal tax schedules of the two countries for each year to our gross wage data and estimate an approximate after-tax effect.[38] This excercises leads to a mechanical reduction in the absolute magnitude of the point estimates, but the effect remains statistically significant at the one percent level, and as a percent of the pre-bridge mean the effect is identical to our main result: the bridge led to a 15 percent increase in the average wage of Malmö residents eight years after the opening of the bridge. This confirms that differences in tax schedules have a very limited impact on the effects identified in our main analysis.

Did the commuting and wage gains among individuals on the Swedish side of the strait negatively impact Copenhagen residents? To provide suggestive evidence on the effects of the bridge

[37]The earliest year we have information on the debt-income ratio 2011, and the 3.5 value used in the calculation should therefore be seen as an upper bound since the ratio in Sweden ha been rising substantially since 2000.

[38]Note that this is an approximation as we are unable to account for any individual tax deductions.

opening on individuals in the receiving city, we compare the aggregate mean wage in Copenhagen to the aggregate mean wage in East-Jutland.[39] Note that this exercise complements existing research on labor market effects of commuters on local workers in Germany (Dustmann, Schönberg, and Stuhler, 2017) and Switzerland (Beerli, Ruffner, Siegenthaler, and Peri, 2018). The results from this exercise are shown in Appendix Figure A15. The figure demonstrates that the wages in Copenhagen and East-Jutland are exhibiting similar trends prior to the opening of the bridge, and that wages in Copenhagen increase a bit more following the opening of the bridge compared to the wages in East-Jutland. This suggest that the impact of increased commuting across the strait among Swedes did not have a negative impact on the wages of Danish residents. If anything, it had a slight positive effect.[40] However, these results have to be interpreted with caution as they are based on simple differences in means between two regions over time.

5.2 Equity Concerns

Gender inequality. The results in Section 5.1 demonstrate that the opening of the bridge led to statistically significant and economically meaningful wage gains among individuals who resided on the Swedish side of the strait. However, these wage gains may not be equally distributed across workers. Specifically, high-educated workers and men are more likely to commute long distances for the same type of jobs than low-educated workers and women (Le Barbanchon, Rathelot, and Roulet, 2019). Thus, gaining access to a larger labor market might impact both income equality and the gender wage gap.

To examine these questions in detail, we estimate Equation (1) for our core outcomes separately for males and females. The results from this exercise are graphically presented in Figure 5, and parsimoniously summarized in Panels B and C of Table 1. Looking across the columns in Table 1, there are large differences in effects across genders. With respect to commuting, there is a 6 percentage point increase in the probability of working in Denmark among males. The magnitude of this effect is approximately 40 percent larger than the effect among women, who experience a 4 percentage point increase in the probability of working in Denmark. However, as a percentage of the pre-bridge mean, the gender-specific effects are relatively similar as females were less likely than males to work in Denmark before the opening of the bridge. Concerning total wages, males experience a gain of around 27,000 SEK per year ($ 2,700), while females experience an increase of approximately 12,000 SEK ($ 1,200). The difference in effect size is close to 80 percent, and even as a percentage of the pre-bridge mean, males benefit much more from the labor market expansion than females. In particular, as a percentage of the pre-bridge mean, males enjoy a 16 percent

[39] We chose East-Jutland because it is similar in size to Copenhagen, but the distance between East-Jutland and Copenhagen is too large for individuals in East-Jutland to commute in large numbers to Copenhagen and be affected by the bridge opening. However, using other regions in Denmark as controls does not alter the main finding of small positive wage increases.

[40] These results are similar to the findings in Beerli, Ruffner, Siegenthaler, and Peri (2018) who study cross-border commuting into Switzerland.

increase in total wage, while females experience a 10 percent increase.[41] With respect to the other labor market outcomes we examine in Table 2, it becomes clear that males and females respond differently on the extensive and intensive margin. Specifically, while most of the extensive margin response among males is driven by individuals on unemployment benefits who are actively looking for work, the female response is primarily driven by individuals going from not being in the labor force to working. With respect to the intensive margin responses among males and females, we again find noticeable differences; while there is a positive effect on holding multiple jobs among males, there is a negative effect on holding multiple jobs among females.

Having found significant gender differences in the identified commuting and wage effects, we probe the data further and examine if the gender differences in labor market effects also depend on the education levels of men and women. To this end, we stratify our sample based on whether the individual has more than a high school degree (high-educated) or a high school degree or less (low-educated), and reestimate Equation (1) separately for males and females by education level. The results from this analysis are graphically presented in Figure 5, and parsimoniously summarized in Table 3.

The results provided in Table 3 demonstrate that both high- and low-educated individuals experience an increase in the probability of commuting to Denmark following the construction of the bridge. However, the increase is substantially larger for high-educated individuals, with coefficient estimates that are approximately 50 percent larger than those for low-educated individuals. In addition, the effects are much larger for men conditional on educational level than for women. The differences between high- and low-educated males and females become even more apparent when examining the effect on total wage: total wage increases substantially more for high-educated men than for high-educated women (the difference in effect size is approximately 62 percent), and total wages do not increase at all for low-educated men and women.

To disentangle the source of the difference in effect size among high-educated men and women, Table 4 provides results on the probability of working in Denmark, and total wage, by broad educational specialization.[42] These results allow us to understand whether the identified gender differences are mainly driven by educational segregation, or whether men - irrespective of educational specialization - benefit more. Table 4 shows that the largest total wage effect is for men in natural sciences, math and information technology, and that the smallest total wage effect is for women and men in services. Interestingly, there is large variation in the number of people specializing in the different fields and in the gender difference in total wage effects across all education specializations. While women are more likely to have a degree in pedagogy and teacher education; humanities and arts; social science, law and public administration; health and social care; and services, men are more likely to have a degree in natural science, math and information technology; technology - industry and manufacturing; and farming, land science and animal science. With

[41] For comparison, we find no gender differences in wages for residents of Copenhagen; see Appendix Figure A16.

[42] Note that these results are conditional on the individuals having earned a college degree.

respect to gender differences in the number of people specializing in a specific field, it is worth highlighting the overrepresentation of men in technology - industry and manufacturing and the overrepresentation of women in health and social care. In terms of gender difference in total wage effects across educational specializations, in natural sciences, math and information technology, for example, men benefit 10 times more than women with the same education; in social sciences, law and public administration men benefit 3 times more; and in farming and land sciences women benefit 2 times more than men.

Within-couple inequality. The gender differences in effects identified above suggest that the opening of the bridge may have had an impact on the within-couple gender wage gap as well. To explore this question, we restrict our sample to married couples and estimate Equation (1) using the couple difference in commuting probability and total wage as dependent variables.

The results from this exercise are depicted graphically in Figure 6 and parsimoniously summarized in Panel A of Table 5. Looking across the columns in Panel A of Table 5, the within-couple gaps in commuting and total wages show an even starker picture of gender inequality than the results identified in the previous subsection. Specifically, eight years after the opening of the bridge, the within-household gender gap in the probability of working in Denmark is 11 percent relative to the pre-bridge mean of 0.002, and the within-household gender gap in total wages has increased by more than 34 percent relative to the pre-bridge mean. This large increase in the within-couple gender gap suggests that the new labor market access, despite representing a clear wage gain for the average individual in Malmö, had a big impact on the gender wage gap — both across- and within-households.

In Panels B and C of Table 5, we explore if the existence of children in the household has an impact on the within-couple wage gap, stratifying the sample based on whether the couple had at least one child under the age of 18 living with them or not. Comparing the results in Panels B and C, we see that the within-couple inequality in cross-border commuting is substantially larger if the couple has children. Among couples without children, the gender gap in cross-border commuting is relatively small. This suggests that young children represent a key reason for the lower probability of cross-border commuting among mothers.[43] The effect heterogeneity in cross-border commuting with respect to couples with and without children also translates into a large difference in the total wage effect: the within-couple gender gap in total wages is 40 percent larger among couples with children compared to couples without children. Yet, it is important to emphasize that there also is a substantial increase in the within-couple gender wage gap in households without young children. Hence, the presence of children is not the only factor underlying the effect of the OB on the within-couple gender wage gap. Additional factors, such as differences in total wage effects across education specializations, are important channels as well.

[43] Note that parents of young children are allowed a few paid sickness absence days due to their children's sickness in Sweden, but not in Denmark. As mothers are more likely to take such leave than fathers, this difference in welfare policies might be an additional reason why mothers of young children decide not to commute to Denmark.

Within-gender inequality. In addition to the identified gender heterogeneity, it is likely that the opening of the Öresund Bridge had a differential impact on within-gender income inequality. This is especially the case given the results in Tables 3 and 4, which reveal substantial variation in commuting and wage effects across education levels and specializations even conditional on gender.

To examine the within-gender distributional effects of the bridge opening, we estimate Equation (1) separately for males and females using a battery of conventional inequality measures as dependent variables: the 50/10 ratio, the 90/50 ratio, the 90/10 ratio, the interquartile range, the standard deviation, and the Gini coefficient. The results are displayed in Panels A and B of Table 6. The estimates provide strong and consistent evidence of increased within-gender inequality due to the opening of the bridge across the entire wage distribution. The one exception is the 50/10 ratio for females, for which we do not find a statistically significant or economically meaningful effect. This suggests that the within-gender inequality among women is primarily driven by individuals in the upper half of the distribution, while it is driven by individuals across the entire distribution among men.[44]

5.3 Robustness

The results in Sections 5.1 and 5.2 have all been obtained through estimation of Equation (1) using individuals in non-Scania border municipalities as our control group. We acknowledge that several alternative control groups can be used for the purpose of our analysis. In this section, we demonstrate the sensitivity of our results to two such alternatives.

First, we use individuals in the 30 largest cities in Sweden as our control group, excluding the Stockholm labor market area.[45] Although these cities represent a much more geographically diverse group than the municipalities in our main control group, they are more comparable to Malmö in terms of population size. Second, we use a synthetic control method based on all municipalities in Sweden outside of Scania.[46]

The results from estimating Equation (1) for our core outcomes using these alternative control groups are provided in Appendix Figure A13. The commuting as well as the total wage effects of the bridge are similar when using these alternative control groups compared to when using our main control group. This is true not only with respect to the magnitude of the effects, but also in terms of the lack of relative pre-treatment trends. This suggests that the results in Sections 5.1 and

[44]Another way to examine the distributional impact of the bridge opening is to estimate unconditional quantile regressions seperately for men and women, using total wage as the dependent variable. Results from this exercise are provided in Appendix Figure A12, and these results confirm the main findings in this section.

[45]We exclude the Stockholm area as the labor market outcomes in Malmö and the labor market outcomes in the Stockholm area are on very different trends prior to the opening of the bridge, violating the parallel trend assumption required for causal inference based on a difference-in-differences approach.

[46]The synthetic control has been chosen based on trends in the following observable characteristics prior to the opening of the bridge: population size, average age, fraction married, fraction immigrants, fraction with at least some college education, average number of children, employment status and gender balance.

5.2 are not driven by the specific choice of non-Scania border municipalities as the control group.[47]

5.4 Extension

In this section, we provide evidence on the importance of the Danish labor shortage in 2005-2008 for our main results, and we use the financial crisis of 2008 and the subsequent recession to document how volatile the wage effects and equity effects are to large economic shocks.

Effect of the Danish labor shortage. How much of our main effects can be explained by the Danish labor shortage in 2005-2008? As illustrated in Appendix Figure A7, the GDP per capita between Denmark and Sweden has been stable over the entire analysis period. However, the difference in unemployment rates between the two countries vary: while Sweden had a relatively high unemployment rate throughout the analysis period, the Danish unemployment rate was lower, in particular during the 2005-2008 period. Interestingly, 2005-2008 are also the years in which we see accelerated effects on commuting and wages. One way to understand the importance of the Danish labor shortage in explaining our results is to study the commuting and wage patterns of those living in the Helsingborg area. Helsingborg residents have the possibility to commute to Denmark through the Helsingborg-Helsingör link both before and after the opening of the bridge. Thus, these individuals are not affected by the bridge, and any effects we observe among individuals in the Helsingborg area are therefore most likely driven by the Danish labor shortage. Results from an estimation of Equation (1) using Helsingborg residents as our treatment group are shown in Figure A17. There are no commuting or wage effects of the bridge on individuals in Helsingborg in the first years after the bridge opened. However, starting with the Danish labor shortage in 2005, we see an increase in commuting and total wage also for individuals living in Helsingborg. Assuming that these estimates for Helsingborg are an upper bound of the labor shortage effect in the absence of the bridge for individuals living in Malmö,[48] we find that the labor shortage can explain about 15% of the commuting effect and about 30% of the wage effect in 2008. This still leaves a substantial bridge effect on both commuting and total wages during the years of the Danish labor shortage.[49]

Effect volatility with respect to economic shocks. For our main results, we restricted the analysis to the period 1997-2008 to prevent the financial crises in 2008 and the subsequent

[47] Given the structure of our data and the potential clustering issue caused by having only one treated group, we have also performed permutation tests in which we randomly assign individuals in our sample to treatment. This excercise allows us to examine whether our main effects simply are driven by random noise, or if they likely respresent true causal effects of the bridge. We have performed this excercise for each of our variables using 100 permutation repetitions, and our true estimates are meaningfully larger than the distribution of these placebo estimates for each of the outcomes.

[48] As Malmö residents would have had a longer travel distance to Denmark in the absence of the bridge, the effect of the labor shortage in the absence of the bridge estimated using Helsingborg residences are likely an upper bound.

[49] Note that we cannot rule out complementarities in the effect of the bridge and the effect of the labor shortage in our setting. Hence, the effects we estimate might be larger than the two separate effects of the bridge and the labor shortage in Denmark.

recession from affecting the results. In this section, we extend the time window to study effects also during and after the financial crisis. This exercise enables us to better understand how a large economic shock with asymmetric consequences across regions may counteract the initial effects of labor market expansions. Panel (a) of Figure 7 suggests that commuting starts decreasing in 2009 compared to the peak in 2008, for both males and females. Panel (b) of Figure 7 suggests that total wages follows a similar pattern, starting to decrease in 2009 for both males and females. However, although substantially lower than the peak year of 2008, total wages are not falling back to pre-bridge levels by 2014.[50]

Interestingly, Panels (a) and (b) of Figure 7 suggest that the decrease in both commuting and total wage is very similar across genders, such that the within-household gender gap may have been unaffected by the economic downturn. This is supported by Panels (c) and (d) of Figure 7, which show that the within-couple gender commuting and wage gaps remained constant during the economic downturn. These results demonstrate that not only do husbands benefit more from new labor market opportunities than their wives in a boom period, but they are also able to maintain this relative gain when these opportunities diminish during a recession.

6 Conclusion

Recent decades have seen a substantial increase in the size of local labor markets across the globe, and advances in transportation infrastructure represent one of the main drivers behind this phenomenon. Yet, a lack of exogenous variation in individuals' access to larger labor markets has prevented a comprehensive analysis on the labor market effects of this development. This limits our ability to understand how current labor market developments interact with government objectives such as economic growth and equality.

In this paper, we exploit the opening of the Öresund bridge as an exogenous change in access to a larger labor market for individuals residing in Malmö on the Swedish side of the strait. Our results show that the bridge led to substantial increases in commuting and wages of Swedes residing in Malmö. In terms of magnitude, individuals close to the bridge experienced a 15 percent increase in their wages eight years after the opening of the bridge. This provides strong evidence of a large wage gain for individuals in Malmö due to the expansion of the local labor market.

In terms of equity, we find that the wage effects are largest for high-educated men and smallest for low-educated women. This differential impact across skill groups and genders fueled an increase in both across- and within-household wage inequality. These effects are driven not only by differences in the propensity to commute, but also by educational specialization. Specifically, female commuters are more likely to have service-oriented educational backgrounds where the gains from access to a larger labor market are smaller, while men are more likely to have business and

[50] Note that some of the decreases in wage gains might be a result of large changes in the exchange rates after 2008.

STEM-related degrees with much higher returns to commuting.

The effects identified in this paper are important for understanding obstacles to income equality and the closing of the gender wage gap. Even though the bridge led to an increase in wages among Swedes residing close to the bridge, these wage gains vary greatly across individuals depending on their tradeoffs between commuting and wages. Le Barbanchon, Rathelot, and Roulet (2019) show that men and women have different reservation wages for commuting after a job loss, which is consistent with our finding that men residing in Malmö are more likely to take advantage of the new opportunities in Denmark. Moreover, these findings contribute to the literature on agglomeration economics with a clear identification of wage gains from access to a large labor market (Overman and Puga, 2010), the findings complement the work on the effects of cross-border commuters on the local workforce (Dustmann, Schönberg, and Stuhler, 2017; Beerli, Ruffner, Siegenthaler, and Peri, 2018), and the results advance the literature on drivers of income inequality (Alvaredo, Chancel, Piketty, Saez, and Zucman, 2018).

In terms of policy implications, our results highlight the importance of understanding the tradeoffs between positive labor market outcomes and equity when deciding on infrastructure projects.[51] It should be noted that our paper speaks to how infrastructure projects that substantially expand labor market and commuting opportunities affect wages and equity. Other large-scale infrastructure projects that connect regions or integrate labor markets include the development of high-speed train connections across metropolitan labor markets (e.g. TGV, Thalys, ICE in Europe or the Shinkansen in Japan) and the opening of bridges and tunnels that provide direct links between labor markets (e.g. the Gotthard Base Tunnel and the Hong Kong-Zhuhai-Macau Bridge). The effects of infrastructure projects that improve transportation links between suburbs and city centers might, however, produce different results from those identified in this paper; such projects often aim to lower commuting time for already existing commuting routes rather than encourage new commuting behavior.

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[51] A few example of proposed (but not implemented) bridges in the US includes the Long Island Sound Link between New York and Connecticut and the Southern Crossing in San Francisco.

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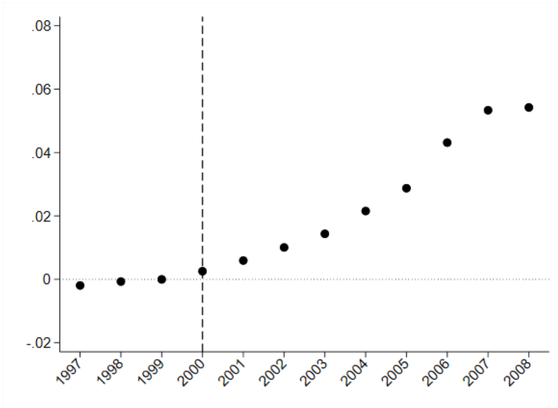
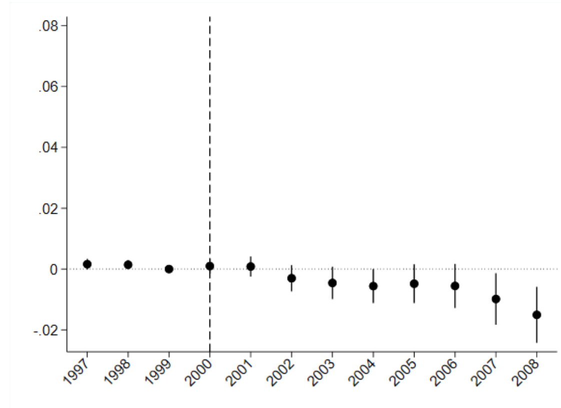
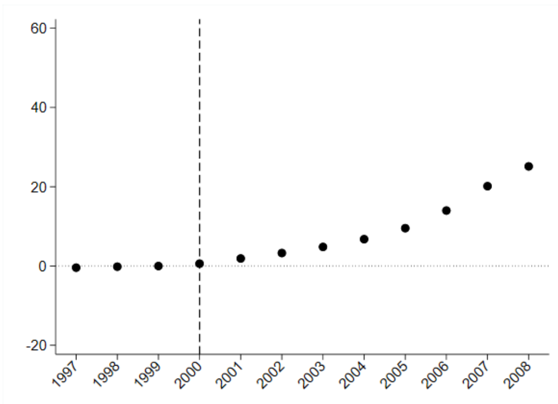
7 Tables and Figures



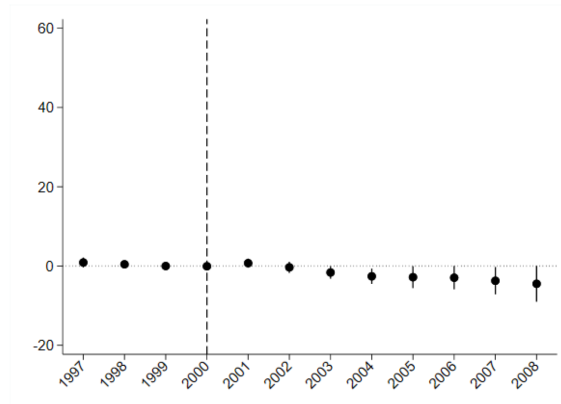
(a) Working in Denmark



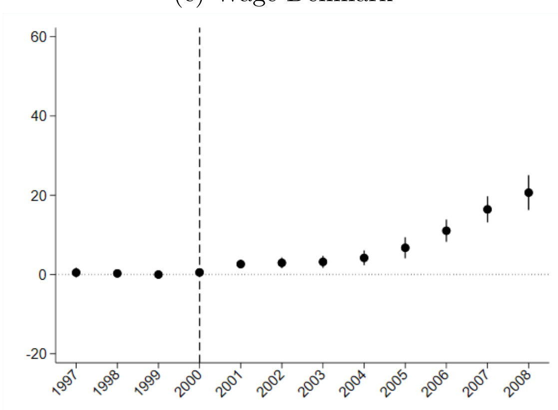
(b) Working in Sweden



(c) Wage Denmark



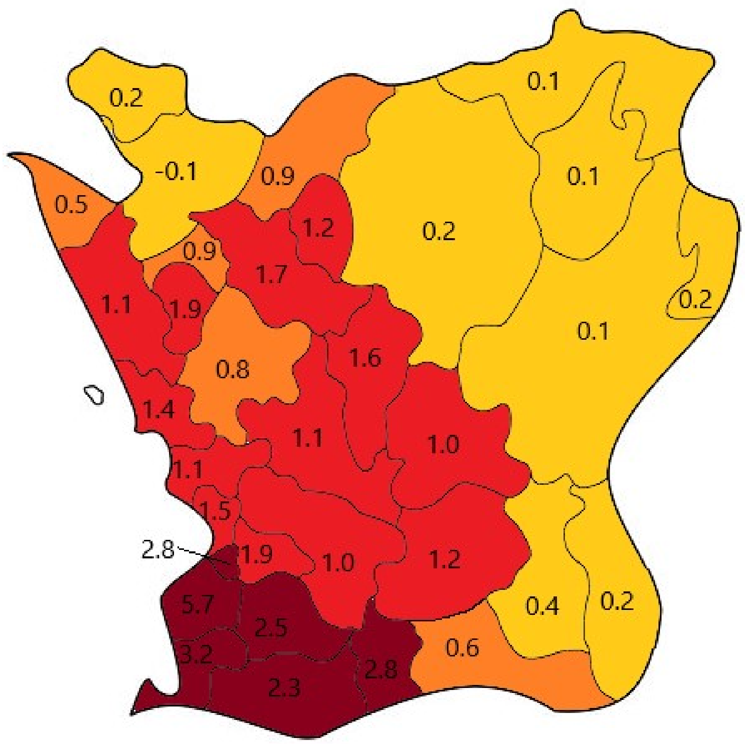
(d) Wage Sweden



(e) Total Wage

Figure 1: Effect of the Bride Opening on Cross-Border Commuting and Wages

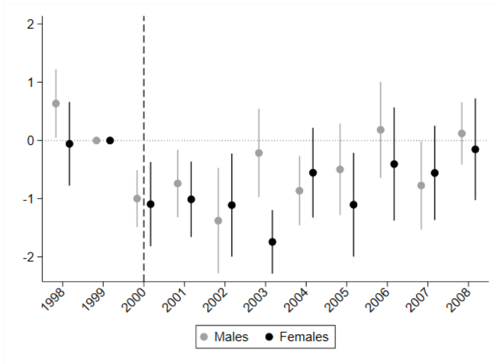
Notes: This figure shows the authors' estimation of Equation (1) as described in the text using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. The dots represent the δ_t estimate from Equation (1) for each of the years indicated on the horizontal axis. The bars extending from the dots represent the 95 percent confidence intervals, clustered at the municipality level. Sample is based on approximately 6 million individual-year observations, and includes all individuals between the ages of 18 and 65 who resided in one of the treatment and control municipalities during the analysis window. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. Wage includes total yearly wages in Denmark, Sweden, or both. Wages are measured in thousands of SEK, where 1 SEK is approximately USD 0.1. Individuals with zero wages are included in the estimation. Individuals are defined as working in Denmark if they have positive wages from Denmark and as working in Sweden if they have positive wages from Sweden.



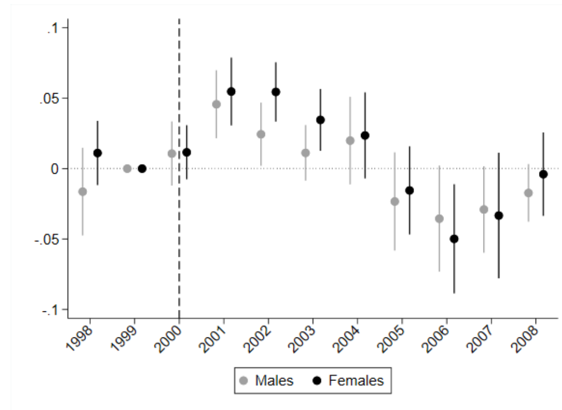
(a) Working in Denmark

Figure 2: Spillover Effects Across Scania

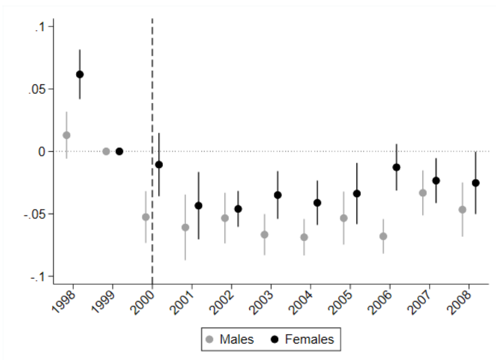
Notes: This figure shows a heat map of the authors' estimation of Equation (1) as described in the text using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. The numbers represent the $\delta_2 008$ estimate from Equation (1) and are obtained by estimating Equation (1) separately for each of the municipalities on the map and the control municipalities. Sample includes all individuals between the ages of 18 and 65 who resided in one of the treatment and control municipalities during the analysis window. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. The outcome variable is the probability of working in Denmark. This variable takes the value of 1 if the individual had a positive wage from Denmark in the given year, and 0 otherwise.



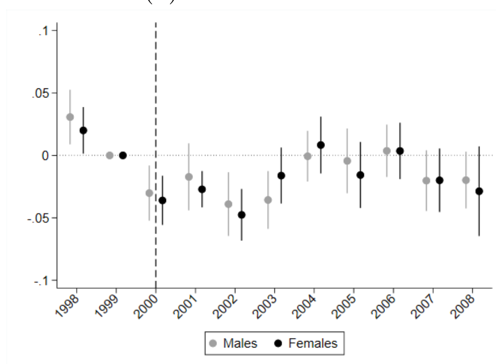
(a) Age



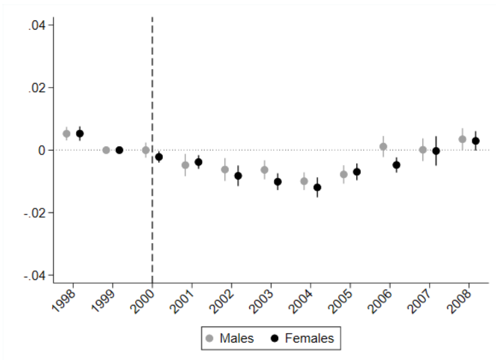
(b) Education



(c) Children



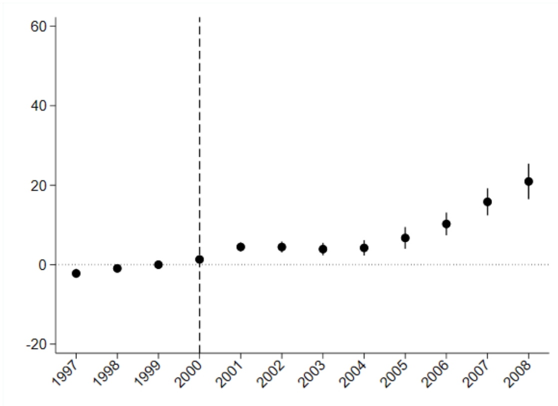
(d) Married



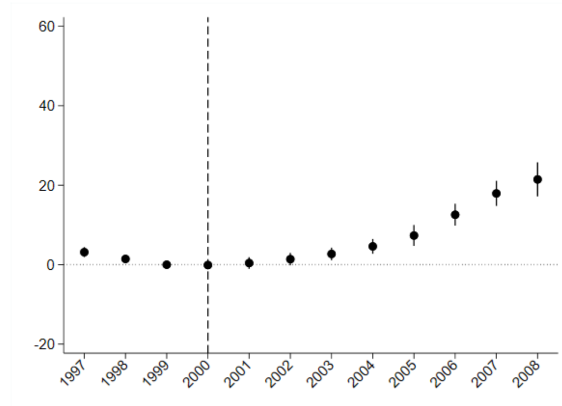
(e) Net migration

Figure 3: Selective Sorting into Malmö

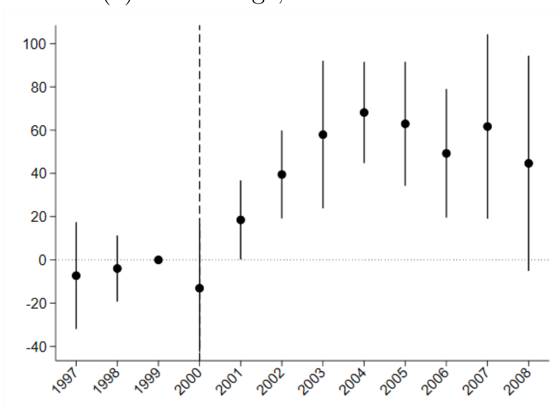
Notes:This figure shows the authors' estimation of a modified version of Equation (1) using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. The sample is based on all individuals aged 18 through 65 who lived in Malmö or in one of the control municipalities in a given year. The sample is further restricted to individuals who lived in a different municipality in the previous year (i.e. inmigrants) and individuals who live in a different municipality in the next year (i.e. outmigrants). The estimating equation underlying Panels (a) through (d) is akin to a triple difference, in which the first difference comes from that between Malmö and the control group, the second difference comes from that over time, and the third difference comes from that between inmigrants and outmigrants. The estimates should therefore be interpreted as the difference in the characteristics of the individuals moving in to the municipality relative to the characteristics of the individuals moving out from the municipality. The estimating equation underlying Panel (e) is based on the original version of Equation (1) as described in the text, with the outcome variable taking the value of 1 if the individual moved into the municipality in a given year, -1 if the individual moved out from the municipality in a given year, and 0 otherwise. The dots represent interactions of the δ_t estimate from Equation (1) with a dummy for being an inmigrant, for each of the years indicated on the horizontal axis. The bars extending from the dots represent the 95 percent confidence intervals, clustered at the municipality level. All estimates include municipality, year, municipality-by-inmigrant, and year-by-inmigrant fixed effects. With respect to the outcome variables shown in the figure, children is a dummy variable for having a child and education is an indicator variable for having more than a high school degree.



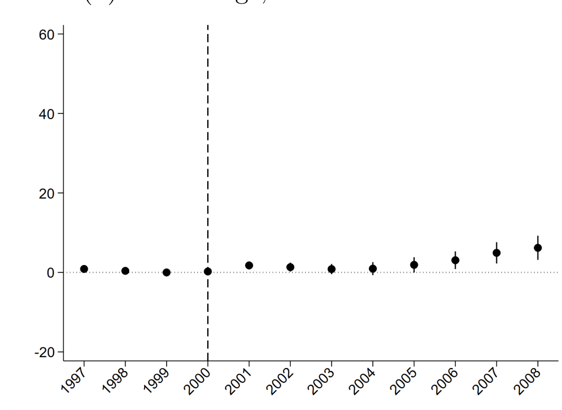
(a) Total Wage, Born in Scania



(b) Total Wage, Not Born in Scania



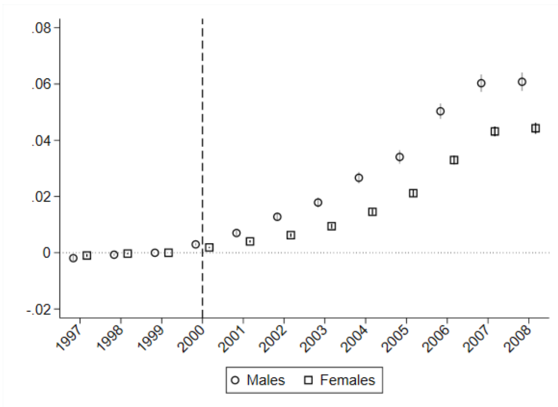
(c) Total Wage, Commuters



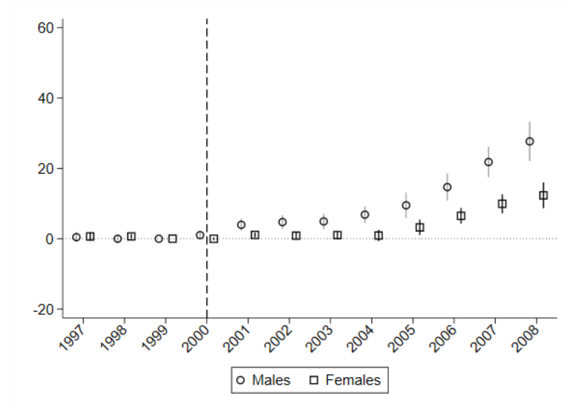
(d) Total Wage, Non-Commuters

Figure 4: Effect of the Bride Opening for Residents vs. Non-residents and Commuters vs. Non-Commuters

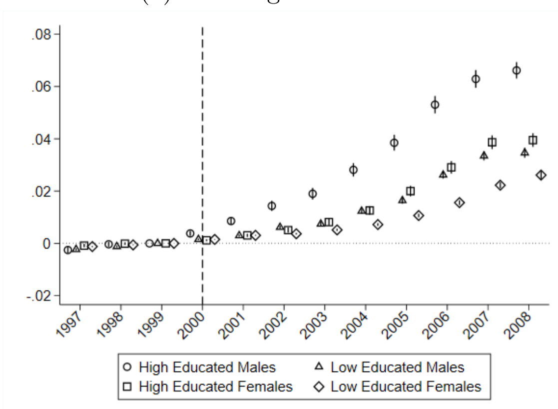
Notes: This figure shows the authors' estimation of Equation (1) as described in the text using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. The dots represent the δ_t estimate from Equation (1) for each of the years indicated on the horizontal axis. The bars extending from the dots represent the 95 percent confidence intervals, clustered at the municipality level. Sample is stratified based on whether the individual was born in Scania (Panel (a)), was not born in Scania (Panel (b)), commuted to Denmark (Panel (c)), or did not commute to Denmark (Panel (d)). Sample includes all individual between the ages of 18 and 65 who resided in one of the treatment and control municipalities during the analysis window. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. Wage includes total yearly wages in Denmark and Sweden. Wages are measured in thousands of SEK, where 1 SEK is approximately USD 0.1. Individuals with zero wages are included in the estimation.



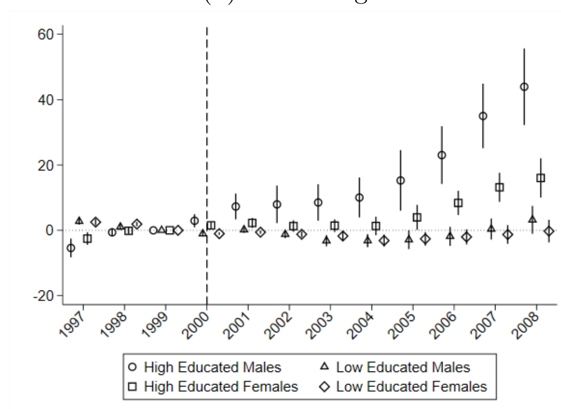
(a) Working in Denmark



(b) Total Wage



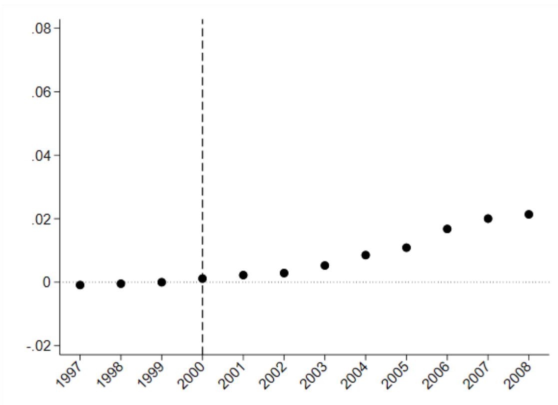
(c) Working in Denmark



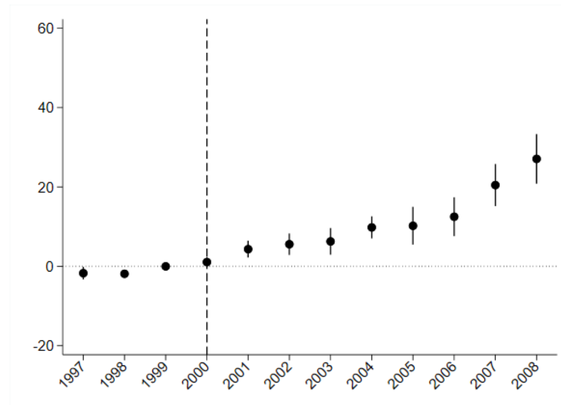
(d) Total Wage

Figure 5: Effect of the Bride Opening by Gender and Education

Notes: This figure shows the authors' estimation of Equation (1) as described in the text using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. The dots represent the δ_t estimate from Equation (1) for each of the years indicated on the horizontal axis. The bars extending from the dots represent the 95 percent confidence intervals, clustered at the municipality level. Sample includes all individual between the ages of 25 and 65 who resided in one of the treatment and control municipalities during the analysis window. The 25 year age cutoff differs from the 18 year age cutoff in the main analysis, and is chosen because this represents the age at which the majority of individuals have completed their education. Low educated individuals are defined as individuals with no more than a high school degree, and high educated individuals are defined as individuals with more than a high school degree. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. Wage includes total yearly wages in Denmark and Sweden. Wages are measured in thousands of SEK, where 1 SEK is approximately USD 0.1. Individuals with zero wages are included in the estimation.



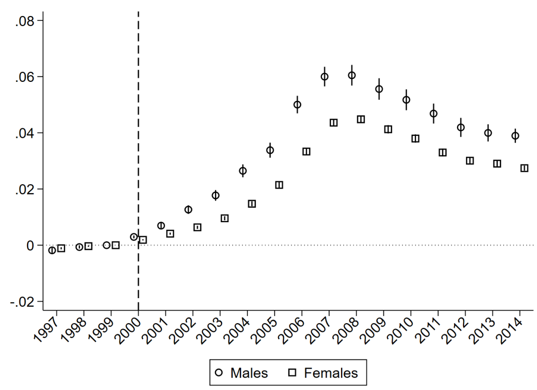
(a) Working in Denmark



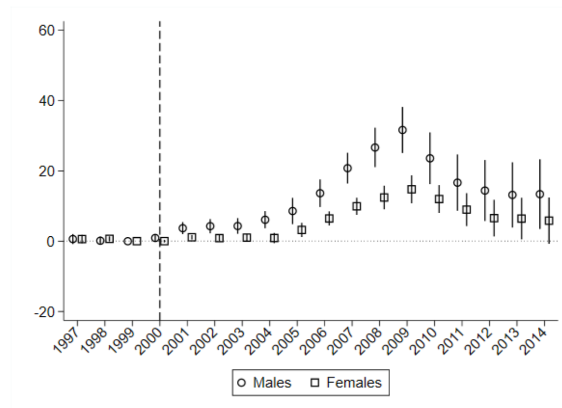
(b) Total Wage

Figure 6: Within-Household Effects of the Bride Opening

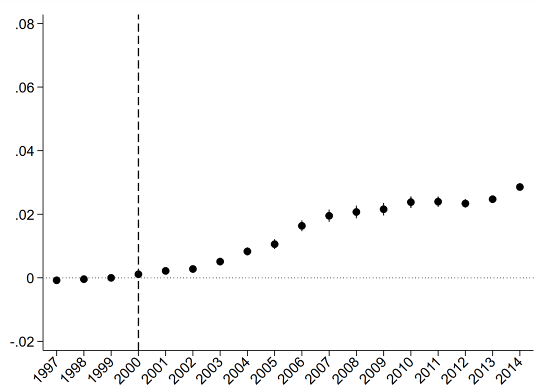
Notes: This figure shows the authors' estimation of Equation (1) as described in the text using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. The dots represent the δ_t estimate from Equation (1) for each of the years indicated on the horizontal axis. The bars extending from the dots represent the 95 percent confidence intervals, clustered at the municipality level. Sample includes all married couples living together and who resided in one of the treatment and control municipalities during the analysis window. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. Total wage measures the difference in wage between the husband and wife. Wage includes total yearly wages in Denmark and Sweden. Wages are measured in thousands of SEK, where 1 SEK is approximately USD 0.1. Individuals with a zero wage gap are included in the estimation. Working in Denmark measured the difference in the probability of working in Denmark between the husband and the wife. Individuals are defined as working in Denmark if they have positive wages from Denmark.



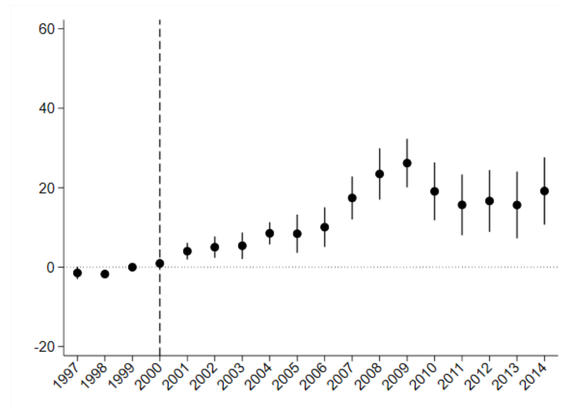
(a) Working in Denmark, by Gender



(b) Total Wage, by Gender



(c) Working in Denmark, Within-Household



(d) Total Wage, Within-Household

Figure 7: Effects of the Bride Opening and an Economic Downturn

Notes: This figure shows the authors' estimation of Equation (1) as described in the text using 1997-2014 administrative data from Statistics Sweden and Statistics Denmark. The dots represent the δ_t estimate from Equation (1) for each of the years indicated on the horizontal axis. The bars extending from the dots represent the 95 percent confidence intervals, clustered at the municipality level. Sample includes all individual between the ages of 18 and 65 who resided in one of the treatment and control municipalities during the analysis window. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. Wage includes total yearly wages in Denmark and Sweden. Wages are measured in thousands of SEK, where 1 SEK is approximately USD 0.1. Individuals with zero wages are included in the estimation.

Table 1: Effect of the Bride Opening on Cross-Border Commuting and Wages

	Working in Denmark	Working in Sweden	Wage in Denmark	Wage in Sweden	Wage Total
Panel A: Men and Women Pooled					
Malmo Resident	0.053***	-0.009*	25.142***	-4.478*	20.664***
	(0.001)	(0.005)	(0.294)	(2.163)	(2.098)
Mean	0.003	0.794	0.821	137.446	138.267
Observations	6375370	6375370	6375370	6375370	6375370
Panel B: Men					
Malmo Resident	0.061***	-0.003	33.019***	-5.346*	27.673***
	(0.002)	(0.005)	(0.522)	(2.727)	(2.665)
Mean	0.004	0.796	1.214	164.133	165.347
Observations	3237882	3237882	3237882	3237882	3237882
Panel C: Women					
Malmo Resident	0.044***	-0.015***	16.956***	-4.618**	12.338***
	(0.001)	(0.004)	(0.179)	(1.802)	(1.745)
Mean	0.002	0.791	0.417	109.990	110.407
Observations	3137488	3137488	3137488	3137488	3137488

Notes: This table shows the authors' estimation of Equation (1) as described in the text using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. The table shows 8-year estimates from the full event study model. Sample is based on approximately 6 million individual-year observations, and includes all individual between the ages of 18 and 65 who resided in one of the treatment and control municipalities during the analysis window. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. Wage includes total yearly wages in Denmark, Sweden, or both. Wages are measured in thousands of SEK, where 1 SEK is approximately USD 0.1. Individuals with zero wages are included in the estimation. Individuals are defined as working in Denmark if they have positive wages from Denmark and as working in Sweden if they have positive wages from Sweden. The outcome means represent the mean in Malmö in the year prior to the bridge opened (1999). Standard errors clustered at the municipality level are shown in parentheses. * indicates significance at the 10% level, ** indicates significance at the 5 % level, and *** indicates significance at the 1 % level.

Table 2: Effect of the Bride Opening on the Extensive and Intensive Employment Margin

	Employment Extensive Margin	Employment — No UI	Unemployment Insurance	Above Mean Annual SEK Wage	Multiple Jobs
Panel A: Men and Women Pooled					
Malmo Resident	0.036***	0.033***	-0.018***	0.064***	-0.002
	(0.005)	(0.005)	(0.003)	(0.006)	(0.002)
Mean	0.795	0.805	0.152	0.502	0.224
Observations	6375370	5633173	6375370	6375370	6375370
Panel B: Men					
Malmo Resident	0.050***	0.044***	-0.037***	0.074***	0.013***
	(0.005)	(0.005)	(0.004)	(0.007)	(0.003)
Mean	0.799	0.813	0.130	0.580	0.234
Observations	3237882	2911371	3237882	3237882	3237882
Panel C: Women					
Malmo Resident	0.020***	0.020***	0.002	0.049***	-0.019***
	(0.004)	(0.004)	(0.003)	(0.005)	(0.003)
Mean	0.792	0.795	0.174	0.422	0.210
Observations	3137488	2721802	3137488	3137488	3137488

Notes: This table shows the authors' estimation of Equation (1) as described in the text using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. The table shows 8-year estimates from the full event study model. Sample is based on approximately 6 million individual-year observations, and includes all individuals between the ages of 18 and 65 who resided in one of the treatment and control municipalities during the analysis window. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. Extensive margin employment is equal to 1 if the individual worked in any of the countries in the given year, and 0 otherwise. Unemployment insurance is equal to 1 if the individual received unemployment benefits from the Swedish government in the given year, and 0 otherwise. Above mean annual SEK wage is equal to 1 if the individual received a wage greater than the average wage in Sweden during the given year, and 0 otherwise. Multiple jobs is equal to 1 if the individual received wage from more than one employer in the given year, and 0 otherwise. While we have information on the number of employers in Sweden, we do not have this information for Denmark, such that this outcome represents a lower bound of the probability of holding multiple jobs. The outcome means represent the mean in Malmö in the year prior to the bridge opened (1999). Standard errors clustered at the municipality level are shown in parentheses. * indicates significance at the 10% level, ** indicates significance at the 5 % level, and *** indicates significance at the 1 % level.

Table 3: Effect of the Bride Opening by Gender and Education Level

	High-Educated		*Low-Educated*	
	Working in Denmark	Total Wage	Working in Denmark	Total Wage
Panel A: Men				
Malmo Resident	0.066***	43.934***	0.035***	3.193
	(0.002)	(5.593)	(0.001)	(2.032)
Mean	0.006	233.844	0.003	146.452
Observations	798910	798910	1931306	1931306
Panel B: Women				
Malmo Resident	0.040***	16.019***	0.026***	-0.244
	(0.001)	(2.863)	(0.001)	(1.653)
Mean	0.003	153.629	0.001	96.489
Observations	898650	898650	1750200	1750200

Notes: This table shows the authors' estimation of Equation (1) as described in the text using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. The table shows 8-year estimates from the full event study model. Sample includes all individual between the ages of 25 and 65 who resided in one of the treatment and control municipalities during the analysis window. The 25 year age cutoff differs from the 18 year age cutoff in the main analysis, and is chosen because this represents the age at which the majority of individuals have completed their education. Low educated individuals are defined as individuals with no more than a high school degree, and high educated individuals are defined as individuals with more than a high school degree. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. Wage includes total yearly wages in Denmark and Sweden. Wages are measured in thousands of SEK, where 1 SEK is approximately USD 0.1. Individuals with zero wages are included in the estimation. Individuals are defined as working in Denmark if they have positive wages from Denmark. The outcome means represent the mean in Malmö in the year prior to the bridge opened (1999). Standard errors clustered at the municipality level are shown in parentheses. * indicates significance at the 10% level, ** indicates significance at the 5 % level, and *** indicates significance at the 1 % level.

Table 4: Effect of the Bride Opening by Education Specialization

	Working in Denmark		*Total Wage*	
	Males	Females	Males	Females
Pedagogy and TeacherEd.	0.035***	0.016***	16.660***	6.087***
[Males=92,880]	(0.001)	(0.000)	(2.449)	(1.170)
[Females=265,841]				
Humanities and Arts	0.045***	0.047***	18.460***	11.503***
[Males=72,517]	(0.001)	(0.000)	(2.743)	(1.756)
[Females=91,463]				
SocSci, Law and PublicAdm.	0.067***	0.042***	44.221***	13.894***
[Males=349,765]	(0.003)	(0.002)	(6.873)	(3.208)
[Females=549,707]				
NatSci, Math and InfTech.	0.106***	0.067***	60.360***	5.999
[Males=63,298]	(0.002)	(0.001)	(7.762)	(6.082)
[Females=41,499]				
TechInd and Manufacturing	0.040***	0.043***	23.744***	30.778***
[Males=994,986]	(0.001)	(0.001)	(3.919)	(4.961)
[Females=124,865]				
Farming, LandSci and AnimalSci	0.029***	0.039***	8.403***	17.184***
[Males=73,502]	(0.001)	(0.001)	(2.149)	(3.607)
[Females=20,693]				
Health and SocCare	0.039***	0.023***	15.166***	7.680***
[Males=106,395]	(0.001)	(0.000)	(3.326)	(1.752)
[Females=619,949]				
Services	0.057***	0.038***	-1.477	-1.778
[Males=157,870]	(0.002)	(0.001)	(3.081)	(1.702)
[Females=175,015]				

Notes: This table shows the authors' estimation of Equation (1) as described in the text using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. The table shows stratified regressions based on the broad education specialization of the individuals, as defined by Statistics Sweden. Individuals with no recorded education specialization are excluded from the table. The table shows 8-year estimates from the full event study model. Sample includes all individual between the ages of 25 and 65 who resided in one of the treatment and control municipalities during the analysis window. The 25 year age cutoff differs from the 18 year age cutoff in the main analysis, and is chosen because this represents the age at which the majority of individuals have completed their education. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. Wage includes total yearly wages in Denmark and Sweden. Wages are measured in thousands of SEK, where 1 SEK is approximately USD 0.1. Individuals with zero wages are included in the estimation. Individuals are defined as working in Denmark if they have positive wages from Denmark. The outcome means represent the mean in Malmö in the year prior to the bridge opened (1999). Standard errors clustered at the municipality level are shown in parentheses. * indicates significance at the 10% level, ** indicates significance at the 5 % level, and *** indicates significance at the 1 % level.

Table 5: Within-Household Effect of the Bride Opening

	Working in Denmark	Total Wage
Panel A: Within-Household Gap		
Malmo Resident	0.021***	27.083***
	(0.001)	(2.984)
Mean	0.002	79.996
Observations	1284219	1284219
Panel B: Within-Household Gap, with Children under 18		
Malmo Resident	0.035***	28.028***
	(0.001)	(3.554)
Mean	0.003	103.596
Observations	349030	349030
Panel C: Within-Household Gap, without Children under 18		
Malmo Resident	0.004***	17.347***
	(0.000)	(2.472)
Mean	0.002	67.028
Observations	655931	655931

Notes: This table shows the authors' estimation of Equation (1) as described in the text using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. The table shows 8-year estimates from the full event study model. Sample includes all married couples living together and who resided in one of the treatment and control municipalities during the analysis window. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. Total wage measures the difference in wage between the husband and wife. Wage includes total yearly wages in Denmark and Sweden. Wages are measured in thousands of SEK, where 1 SEK is approximately USD 0.1. Individuals with a zero wage gap are included in the estimation. Working in Denmark measured the difference in the probability of working in Denmark between the husband and the wife. Individuals are defined as working in Denmark if they have positive wages from Denmark. The outcome means represent the mean in Malmö in the year prior to the bridge opened (1999). Standard errors clustered at the municipality level are shown in parentheses. * indicates significance at the 10% level, ** indicates significance at the 5 % level, and *** indicates significance at the 1 % level.

Table 6: Inequality Effects of the Bride Opening

	50-10	90-50	90-10	IQR	SD	Gini
Panel A: Men						
Malmo Resident	26.043***	16.880***	42.924***	37.473***	79.850***	0.009***
	(2.396)	(3.675)	(5.480)	(3.995)	(5.690)	(0.003)
Mean	172.039	151.621	323.660	223.724	147.712	0.340
Observations	3237882	3237882	3237882	3237882	3237882	3237882
Panel B: Women						
Malmo Resident	-2.228	21.635***	19.408***	26.706***	18.587***	0.017***
	(1.358)	(3.118)	(3.650)	(1.416)	(2.048)	(0.002)
Mean	107.387	123.551	230.937	170.843	97.256	0.354
Observations	3137488	3137488	3137488	3137488	3137488	3137488

Notes: This table shows the authors' estimation of Equation (1) as described in the text using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. The table shows 8-year estimates from the full event study model. Sample is based on approximately 6 million individual-year observations, and includes all individuals between the ages of 18 and 65 who resided in one of the treatment and control municipalities during the analysis window. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. The 50-10 ratio measures the inequality between the middle and the bottom of the wage distribution. The 90-50 ratio measures the inequality between the top and the middle of the wage distribution. The 90-10 ratio measures the inequality between the top and the bottom of the wage distribution. The IQR (interquartile range) measures the difference between the 75th and the 25th percentiles of the wage distribution. The SD (standard deviation) is equal to the square root of the variance and measures the amount of wage dispersion. The Gini is a measure of statistical dispersion, and ranges from 0 to 1 where 1 represents perfect inequality. The outcome means represent the mean in Malmö in the year prior to the bridge opened (1999). Standard errors clustered at the municipality level are shown in parentheses. * indicates significance at the 10% level, ** indicates significance at the 5 % level, and *** indicates significance at the 1 % level.

Online Appendix: Not For Publication

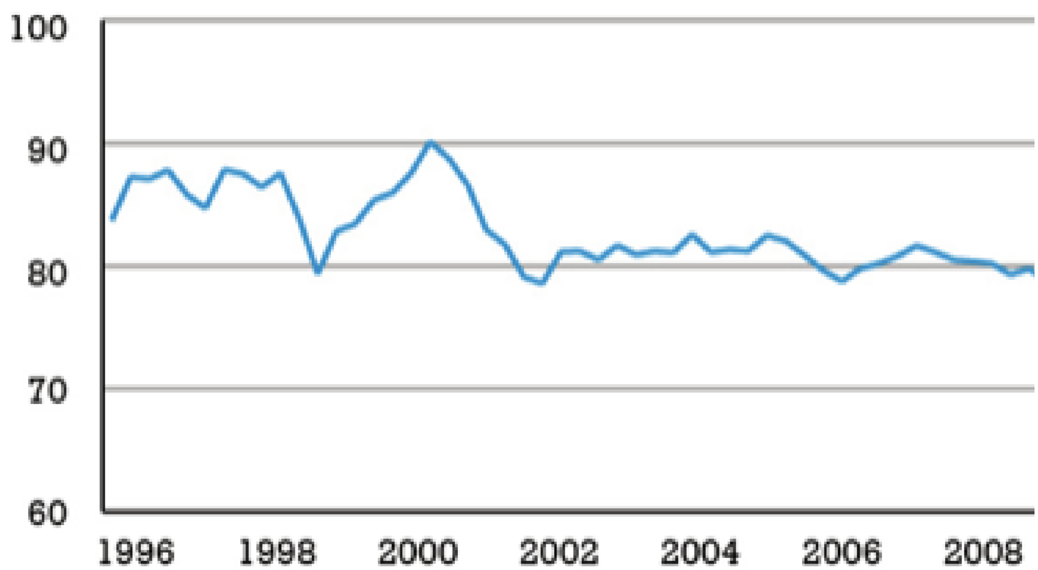


Figure A1: DKK-SEK Exchange Rate

Notes: The value of 1 SEK in DKK over time. Data based on publically-available information from the National Bank of Denmark.

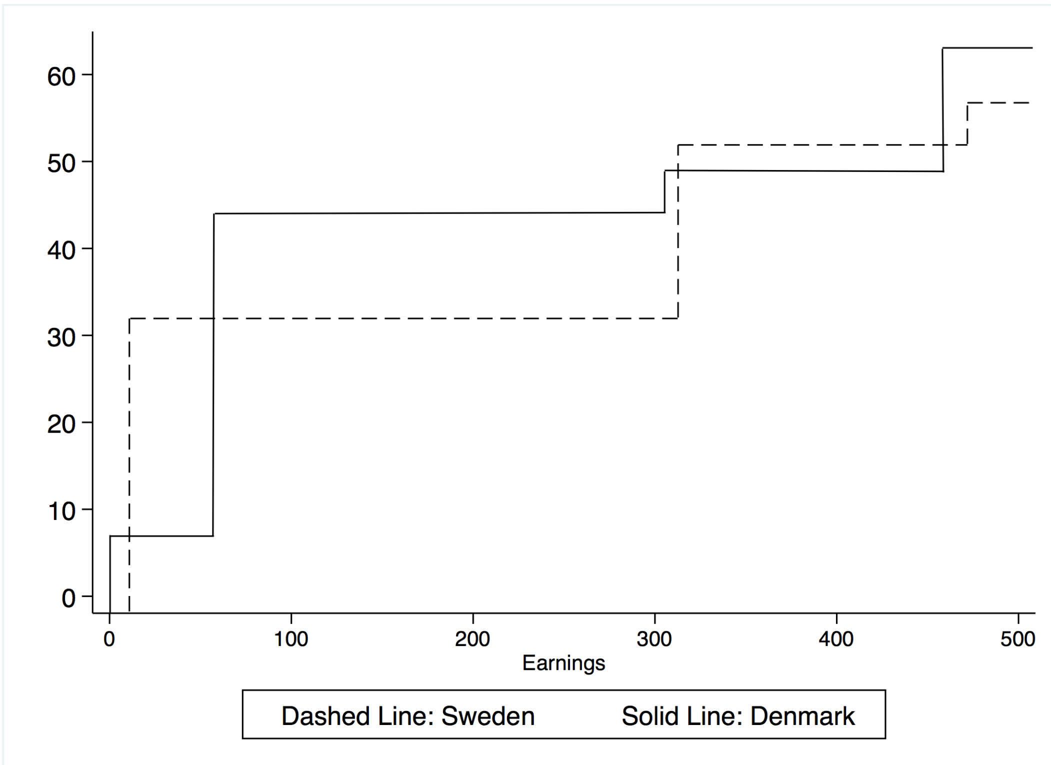


Figure A2: Income Tax Schedules in 2004

Notes: Marginal tax rates in Malmö and Copenhagen in 2004 based on information from the Danish and Swedish tax authorities.

Figure A3: Öresund Region

Notes: Visual illustration of the Öresund region. Map has been obtained from Steenstrup (2012).

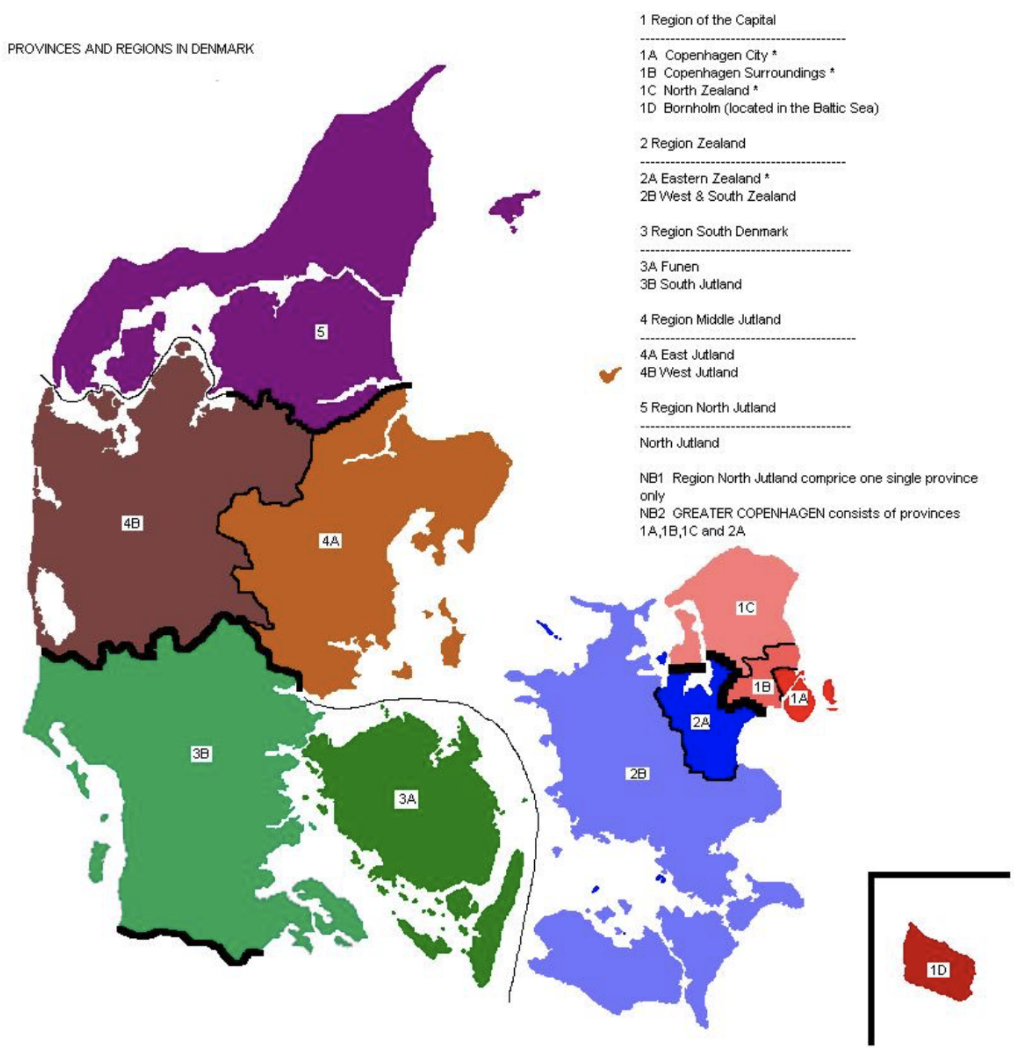


Figure A4: Regions of Denmark

Notes: Figure provides a visual illustration of the aggregate geographic regions in Denmark. Figure is taken from Orestat.

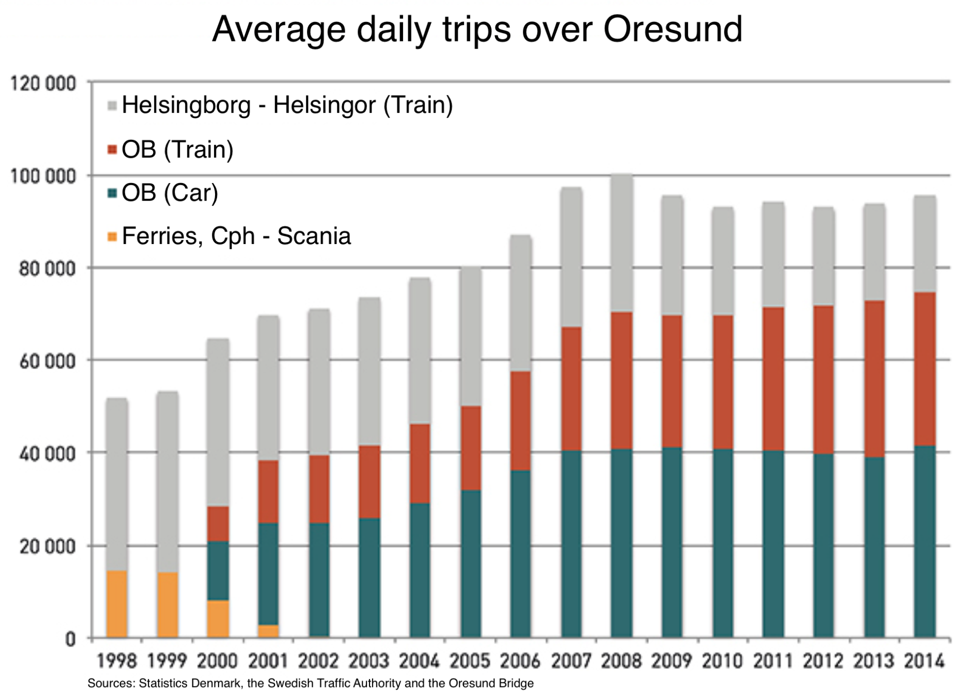


Figure A5: Traffic over Öresund per Year

Notes: Average daily traffic over Öresund per year. Information obtained from Örestundsinstituttet, which can be accessed via the following link: https://www.oresundsinstituttet.org/fakta-4/

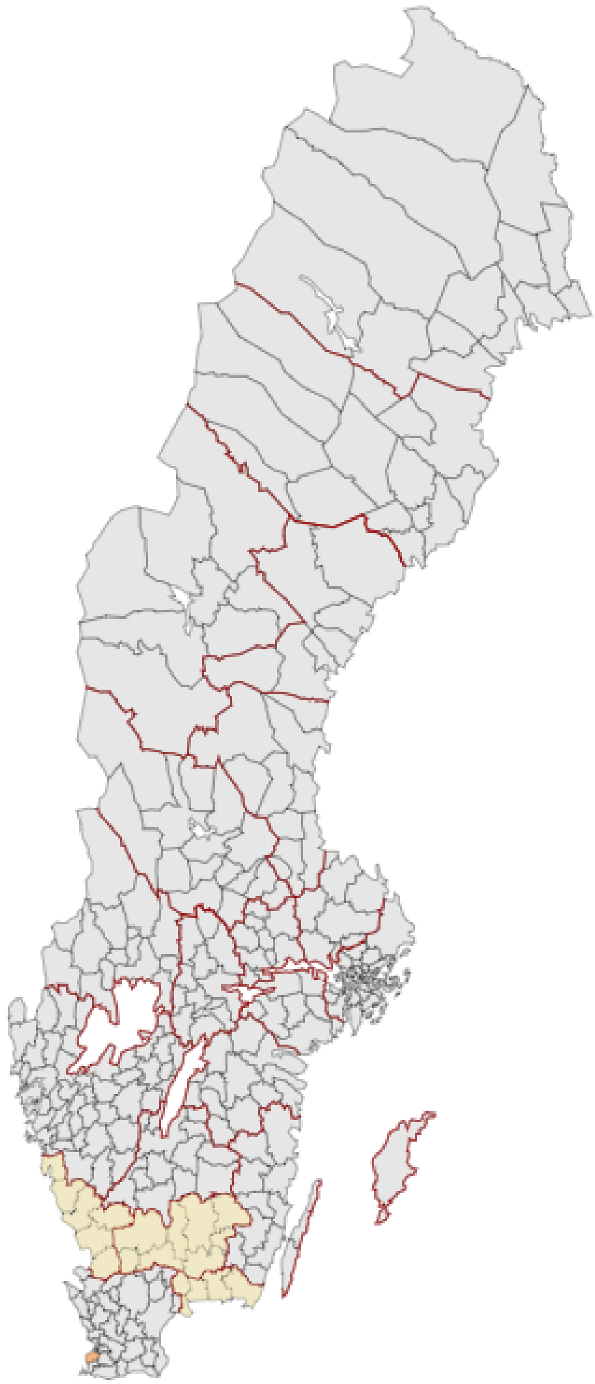
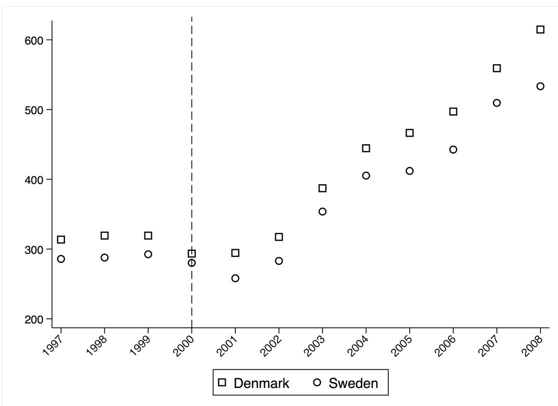
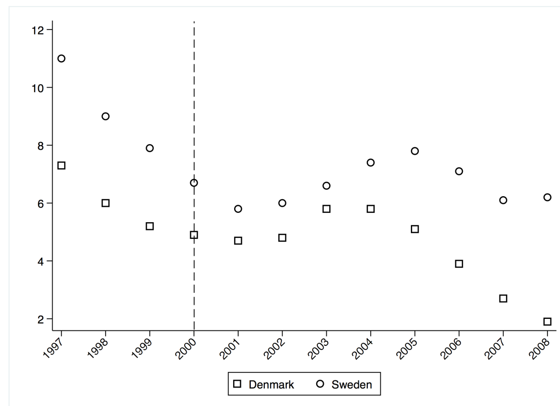


Figure A6: Main Control and Treatment Groups

Notes: Visual illustration of treatment and control groups used for the main analysis. Grey lines denote municipality borders. Red lines denote county borders. Area in orange denotes Malmö municipality. Areas in yellow denote municipalities in the three border counties of Scania: Halland, Kronoberg and Blekinge. In our main analysis, we compare individuals residing in Malmö (organge area) with individuals residing in the non-Scania border municipalities (yellow areas).



(a) GDP per capita



(b) Unemployment rate

Figure A7: Danish and Swedish Local Labor Market Conditions 1997–2008

Notes: Authors' estimation based on data from Statistics Denmark and Statistics Denmark. This data is publicly available at https://www.dst.dk and https://www.scb.se

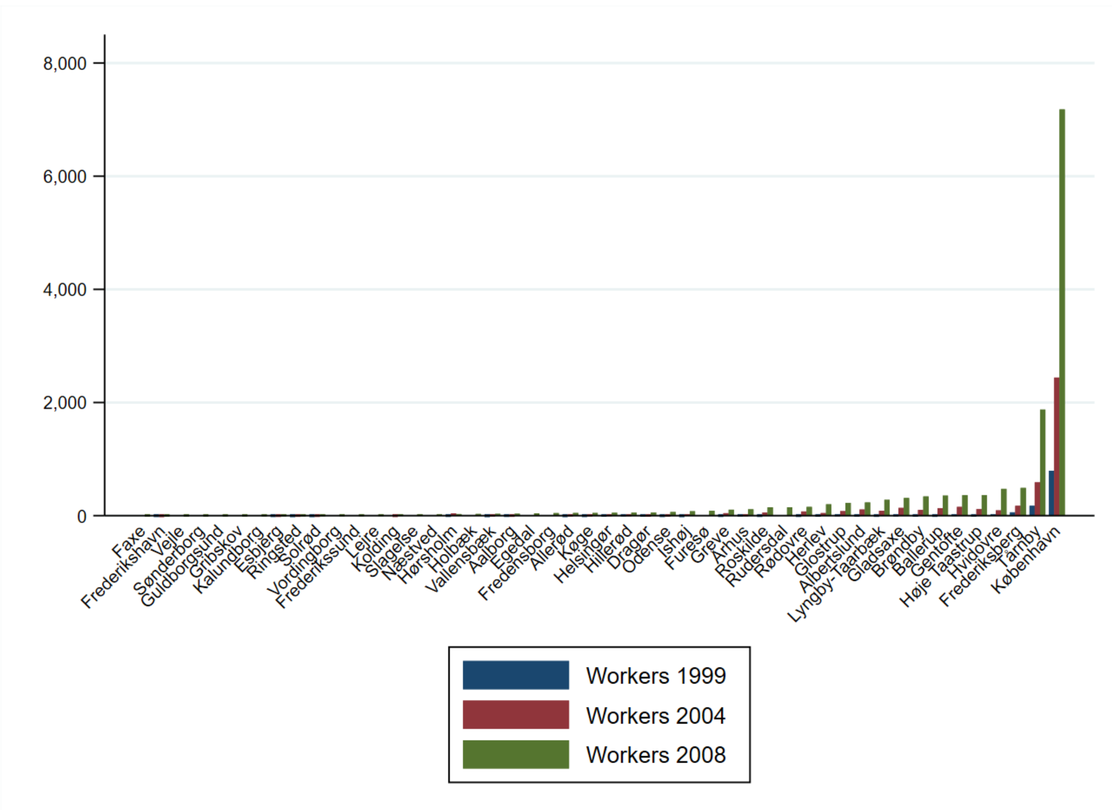


Figure A8: Where in Denmark Commuters from Malmö Work

Notes: This figure shows the authors' estimation of Equation (1) as described in the text using 1999-2008 administrative data from Statistics Sweden and Statistics Denmark. The figure shows the number of workers from Malmö that work in each of the Danish municipalities in 1999, 2004 and 2008. Danish municipalities that had less than 11 workers from Malmö in 2008 have been dropped from the figure.

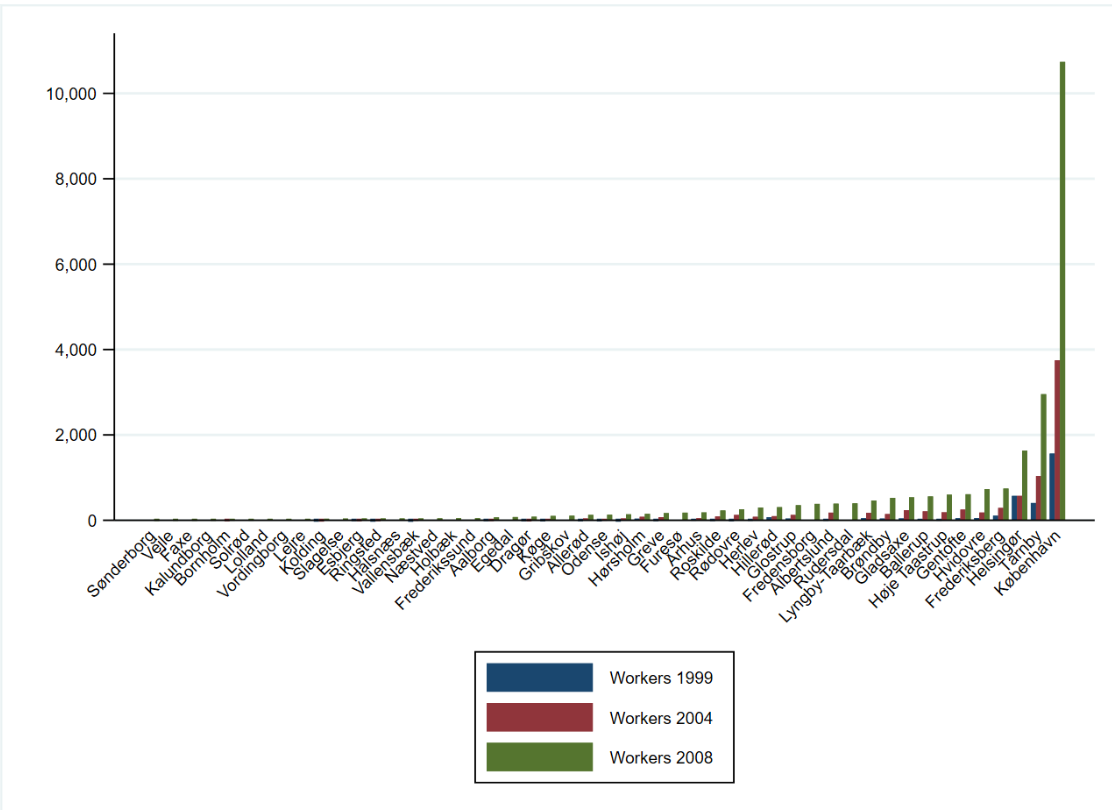
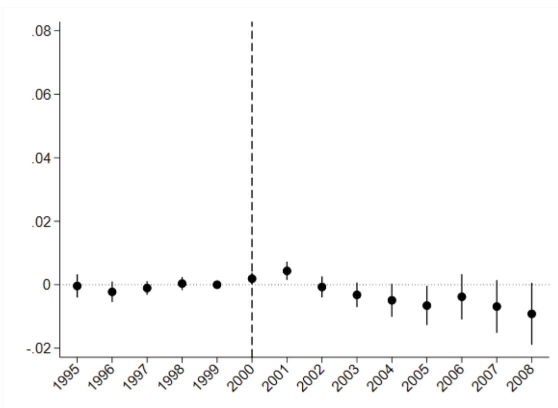
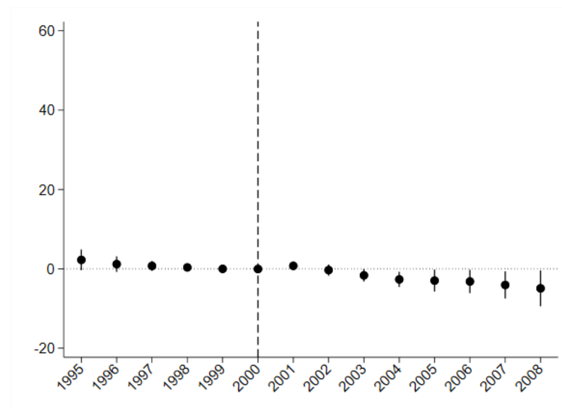


Figure A9: Where in Denmark Commuters from Scania Work

Notes: This figure shows the authors' estimation of Equation (1) as described in the text using 1999-2008 administrative data from Statistics Sweden and Statistics Denmark. The figure shows the number of workers from Scania that work in each of the Danish municipalities in 1999, 2004 and 2008. Danish municipalities that had less than 21 workers from Scania in 2008 have been dropped from the figure.



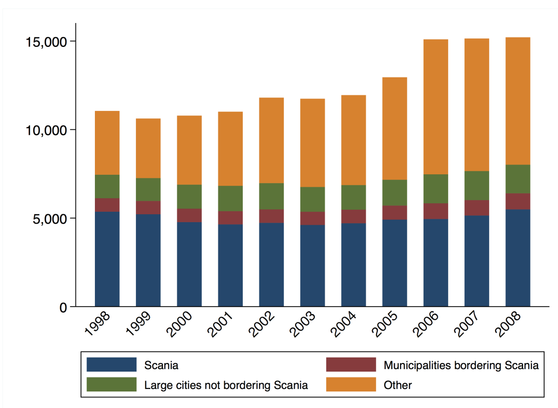
(a) Work in Sweden



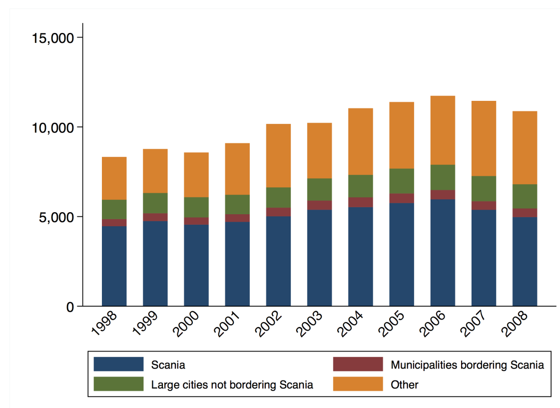
(b) Wage from Sweden

Figure A10: Effect on Wages and Employment in Sweden, Extended Pre-Trends

Notes: This figure shows the authors' estimation of Equation (1) as described in the text using 1995-2008 administrative data from Statistics Sweden and Statistics Denmark. The dots represent the δ_t estimate from Equation (1) for each of the years indicated on the horizontal axis. The bars extending from the dots represent the 95 percent confidence intervals, clustered at the municipality level. Sample is based on approximately 6 million individual-year observations, and includes all individual between the ages of 18 and 65 who resided in one of the treatment and control municipalities during the analysis window. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. Wage includes total yearly wage in Sweden. Wages are measured in thousands of SEK, where 1 SEK is approximately USD 0.1. Individuals with zero wages are included in the estimation. Individuals are defined as working in Sweden if they have positive wages from Sweden.



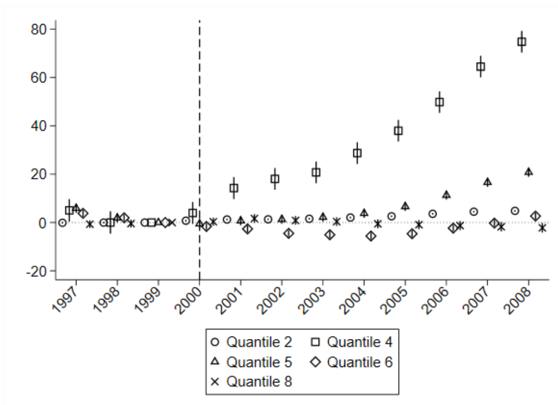
(a) Inmigration from



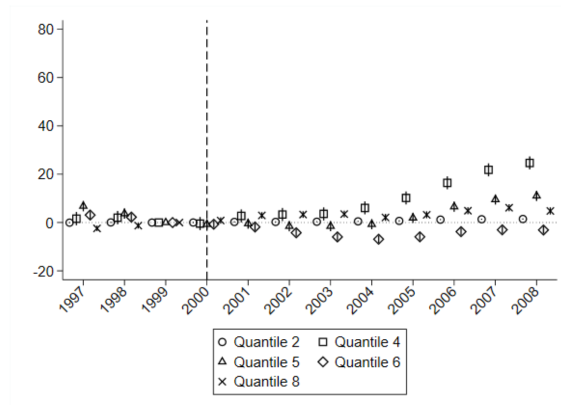
(b) Outmigration to

Figure A11: In- and Out-Migration from Malmö 1998–2008

Notes: Authors' estimation using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. Municipalities bordering Scania refers to the municipalities in our main control group. Large cities not bordering Scania refers to the ten largest non-Scania non-bordering municipalities of Sweden.



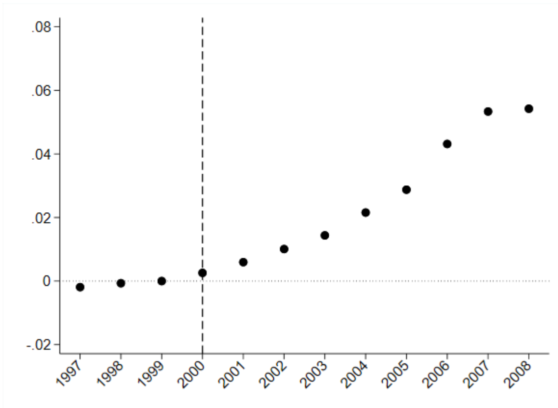
(a) Total wage, males



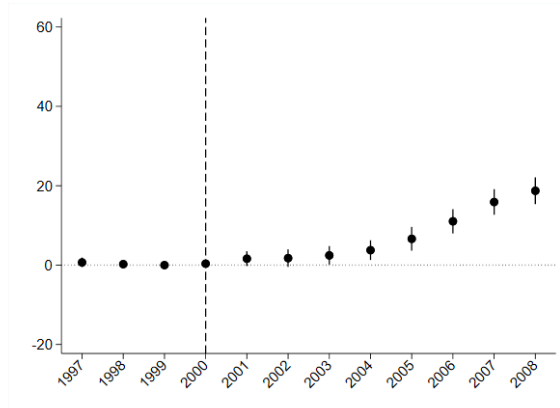
(b) Total wage, females

Figure A12: Quintile Effects

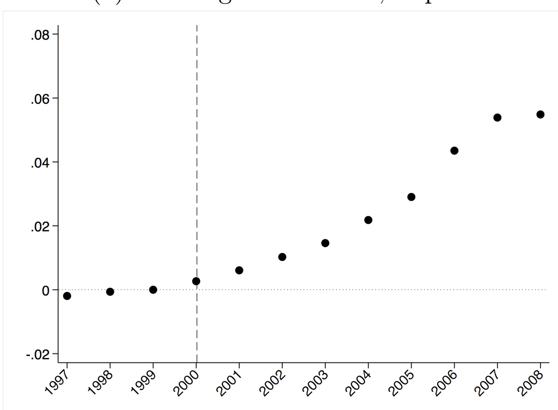
Notes: This figure shows the authors' estimation of Equation (1) as described in the text using RIF regressions and 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. The dots represent the δ_t estimate from Equation (1) for each of the years indicated on the horizontal axis. The bars extending from the dots represent the 95 percent confidence intervals, clustered at the municipality level. Each gender-specific sample is based on approximately 3 million individual-year observations, and includes all individual between the ages of 18 and 65 who resided in one of the treatment and control municipalities during the analysis window. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. Wage includes total yearly wages in Denmark and Sweden. Wages are measured in thousands of SEK, where 1 SEK is approximately USD 0.1. Individuals with zero wages are included in the estimation.



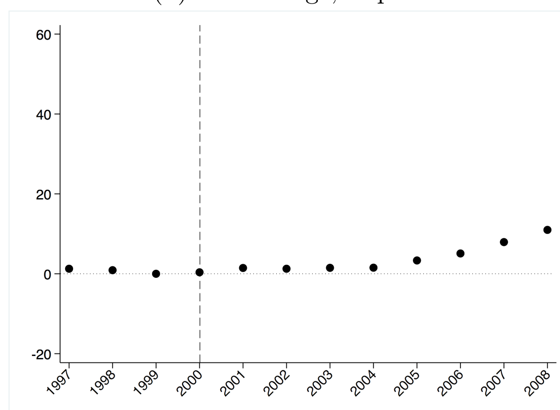
(a) Working in Denmark, Top 30



(b) Total Wage, Top 30



(c) Working in Denmark, Synthetic Control



(d) Total Wage, Synthetic Control

Figure A13: Effect of Bridge, Alternative Control Groups

Notes: This figure shows the authors' estimation of Equation (1) as described in the text using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. In subfigures (a) and (b), the control group consists of the 30 largest non-Stockholm non-Scania municipalities of Sweden. In subfigures (c) and (d), a syntethic control group based on all non-Scania municipalities in Sweden have been used. The synthetic control has been chosen based on trends in the following observable characteristics prior to the opening of the bridge: population size, average age, fraction married, fraction immigrants, fraction with at least some college education, average number of children, employment status and gender balance. The dots represent the δ_t estimate from Equation (1) for each of the years indicated on the horizontal axis. The bars extending from the dots represent the 95 percent confidence intervals, clustered at the municipality level. Sample is based on approximately 6 million individual-year observations, and includes all individual between the ages of 18 and 65 who resided in one of the treatment and control municipalities during the analysis window. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. Wage includes total yearly wages in Denmark, Sweden, or both. Wages are measured in thousands of SEK, where 1 SEK is approximately USD 0.1. Individuals with zero wages are included in the estimation.

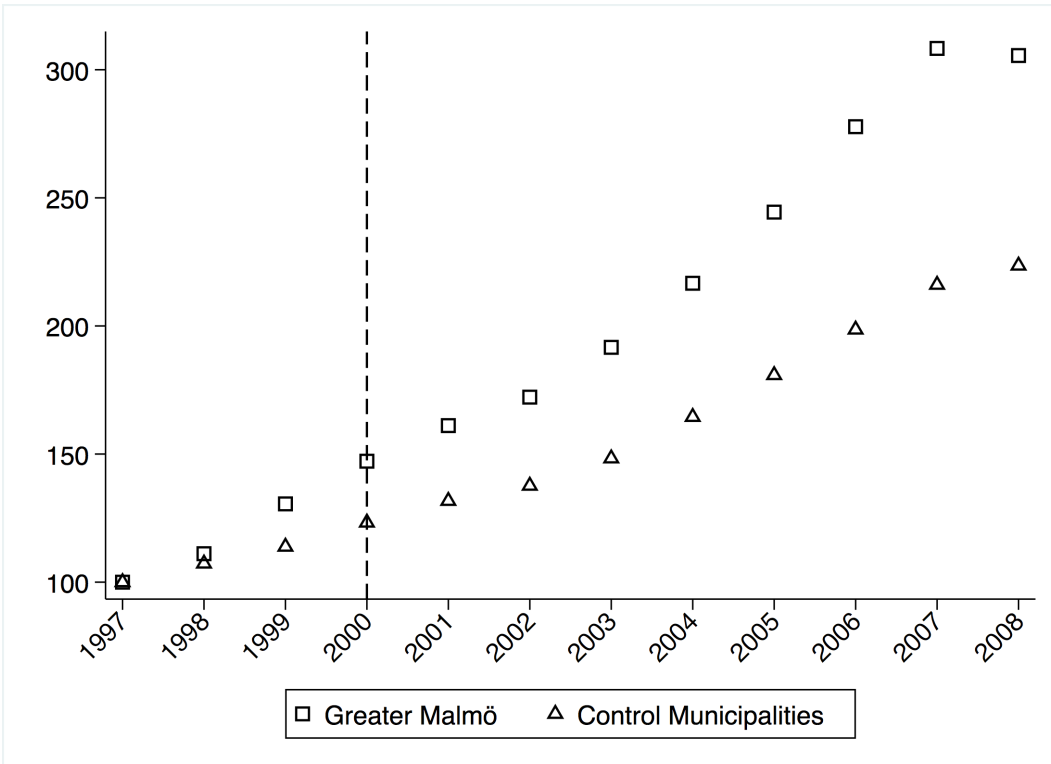


Figure A14: House Price Index Development (1997==100)

Notes: House Price Index of Greater Malmo and the Control units based on publically-available data which can be accessed through www.orestat.se. The HPI is set to equal 100 in the first year of the analysis period, 1997.

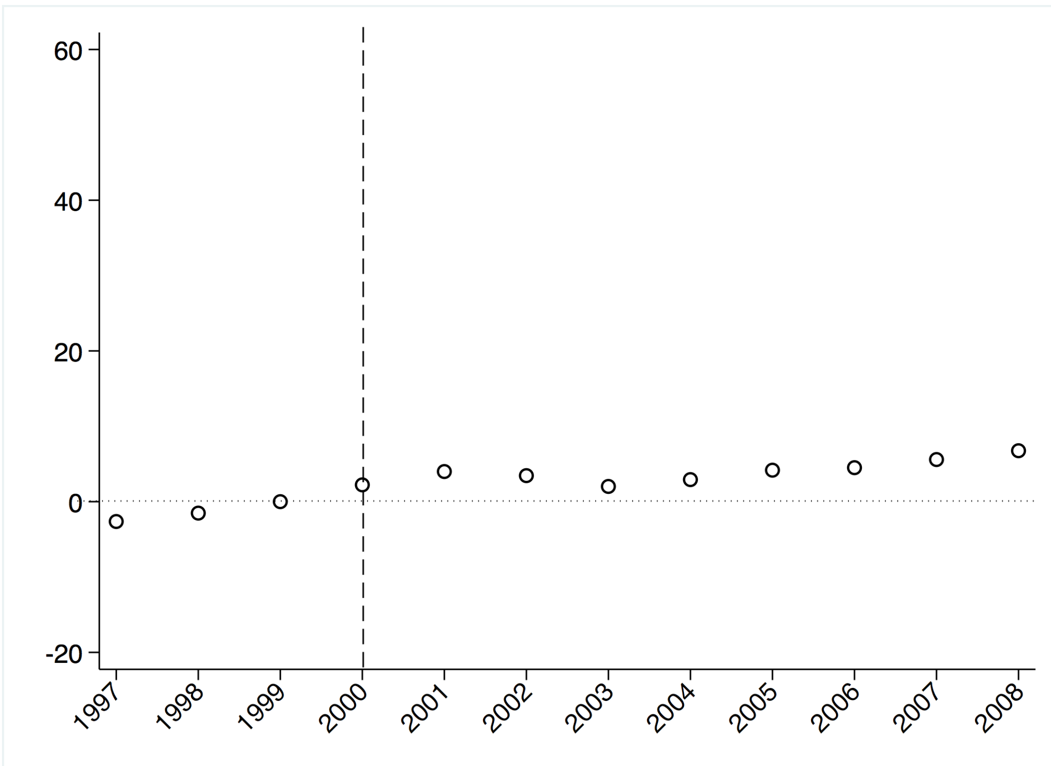


Figure A15: Suggestive Wage Effects on the Danish Side

Notes: Figure shows the average wage in Copenhagen and East-Jutland for each year between 1997 and 2008 using publically-available data from Statistics Denmark (http://statbank.dk).

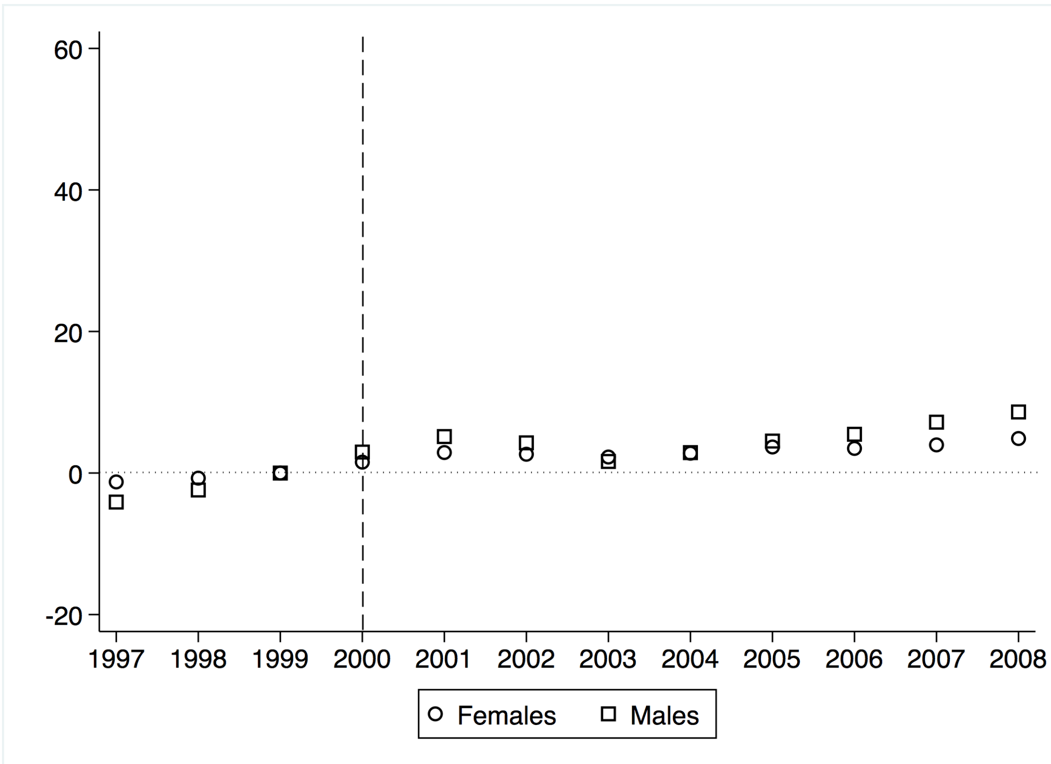
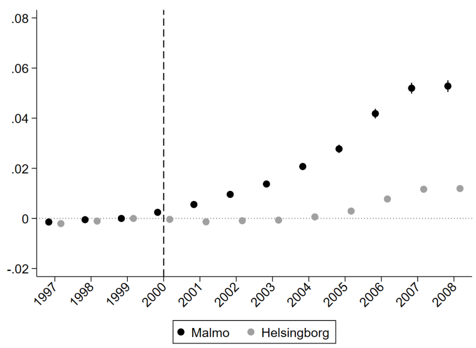
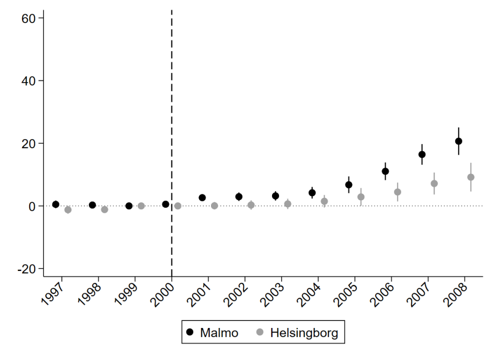


Figure A16: Suggestive Wage Effects on the Danish Side

Notes: Figure shows the average gender-specific wage in Copenhagen and East-Jutland for each year between 1997 and 2008 using publically-available data from Statistics Denmark (http://statbank.dk).



(a) Working in Denmark



(b) Total wage

Figure A17: Wage and Commuting Effects in Malmö and Helsingborg

Notes: This figure shows the authors' estimation of Equation (1) as described in the text using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. The equation has been estimated seperately for Malm versus the control municipalities and for Helsingborg versus the control municipalities. The dots represent the δ_t estimate from Equation (1) for each of the years indicated on the horizontal axis. The bars extending from the dots represent the 95 percent confidence intervals, clustered at the municipality level. Sample is based on approximately 6 million individual-year observations, and includes all individual between the ages of 18 and 65 who resided in one of the treatment and control municipalities during the analysis window. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. Wage includes total yearly wage in Sweden. Wages are measured in thousands of SEK, where 1 SEK is approximately USD 0.1. Individuals with zero wages are included in the estimation. Individuals are defined as working in Sweden if they have positive wages from Sweden.

Table A1: Percent of commuters by commuting stint

	Scania	Malmö
One year	38.26	37.55
Two years	24.57	25.07
Three years	13.73	14.67
Four years	7.81	7.90
Five years	5.21	5.35
Six years	3.23	3.21
Seven years	2.23	2.19
Eight years	1.37	1.30
Nine years or more	3.59	2.76
Average years	2.70	2.64

Notes: Authors' estimation based on cross-country matched registry data on all Swedes aged 18 through 64.

Table A2: Age Stratification

		Work in Denmark	Total Wage
Panel A: Aged 18-29			
	Malmö Resident	0.069***	7.331***
		(0.002)	(2.321)
	Mean	0.010	83.651
	Sample Size	1 606 682	1 606 682
Panel B: Aged 30-49			
	Malmö Resident	0.062***	21.713***
		(0.001)	(2.986)
	Mean	0.010	142.200
	Sample Size	2 808 052	2 808 052
Panel C: Aged 50-64			
	Malmö Resident	0.015***	3.180
		(0.001)	(2.983)
	Mean	0.005	137.322
	Sample Size	1 960 636	1 960 636

Notes: This table shows the authors' estimation of Equation (1) as described in the text using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. The table shows 8-year estimates from the full event study model. Sample includes all individual in the age ranges specified in the table who resided in one of the treatment and control municipalities during the analysis window. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. Wage includes total yearly wages in Denmark and Sweden. Wages are measured in thousands of SEK, where 1 SEK is approximately USD 0.1. Individuals with zero wages are included in the estimation. Individuals are defined as working in Denmark if they have positive wages from Denmark. The outcome means represent the mean in Malmö in the year prior to the bridge opened (1999). Standard errors clustered at the municipality level are shown in parentheses. * indicates significance at the 10% level, ** indicates significance at the 5 % level, and *** indicates significance at the 1 % level.

Table A3: Controlling for Selection

	Work in Denmark	Work in Sweden	Wage Denmark	Wage Sweden	Total Wage
Malmö Resident	0.053***	-0.018***	25.061***	-10.127***	14.933***
	(0.001)	(0.005)	(0.344)	(2.535)	(2.498)
Observations	6375370	6375370	6375370	6375370	6375370

Notes: This table shows the authors' estimation of Equation (1) as described in the text using 1997-2008 administrative data from Statistics Sweden and Statistics Denmark. The table shows 8-year estimates from the full event study model. Sample is based on approximately 6 million individual-year observations, and includes all individual between the ages of 18 and 65 who resided in one of the treatment and control municipalities during the analysis window. All estimates include municipality, year, and birth cohort fixed effects, as well as a control for immigrant status. In addition, we also control for educational attainment, marital status and the presence of children. Wage includes total yearly wages in Denmark, Sweden, or both. Wages are measured in thousands of SEK, where 1 SEK is approximately USD 0.1. Individuals with zero wages are included in the estimation. Individuals are defined as working in Denmark if they have positive wages from Denmark and as working in Sweden if they have positive wages from Sweden. The outcome means represent the mean in Malmö in the year prior to the bridge opened (1999). Standard errors clustered at the municipality level are shown in parentheses. * indicates significance at the 10% level, ** indicates significance at the 5 % level, and *** indicates significance at the 1 % level.

Table A4: Summary Statistics

	Malmo [158,132]	Control Group [357,377]	Remaining Municipalities [4,873,257]
Age	39.450	41.040	40.670
Female	0.501	0.489	0.492
Mobility	0.065	0.048	0.059
Some College	0.283	0.236	0.271
Employed	0.722	0.828	0.816
Total Wage	124.458	144.378	150.018
UI take-up	0.167	0.145	0.139
Children	0.323	0.398	0.377
Immigrant	0.305	0.114	0.154
Married	0.387	0.485	0.440

Notes: Authors' estimation using 1999 administrative data from Statistics Sweden. Sample includes all individuals aged 18 through 65. Control group refers to the municipalities in our main control group. Mobility is defined as the number of times an individual has moved across municipality borders in the past year. Some college is defined as having received at least some university education. Employed is defined as having positive wage from Sweden. Total wage is defined as the combined wage from all employers in Sweden during the year. UI take-up is a dummy variable for receiving unemployment benefits from the Swedish government. Children is an indicator variable taking the value of one if the individual has a child.