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When Work Disappears

Empirical Evidence from Sweden of Manufacturing Decline and its Effect on Marriage and Family Formation

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Abstract: This thesis examines if local labor demand shocks stemming from increasing manufacturing competition from China shifts the employment status among young adults during the years 1995 to 2018, using data on Swedish municipalities. In the context of labor market uncertainties and family formation decisions, we aim to test whether changes in economic stature affects marriage, fertility and children's living circumstances in Sweden. We exploit gender-specific components within manufacturing industries to allow shocks to differently affect male and female intensive industries. Following the empirical strategy in Autor et al. (2019), we use a Bartik instrument and find a negative effect on the manufacturing employment share. This is consistent with existing literature on the role of Chinese imports in Nordic labor markets. However, we cannot with certainty link the decline in manufacturing with overall employment status, since we do not find statistically significant effects on annual income, unemployment, or idleness. Neither do we obtain any significant effects on the male relative to the female economic stature. Unlike prior research, our analysis suggests that trade shocks affecting male intensive industries increase marriage and fertility rates among young women. As such, our findings could contribute to a more versatile understanding of what happens when manufacturing jobs disappear.

Keywords: Bartik instrument, labor market shocks, import competition, marriage, fertility, Sweden

JEL: F16, J12, J13, J16, J23, J31, L60

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Contents

1 Introduction

Losing your job comes with various social and individual costs and consequences. During recent decades, labor market uncertainties have emerged as key factors in the research and debate on family formation. In the marriage market, unemployment has historically been considered to be correlated with couple's mating choices (Schaller, 2013; Shore, 2010; Stevenson and Wolfers, 2007). Economic theory by Becker (1973) suggests that negative shocks to family income and worsened labor market conditions for men should be associated with a decrease in marriage and fertility. Building on to this, Wilson (1987) hypothesize that the decline of US blue-collar jobs has limited the pool of economically secure young men and thus diminished women's gains from marriage and, ultimately, shifted traditional gender roles and damaged children's living conditions. However, because of the difficulty of differentiating cause from effect in the correlations between labor market status and family formation, most previous literature has struggled to test these hypotheses.

In this study, we turn our eyes to Sweden. Following the consecutively developed instrumental variable strategy with a Bartik instrument by Autor et al. (2013), Acemoglu et al. (2016), and finally Autor et al. (2019), we test the predictions of the diminishing share of manufacturing employment on the gains from marriage and family formation arising from the hypotheses by Becker (1973) and Wilson (1987). Autor et al. (2019) construct a measure of local labor market shocks in US commuting zones by using recent decades increased globalization, international trade and particularly the growth in imports from low-cost countries. The net effect of low-cost countries' exports and imports to developed countries on domestic labor markets is widely debated, and the evidence is mixed (Liang, 2021; Acemoglu et al., 2016; ; Balsvik et al., 2015; Autor et al., 2013; Donoso et al., 2014; Utar, 2014). China is the world's largest exporter and accounts for the largest part of the rapid growth in low-income countries' imports to the US in the early 2000s (Autor et al., 2013). The situation is similar in Sweden, where trade with China has increased substantially since the start of China's export boom in 1992 (Amity and Freund, 2007). In 2021, imports from China amounted to SEK 110.2 billion, which represents 6.9 percent of Sweden's total imports (National Board of Trade Sweden, 2022). Therefore, the growth in imports from China should also be considered as labor market shocks to manufacturing employment in Sweden.

Like most OECD countries, Sweden has experienced a decrease in manufacturing employment since the 1970s (Pilat et al., 2006). Between 1995 and 2018, Swedish manufacturing employment decreased from 25 to 18 percent (The World Bank, 2022b). Given the large size of the increase in imports from China to Sweden, it will likely influence the Swedish labor market and specifically employment within manufacturing industries. To the best of our knowledge, previous research on employment effects using import shocks from China in the Swedish setting is largely unexplored. From a Nordic perspective, Balsvik et al. (2015) follow the approach in Autor et al. (2013) on the Norwegian labor market and emphasize the difference between the institutional features of the US and the Nordic model. Despite the differences in the social and economic systems, they find a negative impact of increased exposure to imports from China on the share of manufacturing employment, but no effects on earnings. Their findings highlight the need for further empirical work on the role of Chinese import competition in Nordic labor markets. Similar to Norway, the

Swedish labor market is characterized by influential unions, centralized wage bargaining and generous unemployment benefits. Taking into account the institutional differences between the US and Sweden, we expect that increased import competition from China could lead to different results.

When linking labor market shocks to marriage and family formation, it is important to emphasize that Sweden is one of the most gender-egalitarian societies in the world and is ranked as the world's 5th most gender-equal country according to The Global Gender Gap Report (The World Economic Forum, 2021). It is known for its strong ideological and policy support for dual-earner families. Universal low-cost child care is offered, and surveys of gender norms reveal top levels of public support for gender equality (World and European Value Surveys, 2018). The Swedish labor market has for recent decades been characterized by high labor force participation among both genders compared to many other countries (Blau et al., 2009). However, the question of gender equality and social gender norms in Sweden is still debated. In the 1995 World Value Survey, 33 percent of Swedish respondents agreed with the statement: "If a woman earns more money than her husband, it's almost certain to cause problems" (Inglehart et al., 2018). This makes it interesting to investigate whether support for the predictions in Becker (1973) can be found in Swedish data. Hence, we argue that changes in Swedish labor and marriage markets can be seen as an indication of events to come in more gender-equal futures of other countries.

The aim of this study is to see whether a shift in the employment status among young adults affects marriage and family formation. We do this using local labor demand shocks that result from increased exposure to Chinese imports on manufacturing employment in Swedish municipalities between 1995 and 2018. Distinct from most prior research on Sweden, we link local labor market shocks to marriage and fertility by exploiting the gender composition within manufacturing industries. First, we find a negative impact of increased imports from China on the manufacturing employment share among young adults in Sweden. By performing a simple benchmarking exercise, we find that the growth in increased imports from China accounts for roughly 18 percent of the overall decline in manufacturing jobs between 1995 and 2018. Second, we find that there is no effect on average earnings due to import shocks. Third, when allowing for variation in how the import shocks affect male and female intensive industries, male-specific shocks significantly increase the share of married young women and fertility rates. However, since we do not find an effect on unemployment, we cannot with certainty link the decline in manufacturing jobs to men's relative economic status.

The remainder of the paper is structured as follows. Section 2 provides a brief background on the Swedish manufacturing industry and a short comparison with the US. Section 3 presents relevant previous research. Section 4 lays out the theoretical framework and Section 5 presents a description of our data. Section 6 describes our empirical strategy, and Section 7 presents our results. Section 8 discusses the empirical findings and Section 9 concludes.

2 Background

2.1 The Swedish manufacturing industry

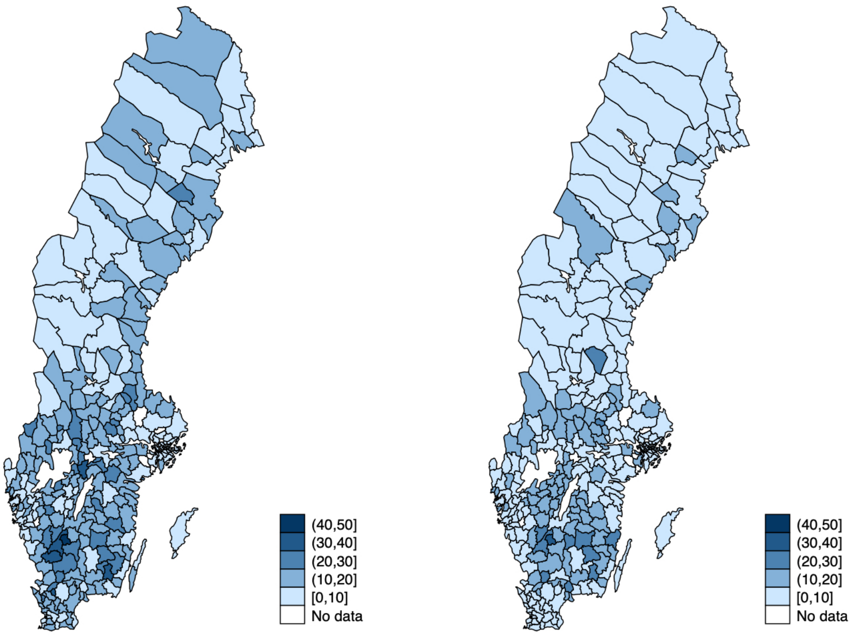

Figure 1: The share of the young adult population working in manufacturing industries in 1995 and 2018[1]

Sweden has experienced a steady decline in the share of manufacturing in overall employment and total domestic output, with a concurrent rise in the share of services (Pilat et al., 2006). In 1995, manufacturing industries represented approximately 20 percent of total GDP in Sweden, and declined to around 13 percent in 2018 (The World Bank, 2022a). Over the same period, manufacturing employment decreased from roughly 25 to 18 percent (The World Bank, 2022b). According to Pilat et al. (2006), the decrease in both the manufacturing industries' share of GDP and manufacturing employment in Sweden may be the result of a variety of factors, such as increased productivity, technological progress, import substitution, and the interaction between services and manufacturing. The productivity growth in Sweden exceeds the OECD average, and combined with a slow growth in manufacturing demand, it can contribute to declines in manufacturing employment. However, due to manufacturing industries' high rate of productivity growth, the sector continues to make a significant contribution to aggregate productivity growth, and thus to the Swedish economy at large. Furthermore, the Swedish manufacturing industry accounts for a large share of Swedish exports and is described as internationally competitive (The National Institute of Economic Research, 2017).

In recent decades, the Swedish manufacturing industry has seen a large shift where traditional industries such as steel, metal, and paper have lost their importance (The Swedish Agency for Economic and Regional Growth, 2018). At the same time, industries producing motor vehicles, machinery, electronics, chemicals, and pharmaceuticals have taken on a leading role and these industries also encompass the most people within the sector (ibid.). For example, the automotive industry employed almost 120 000 people in Sweden in 2017 (Statistics Sweden, 2017), compared

[1]Source: Labor Statistics based on Administrative Sources (RAMS) from Statistics Sweden.

to total manufacturing employment of approximately 500 000 people in the same year (Statistics Sweden, 2022a). The share of women employed within the manufacturing industry has been steadily increasing to 25 percent in recent decades (Statistics Sweden, 2020). As such, the Swedish manufacturing industry is dominated to a large extent by men. In Appendix, Figures A1 and A2 illustrate the male dominance in Swedish manufacturing industries, as well as the decrease in manufacturing employment between 1995 and 2018.

There are also considerable geographical differences with regards to manufacturing employment in Sweden with variations specifically pronounced at the municipal level, according to The Swedish Agency for Economic and Regional Growth (2018). The share of manufacturing employment in municipalities ranges from around 20 to 45 percent. In 35 of the 290 municipalities, the share of manufacturing employees corresponds to 25 percent of total employment. These municipalities are mainly located in the south and middle parts of Sweden: Jönköping, Kalmar, Kronoberg och Västra Götaland. Also, municipalities in Bergslagen: Örebro, Västmanland, Dalarna, and Värmland are highly dependent on employment within manufacturing. However, the focus in this study is on young adults aged 16–39, employed in manufacturing industries. The regional differences in the manufacturing employment shares in this sample is presented in Table 1 and Figure 1. Both show that the municipalities with the highest share of manufacturing employment are located in the south and middle parts of Sweden.

Table 1: Regional differences in manufacturing employment shares among young adults

Employment shares in 1995				Change in the Employment shares 1995–2018			
Lowest share		*Highest share*		*Largest increase*		*Largest decrease*	
Boden	3.2	Gnosjö	41.1	Olofström	16.0	Perstorp	22.9
Vaxholm	3.6	Gislaved	36.6	Oskarshamn	11.5	Kumla	19.3
Umeå	4.1	Perstorp	34.0	Tidaholm	10.4	Lessebo	18.8
Lidingö	4.3	Hylte	33.3	Mullsjö	8.4	Laxå	16.7
Uddevalla	4.7	Emmaboda	31.8	Köping	7.0	Hylte	15.0
Danderyd	4.9	Laxå	30.2	Ovanåker	7.0	Bjuv	14.8
Average share:	13.2%			Average change:	-4.4%		

Notes: Lowest and highest share of young adults working in manufacturing industries in the municipalities and the municipalities with the largest percentage point increase and decrease in the shares between 1995 and 2018.

2.2 Differences in manufacturing industry employment and import trends between Sweden and the US

As previously mentioned, Sweden has seen a large decline in both manufacturing employment (Pilat et ak., 2006) and simultaneously a large increase in manufacturing imports from China (The World Bank, 2022b). The increase in imports from China accelerated in the early 1990s, mainly due to the flexible business environment, the large supply of workers, and lowered trade costs (Amiti and Freund, 2007). Figure 2 compares the developments in Sweden and the US. The share of manufacturing employment in Sweden 1995 was roughly 18 percent, steadily decreasing to approximately 12 percent in 2018. The corresponding share of manufacturing employment in the US was 14 percent in 1995 and barely 0.1 percent in 2018. During the same period of time, imports from China to Sweden increased almost fifteen times and more than six times in the US. In Figure 3, we plot the employment shares of the different manufacturing industries in 1995 against the increase in industry-specific imports from China for Sweden and the US. The key takeaway from the figure is that both Sweden and the US have seen an increase in imports from China whilst having different initial concentrations in industry employment. The Swedish motor vehicle industry, which is excluded from the figure, experienced the largest increase in Chinese import, approximately 55 percent between 1995 and 2018. It also represented 10 percent of manufacturing employment in 1995. The industry with the second largest increase in imports, printing and reproduction of recorded media, is also excluded from the figure, and experienced an increase by 27 percent while absorbing 5 percent of total manufacturing employment. Both industries accounted for a greater share of manufacturing employment in Sweden than in the US, and experienced a substantially greater increase in imports. As shown in Figure 3, Swedish machinery experienced an increase in imports roughly corresponding to a 100 percent increase, while accounting for roughly 13 percent of manufacturing employment in 1995. In the US, the situation is different, where machinery experienced a slower increase in imports and accounted for approximately 6 percent of manufacturing jobs in the US. Food products and fabricated metals witnessed relatively small import increases in Sweden, and they accounted for similar shares of manufacturing employment for Sweden and the US. We can conclude that both Sweden and the US have seen a large increase in imported goods from China, and thus have been subject to a growth in Chinese import competition. However, as both the industry employment shares and the sample of industries exposed to increases in imports differ, we can imagine that the effects of import shocks from China could differ between the two countries.

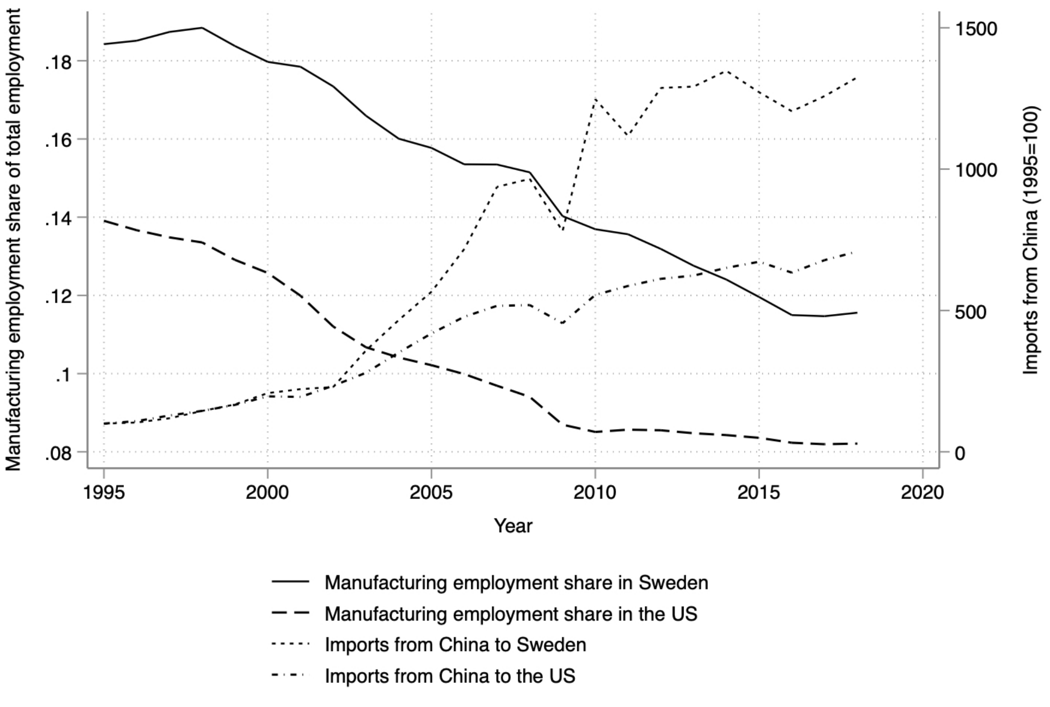

Figure 2: Manufacturing employment and imports from China in Sweden and the US[2]

[2]Source: OECD STAN Bilateral Trade Databases and STAN Indicators.

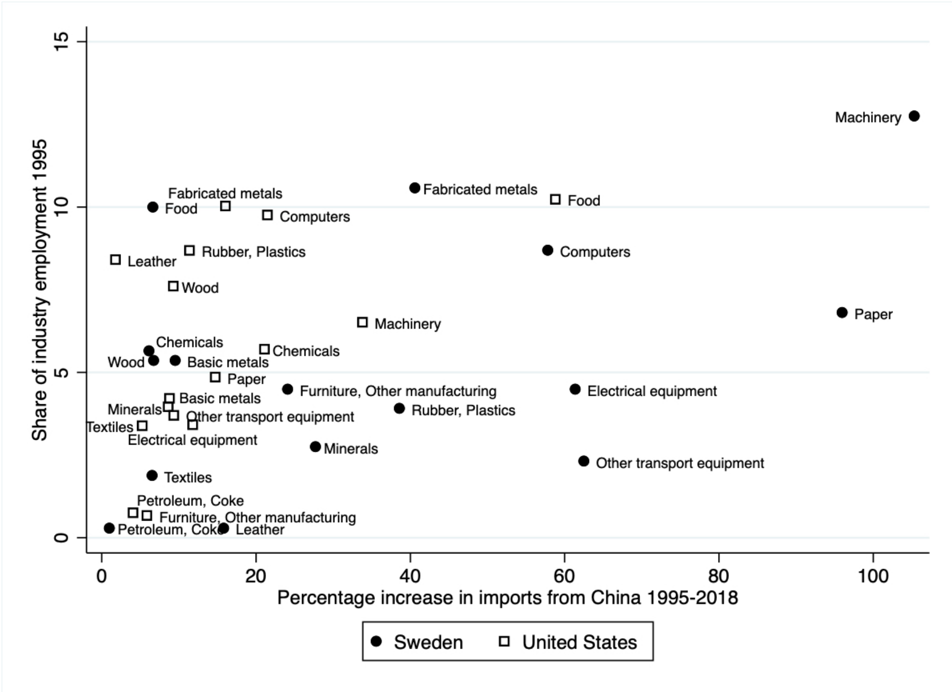

Figure 3: Differences between Sweden and the US in industry structure and imports from China[3]

3 Previous research

3.1 The role of import competition in labor economics

Labor market consequences caused by international trade have generated a growing interest among labor economists during the last decades. Increased globalization and liberalization of trading relationships could affect outcomes in domestic labor markets, especially within import-competing industries. A large number of studies in the 1990s investigated the effect of trade with developing countries on employment and wages among both skilled and unskilled workers in developed countries (Wood, 1995a; Krugman and Lawrence, 1994). In the UK, Hine and Wright (1998) focus on manufacturing industries and find that the main factor behind the decline in employment since the 1970s can be explained by demand-side developments and skill-biased technologies. However, globalization and trade with low-cost countries is also an important explanation, as it has further stimulated productivity improvements and forced industries to come up with defensive responses, resulting in job losses in the short run. During the period 1981 to 1991, Hine and Wright (1998) find that around 6 percent of the general decline in UK manufacturing jobs can be explained by increased import penetration. The literature has also been especially focused on the US labor market. Bernard et al. (2006) find that US firms being exposed to low-wage countries' imports were more likely to have less growth and plant survival, and Harrison and McMillan (2011) suggest that offshoring to low-wage countries substitutes for a large part of domestic manufacturing employment. Further, since China has seen a massive growth in its export opportunities, many studies investigate increased exposure to imports from China. Autor et al. (2013), Acemoglu et al. (2016) and Autor et al. (2019) all find negative

[3]Source: OECD STAN Bilateral Trade Databases and STAN Indicators.

effects on manufacturing employment, as well as a decline in overall employment and wages due to increased penetration of imports from China. Acemoglu et al. (2016) also find that increased import competition has lead to a suppression in overall US job growth. Liang (2021) accompanies these results with the contradictory finding that US exports actually play a critical role in supporting manufacturing employment and that the positive effect due to increased export opportunities almost nets out the estimated loss in manufacturing jobs.

Similar evidence can be found in the European context, however, the literature is less extensive. In Spain, Donoso et al. (2014) find that provinces predominantly exposed to Chinese imports experienced a significant decline in manufacturing employment but was compensated by an overlapping increase in non-manufacturing employment. Dauth et al. (2014) find comparable effects for manufacturing workers in Germany, but also an offset effect created by increased employment in exporting industries due to enhanced trade integration with China. From a Nordic perspective, Balsvik et al. (2015) suggest that around 10 percent of the overall decline in manufacturing employment in Norway can be explained by the increase in exposure to imports from China. However, unlike Dauth et al. (2014) they cannot prove that increased Norwegian exports to China act as a compensating factor. Balsvik et al. (2015) do not find any effects on wages, potentially explained by the Nordic model where firms are flexible at the employment but not at the wage margin. In Denmark, Utar (2014) finds a negative employment effect when focusing on textile imports from China suggesting that firms leave heavily competitive markets for in which products were imported from China and instead become more skill-oriented. The evidence on the effects of international trade on labor markets in Sweden is limited to our knowledge, particularly when it comes to the effect of trade shocks from China on local labor market outcomes. A recent paper by Jiang et al. (2022) investigate both the effect on employment and the wage earner distribution among the working-age population by an increase in exposure to imports from China. In contradiction to the negative effects found in many other developed countries, they cannot find any statistically significant effects on manufacturing or non-manufacturing employment, except for in the transportation sector. Nevertheless, they find a positive effect on wage earners at the median or above, but no statistically significant effect for low-wage earners.

3.2 Unemployment, marriage and fertility

The relationship between unemployment and marriage rates remains largely unexplored, especially in a Swedish context. However, the small amount of literature on the relationship between unemployment and marriage formation is ambiguous. Some empirical evidence suggests a larger negative impact on male employment than on that of female employment during the business cycle, and a negative association between unemployment and marriage rates (Gonzalés-Val and Marcén, 2018; Schaller, 2013). Other scholars have found the opposite link, where marriage is considered as an insurance against poor economic conditions such as unemployment, suggesting that unemployment and marriage should be positively correlated (Shore, 2010; Stevenson and Wolfers, 2007). Scholars have also argued that gender culture, i.e., a set of beliefs, norms, and social expectations that define traits of masculinity and femininity, plays a key role in when and how romantic relationships form. For instance, Ganalons-Pons and Gangl (2021) exploit cross-country variations (Sweden included) in gender norms and provide robust evidence that the male-breadwinner norm is a key driver of the association between men's unemployment and couple separation. To our awareness, there are two related studies focusing on changes in labor market conditions and marriage formation. Kondo (2012) use panel data for young adults aged 18–20 in the US to estimate the effects of increases in male and female unemployment on marriage. The authors find that increases in male unemployment is associated with a delay in marriage timing. Similarly, Gutiérrez-Domènech (2008) shows that increases in local unemployment also cause a delay in the time of marriage in Spain. In linking local labor demand shocks to marriage and fertility, Black et al. (2003) document an increase in the prevalence of single households in US states that experienced a decline in coal and steel industries.

A larger part of the literature have instead focused on marital stability and divorce, where male job loss could boost the probability of divorce. Focusing on Denmark, Jensen and Smith (1990) use panel data for a sample of married couples and find that unemployment is an essential determinant of marital instability. Their findings suggest a positive effect of the husband's job loss on the risk of divorce. For the UK, Doiron and Mendolia (2011) also find evidence that involuntarily job loss has a positive effect on the likelihood of divorce. In a Swedish setting, Eliasson (2012) examines the impact of both the husbands' and wives' job displacement by using Swedish employee-employer data for all married couples in which one of the spouses lost their job due to an establishment closure. The author shows that the risk of divorce statistically significantly increased by 13 percent when the husband was displaced, but no effects of the wives' job displacement.

Previous studies on how employment status is related to family formation and fertility do not provide a simple answer to whether unemployment deters (or boosts) fertility. Studies on Germany (Kreyenfeld, 2010; Özcan et al., 2010), the UK (Schmitt, 2012) and Norway (Kravdal, 2002) find that unemployment and insecure economic situations are associated with family formation and fertility, however, the patterns in these papers differ between countries in term of directions and magnitudes. For the US, Schaller (2016) tests the Becker model using gender-specific labor demand shocks and show that improvements in men's labor market conditions predict increases in fertility, while improvements for women have the opposite effect. Using Swedish data, Lundström and Andersson (2012) provide evidence on how unemployment correlates with first birth behavior among young adults and show that unemployed individuals are less likely to start a family. More recently, Kolk and Barclay (2021) examine the effect of men's income level on fertility rates in Sweden. They find a positive relationship between men's income and fertility, suggesting lower access to marriage and family formation among low-income men.

3.3 The development of the empirical framework

Autor et al. (2013) analyze the effect on employment, earnings, and transfer payments across local labor markets by an increase in exposure to Chinese import competition. They construct 722 commuting zones (CZs) with different initial industry specialization patterns and strong commuting ties within but weak ties between zones. They also develop a theoretical trade model based on monopolistic competition where each CZ is treated as a small open economy that is differently affected by Chinese trade developments (this is described in the Theoretical framework, Section 4.1). When estimating the impact on employment by increased import penetration in the CZs between 1990 and 2007, they use a Bartik instrument. The share of manufacturing employees in a CZ is multiplied by the increase in imports from China per worker and summed over all industries:

$$\Delta IPW_{uit} = \sum_{j}^{J} \frac{L_{ijt}}{L_{ujt}} \frac{\Delta M_{ucjt}}{L_{it}} \tag{1}$$

where $\frac{L_{ijt}}{L_{ujt}}$ is the share of manufacturing employees within each industry j and CZ i in year t. ΔM_{ucjt} is the growth of Chinese imports to a specific industry j, in year t divided by the number of workers in CZ i in year t. To account for the risk of endogeneity in US trade exposure, which would be difficult in a simple OLS specification, Autor et al. (2013) use an instrumental variable strategy to isolate the supply-component of the growth in US imports. The Bartik instrument is the growth in Chinese import exposure to eight other high-income countries, isolating the import-specific impact that comes from productivity gains within Chinese manufacturing and cost reductions due to lowered trade barriers. As such, the IV approach excludes factors specific to changes in US import demand. The instrument is as follows:

$$\Delta IPW_{oit} = \sum_{j}^{J} \frac{L_{ijt-1}}{L_{ujt-1}} \frac{\Delta M_{ucjt}}{L_{it-1}} \tag{2}$$

where the difference from Equation 1 is the lagged variables $t-1$ in the share component and ΔM_{ucjt}, which is the growth of Chinese imports to eight other high-income countries in industry j in year t. Autor et al. (2013) find that import competition caused a decline in manufacturing employment in US CZs exposed to international trade competition from China during 1990 to 2007. Their estimates suggest that China's growth in imports can explain 21 percent of the overall decline in manufacturing jobs. In addition, they find that increased exposure to Chinese imports led to general declines in both employment and wages, also seen outside of the manufacturing sector. Hence, rising import exposure resulted in a drop in average household earnings which in turn also contributed to increased transfer payments and disability expenses.

Building on the framework developed by Autor et al. (2013), Acemoglu et al. (2016) expand the analysis to include national level industries and alternative mechanisms in which import growth affects local labor markets in the US. In the conceptual framework, the authors decompose the impact of increased Chinese trade exposure on national employment into four dimensions; direct impact on exposed industries (whose products compete with China), indirect impact on linked industries, aggregate reallocation effects (appropriating the potential increase in employment in contracting industries) and aggregate demand effects (the multiplier effect that arise from shifts in consumption and investment). Furthermore, when analyzing the impact on local labor markets, they similarly decompose the local employment impact into: direct impact on exposed industries, local impact on linked industries, local reallocation effects, and local demand effects. According to Acemoglu et al. (2016), the direct impact at the local level is comparable to the national level when local labor markets are scaled by the size of the industry. In their analysis, they also separately explore input-output linkages and indirect channels of transmission. Acemoglu et al. (2016) develop a new measure of trade exposure, i.e., the change in increased imports from China to the US, defined by the following expression:

$$\Delta IPW_{j\tau} = \frac{\Delta M_{j\tau}^{UC}}{Y_{j,91} + M_{j,91} - E_{j,91}} \tag{3}$$

where $\Delta M_{j\tau}^{UC}$ is the growth of imports from China to the US between 1991 and 2011. The denominator is the initial absorption in 1991, which is total industry shipments $Y_{j,91}$, industry imports $M_{j,91}$, and industry exports $E_{j,91}$. The expression suggests that supply-driven changes in Chinese exports will have a reductive effect on demand for employment in US manufacturing industries. Acemoglu et al. (2016) also employ an IV strategy to overcome concerns about the effects of domestic shocks on industries, which affects domestic import demand. The instrument used to capture the supply-driven component of the Chinese trade exposure is:

$$\Delta IPO_{j\tau} = \frac{\Delta M_{j\tau}^{OC}}{Y_{j,88} + M_{j,88} - E_{j,88}} \tag{4}$$

where $\Delta M_{j\tau}^{OC}$ is the growth of Chinese imports in eight other high-income countries and the initial absorption is lagged 3 years to mitigate simultaneity bias. In line with Autor et al. (2013), Acemoglu et al. (2016) find support for declining manufacturing employment due to exposure to Chinese import shocks during 1999 to 2011. The estimates imply that the import growth from China led to a reduction in employment of 2.4 million workers, also taking into account the changes in employment in non-manufacturing sectors. In addition, they find that import growth appears to have significantly suppressed overall job growth in the US.

Finally, Autor et al. (2019) exploit the same relationship of growth in import exposure from China and US employment. However, they shift focus to analyze how gender-specific trade shocks differently reduce employment and wages among young adults aged 18–39 years, between 1990 and 2014. They also study how shifts in relative economic stature between sexes affect marriage and fertility. By combining the independent variable of interest in Autor et al. (2013) with the variable in Acemoglu et al. (2016), the authors construct the independent variable and add a gender component[4] The results in Autor et al. (2019) show that trade shocks to US manufacturing employment induce changes in marriage, fertility, mortality, household structure, and children's living circumstances. More specifically, shocks to male intensive industries stemming from rising trade with China cause a decline in manufacturing employment and a boost in male relative to female idleness and premature mortality. In addition, it causes a decline in marriage and fertility, a raise in the fraction of unwed mothers who are heads of single non-cohabiting homes, and an increase in the share of children living in households below the poverty line. Adverse shocks to female intensive industries show opposite effects: an increase in male relative to female overall employment, a reduction in male idleness and premature mortality, and a surge in marriage and fertility. It also raises the number of children living with married parents and reduces the share of children living in single-headed households, but no effect on the fraction of children living in poverty. Furthermore, they find varying evidence of the effects on earnings due to trade shocks[5]. Shocks to male intensive industries generate absolute losses in earnings for men in all percentiles of the distribution, while shocks to female intensive industries have no effect on female earnings.

[4] Since we closely follow Autor et al. (2019) we provide a more detailed description of the empirical strategy in Section 6.

[5] To estimate how trade shocks raise CZ-level earnings inequality, Autor et al. (2019) use a separate IV quantile regression with group-level treatment developed by Chetverikov et al. (2016).

4 Theoretical framework

The theoretical foundation of this paper is based on the trade model developed by Autor et al. (2013), the classic Becker (1973) model of gains from marriage, and the related framework developed by Wilson (1987). In this section, we will first describe the trade model of shocks to local labor markets. This is followed by the model of economic gains from marriage and household specialization. Lastly, we will describe the theory of the consequences of the decline in blue-collar jobs in the US and its impact on marriage.

4.1 Shocks to local labor markets

Autor et al. (2013) develop a theoretical trade model based on monopolistic competition. The framework treat the constructed CZs as sub-economies with different structures in industry specialization. Thus, each CZ is treated as a small open economy that is differently affected by Chinese trade developments. In the model, three main labor market outcomes are analyzed; wages $\hat{W}_i$, employment in traded manufacturing goods $\hat{L}_{Ti}$ and employment in non-traded manufacturing goods $\hat{L}_{Ni}$. These outcomes are affected through two main channels: (i) China's export-supply capability in each industry, and (ii) China's change in expenditure in each industry. Channel (i) measures increased competition in the region that sells the product and is treated as an exogenous function of labor and trade costs, as well as the number of different products made in China. Channel (ii) measures increased demand for the produced product. The change in industry expenditure is treated as exogenous. Channel (i) and (ii) are the calculated export-supply and import-demand shocks in China. Wages and employment in traded and non-traded manufacturing goods are presented below:

$$\hat{W}_i = \sum_j^J c_{ij} \frac{L_{ij}}{L_{Ni}} \left[\theta_{ijC} \hat{E}_{Cj} - \sum_k^K \theta_{ijk} \phi_{Cjk} \hat{A}_{Cj} \right] \tag{5}$$

$$\hat{L}_{Ti} = \rho_i \sum_j^J c_{ij} \frac{L_{ij}}{L_{Ti}} \left[\theta_{ijC} \hat{E}_{Cj} - \sum_k^K \theta_{ijk} \phi_{Cjk} \hat{A}_{Cj} \right] \tag{6}$$

$$\hat{L}_{Ni} = \sum_j^J c_{ij} \frac{L_{ij}}{L_{Ni}} \left[- \theta_{ijC} \hat{E}_{Cj} + \sum_k^K \theta_{ijk} \phi_{Cjk} \hat{A}_{Cj} \right] \tag{7}$$

The impact of the two Chinese import shocks on regional wages and employment are calculated as the sum of the change in expenditure from China $\hat{E}_{Cj}$ multiplied by region i's initial share of produced products exported to China and the change in region i's product demand in other markets competing with Chinese exports ($\theta_{ijC} \equiv \frac{X_{ijC}}{X_{ij}}$). China's export-supply capability $\hat{A}_{Cj}$ is multiplied by region i's initial proportion of products shipped to different markets θ_{ijk} and each market k's initial share of Chinese imports ϕ_{Cjk}. The shocks are summed over industries j and weighted by the initial share of industry j's employment in non-traded, $\frac{L_{ij}}{L_{Ni}}$, and traded industries, $\frac{L_{ij}}{L_{Ti}}$. All three expressions are scaled by a general equilibrium factor c_{ij}, which is greater than zero. The expression for the employment in traded manufacturing is also scaled by the share of the current account deficit in total expenditure ρ_i.

According to the model, a positive export shock in China will have a decreasing effect on region i's employment and wages in traded goods industries as well as a rise in employment in the non-traded industries. On the other hand, a positive import shock in China increases employment and wages in traded industries, while employment in non-traded industries experience a decline. Furthermore, this means that the aggregated labor demand for the US economy remains unchanged in times of balanced trade. Therefore, the two different effects on employment compensate each other when the demand for export production to China and the import competition are equivalent. In times of unbalanced trade, for example when the import competition from China is greater than the increase in export production to China, the demand for manufacturing employment decreases, thus affecting both employment and wages in local labor markets. To focus on the channel of increased import competition from China in the US market and thus ignore the export-demand component, the change in employment for traded industries become:

$$\hat{L}_{Ti} = -\alpha \sum_{j}^{J} \frac{L_{ij}}{L_{Ti}} \frac{X_{ijU}}{X_{ij}} \frac{M_{CjU}}{E_{Uj}} \hat{A}_{Cj} \approx -\tilde{\alpha} \sum_{j}^{J} \frac{L_{ij}}{L_{Ui}} \frac{M_{CjU} \hat{A}_{Cj}}{L_{Ti}} \tag{8}$$

where employment in industries with traded goods depends on the growth of imports from China due to the growth of China's export-supply capacity $M_{CjU}\hat{A}_{Cj}$, which is weighted by the labor force L_{Ti} and the share of employment in the industry $\frac{L_{ij}}{L_{Uj}}$, and $\tilde{\alpha}$ is a constant. In summary, the model predicts a decrease in manufacturing employment and wages in local labor markets due to positive trade shocks resulting from increased trade competition from China.

4.2 Model of the gains from marriage and household specialization

Becker (1973) presents a simple model of the gains from marriage that assumes specialization in household production. The model is based on the principle of a preference theory since marriage is assumed to be voluntary and the individuals marrying are assumed to expect their utility level to increase, compared to the level of remaining single. The efficiencies of marriage can be demonstrated by the comparison between households and firms, where the inputs into the marriage correspond to the traits of the spouses. The model considers two types of agents, men and women, who must decide whether to marry each other or remain single[6]. Utility is assumed to strictly depend on the commodities jointly produced by the household. Examples of household commodities are meals, children, prestige, recreation, love, and health status, and are produced partly with market goods and services and the time spent by the two household members. Commodities are not transferable to other households or markets. The overall goal of the household is to maximize these commodities and couples prefer to maximize household utility rather than their individual utility. When maximizing, each household must consider a budget and a time constraint to allocate its time and goods optimally. The budget constraint consists of the wage from the time the household member spends working in the labor market but also of a property income. By combining the property income with the labor income of the two household members, each household obtains a full income constraint, that is, the maximum money income achievable.

[6]The model only considers heterosexual couples.

Another assumption in the model is that a reduction in a household's total output of produced commodities does not make any member worse or better off. Because of this, each member wants to allocate their time and goods optimally to maximize household total output. Each household member must also cooperate and allocate their time between the market and the home sectors. This creates a necessary condition for marriage in which the total income produced by the household must exceed the total income produced separately by the household members. According to the model, the gain from marriage is greater the more complementary the inputs are, i.e. the time of spouses and market goods. The time and market goods produced by spouses are complementary given the equal desire to raise children, making it easier for spouses to cooperate when allocating their time. Therefore, the gain from marriage should be positively related to the importance of having children. In addition, gains from marriage also depend on market opportunities such as labor force participation and wage levels. Becker (1973) defines the gain from marriage as follows:

$$Z_{mf} = \frac{\textit{full income}}{\textit{average cost of production}} \equiv \frac{S_{mf}}{C_{mf}(w_m, w_f, p)} \equiv \frac{S_m + S_f}{C_{mf}} \tag{9}$$

where Z_{mf} is the gain from marriage, the subscripts represent males m and females f, S_{mf} is the full income of the household, C_{mf} is the average cost of production, w_m and w_f is the individual wage for the household members. If the property income of the two members of the household, p, increase endogenously by the same percentage, then S_m, S_f and S_{m_f} would increase by the same percentage. With constant returns to scale, the absolute gain from marriage would also increase with income given that both members of the household continue to participate in the labor market. Consequently, a rise in property income would also increase incentives for marriage. If wages of the two members of the household rise with the same percentage, it would increase output but by a smaller effect since costs of production increase simultaneously. Thus, a wage increase should have a positive effect on incentives to marry, but of smaller magnitude than a rise in property income. Naturally, a decrease in wage rates and property income may have a negative effect on the incentives to marry.

Further, Becker (1973) emphasizes the *relative* economic stature between spouses. This implies that a rise in w_f relative to w_m, an increase in the female's wage relative to the male's wage, holding the productivity of time in home production constant, are less than w_m. In other words, the gain of substituting male labor market time for female labor market time is greater when female wage is lower compared to male wage. So, Becker (1973) prescribes that differences in market opportunities, such as wages and employment should have different effects on marriage formation. The key assumption derived from the model is that specialization of labor within the household is the basis of the gains from marriage. Couples exhibit specialization by allocating more hours of one partner to the labor market and more hours of the other to home production. This implies that high-wage men will prefer to marry low-wage women and form a household where the woman specializes in home production and the man specializes in labor market production. Hence, it suggests that the husband would have a higher salary than the wife. To summarize, the framework by Becker (1973), where economic gains from marriage emerge from differences in spousal earnings and household specialization, predicts that shocks to men's relative earnings reduce marriage, whilst shocks to women's relative earnings would have an opposite effect.

4.3 Consequences of declining blue-collar employment

Wilson (1987) hypothesize that the decline of employment in blue-collar jobs in the US has diminished the pool of economically secure young working men, and thereby decreasing women's gains from marriage. The decline in marriage rates among black Americans, especially living in poor-inner city areas, can primarily be explained by a smaller portion of acceptable marriage partners for black women. In line with the aforementioned model of the gains from marriage, the hypothesis rests on the assumption that there are certain financial payoffs for women associated with being married to a man, and as these payoffs decrease, marriage rates are affected. Compared to the model in Becker (1973), Wilson (1987) focuses on the *absolute* economic stature of young adult men, and not the *relative* economic stature between men and women. Instead, Wilson (1987) argue that reductions in blue-collar jobs generates an absolute fall in employment and earnings for young black men, making them less marriageable.

To support the hypothesis, Wilson (1987) constructs a "male marriageable pool index" (MMPI) which is the number of employed men per women of the same race and age. To study the change in MMPI, he uses current employment status as a proxy for a man's ability to support a family and his "marriageability". The index treats men who are employed as "marriageable" and men who are unemployed as "unmarriageable". The number of women is used as the denominator to convey the situation of young women in the marriage market. The measure is created to reveal the marriage market conditions facing women under the assumption that a marriageable man needs to be employed. Using regional longitudinal data for the period 1960s to 1980, the index shows that black women in the US are experiencing a shrinking pool of marriageable black men. The decline in the economic status of black men is also associated with the incidence of intact marriages among black Americans. Besides from providing a narrative of how male employment status coincides with a decline in marriage rates, Wilson (1987) further amplify the consequences of the shrinking pool of potential husbands. He suggests that as the decline in jobs for men has a negative effect on the prevalence of marriage, this leads to eroded gender roles and a larger share of single parents. When traditional family gender roles disappear, it can also have a negative effect on children, where the most important determinant of poverty status for families is considered to be the sex and marital status of the head. Therefore, Wilson predicts that a decline in marriage rates due to a decrease in male marriageability may have a negative effect on children's living circumstances.

Wood (1995b) put the sociological reasoning of Wilson (1987) in the context of economic theory by highlighting that only marriageable men enter the marriage market. Men will only consider marriage if they expect to be able to achieve a minimum standard of supporting a family. Wood (1995b) goes further to argue that it is not obvious to assume that the utility of being single would exceed the utility of being married for men with a low wage and a weak labor market position. Under such circumstances, marriage might not be seen as neither an interesting investment nor a plausible option. Lerman (1989) assumes that if the greatest source of a man's value on the marriage market is the value he assigns on his role as a "breadwinner" in the family, then a man who believes in his ability to provide for a family will consider marriage. As such, men who do not consider themselves a potential breadwinner might abstain marriage. Wood (1995b) also considers a woman's choice to marry. The assumption is that women only consider marrying men who have proved a minimum ability to succeed in the labor market. This means that a woman could base the marriageable criterion on a man's employment status. Women might also view a man's current economic status as a indication of his future earnings potential, namely, his ability to provide for the family. Therefore, when considering the pool of potential husbands, women can set a minimum acceptable level of labor market position, such as employment status, corresponding to a minimum lifetime earnings of a potential husband. Men who meet these criterion are then allocated in the pool of marriageable men as described in Wilson (1987).

5 Data

5.1 Trade data

Trade data over total exports and imports from China to Sweden and to the rest of the world, as well as data on imports from China to eight other countries (Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain, and Switzerland) are collected from the OECD's STAN database, Bilateral Trade in Goods by Industry and End-use (BTDIxE). Data are obtained for the years 1995, 2005, and 2018. The BTDIxE data are primarily based on the UN Comtrade database with historical data from the OECD's international trade by commodity statistics. Imports and exports are divided into industrial activities according to the fourth revision of the international standard industrial classification, ISIC Rev. 4 (OECD, 2022a). The Harmonized System (HS) Rev. 4 is used to classify imports and exports of goods that are sequentially grouped into ISIC industries. Imports are measured as cost, insurance and freight (cif), exports as free on board (fob), and the value of traded goods is presented in thousands of current US dollars (OECD, 2017). Production values for Swedish manufacturing industries in 1993 and 1996 are also gathered from the STAN Industrial Analysis database 2020 edition (OECD, 2022b). The data are compiled according to the System of National Accounts 1993 (SNA93), consisting of the annual national accounts for OECD member states. The Swedish production value is reported in current million SEK and is converted to thousands of current USD for comparable reasons according to the aggregated annual average exchange rates for 1993 (Riksbank, 2022a) and 1996 (Riksbank, 2022b).

Trade data are adjusted for annual US inflation rates. Annual inflation rates are collected from the CPI for All Urban Consumers (CPI-U) database available at the U.S. Bureau of Labor Statistics (2022) with the base year 2018. The available trade and production data differs with respect to industrial classifications. Specifically, the classifications for the STAN Industrial Analysis are less detailed compared to BTDIxE. To make the industrial categories consistent, we treat the 20 categories in the production value data as a benchmark and remove all excessive categories from the remaining data sets. The 20 manufacturing industries are reported with their respective ISIC Rev 4. classification in Table 2.

Table 2: Industrial Classification

Manufacturing industries	ISIC Rev.4
Food products and beverages	D10T11
Tobacco products	D12
Textiles	D13
Wearing apparel	D14
Leather and related products	D15
Wood and products of wood and cork, except furniture	D16
Paper and paper products	D17
Printing and reproduction of recorded media	D18
Coke and refined petroleum products	D19
Chemical and pharmaceutical products	D20T21
Rubber and plastics products	D22
Other non-metallic mineral products	D23
Basic metals	D24
Fabricated metal products, except machinery and equipment	D25
Computer, electronic and optical products	D26
Electrical equipment	D27
Machinery and equipment n.e.c	D28
Motor vehicles, trailers and semi-trailers	D29
Other transport equipment	D30
Furniture, other manufacturing	D31T32

5.2 Employment data

Data on manufacturing employment are based on Statistics Sweden's register data; labor statistics based on administrative sources (RAMS) and consist of all registered Swedish citizens as of December 31 each year. Each citizen is classified as employed or not according to a wage income model that compares the calculated wage income with a reference limit. If the income exceeds the limit, the citizen is registered as employed (Statistics Sweden, 2022b). Registered employees in RAMS are also classified into the Swedish Standard of Industry Classification (SNI). The data we use are aggregated on a 4-digit SNI-level for the 284 Swedish municipalities for the years 1990, 1995, 2005, and 2018[7]. It contains employee information about gender, age and registered municipality of residence. If there are 1–2 employees in an observation, Statistics Sweden will code it as a missing value due to the disclosure policy. We choose to code such observations conservatively as 1 employee. Summary statistics on manufacturing employment shares are presented in Appendix Table B1.

Manufacturing employment data contain three versions of SNI classifications: 1990 and 1995 are classifying employees according to SNI1992, 2005 as SNI2002, and 2018 as SNI2007. To match workers within the same industries throughout the time periods, we use their respective conversion keys to transform all to SNI2007 (Statistics Sweden, 2022c). Conversion was carried out according to the keys, with a few exceptions. Since we only have access to the 4-digit SNI and not the fully detailed 5-digit level, we consistently group SNI92 and SNI2002 into SNI2007. If the 4-digit SNI92 is split into multiple 4-digit groups in SNI2007, we code it as the original group of SNI2007 if there is at least one group that corresponds to that group. For example: group 1740 in SNI92 corresponds to groups 1392, 3250, 3319 and 9529 in SNI2007, but it will be coded as the 2-digit group 13, according to the "main" SNI2007-group. SNI2007 is the version compatible with the ISIC Rev. 4 classification of trade data at a 2-digit level. By matching SNI2007 to ISIC Rev. 4 we are able to get a consistently matched sample of industry-specific imports and employment.

[7] We made a customized order from Statistics Sweden regarding the RAMS data with 4-digit SNI classification.

Data on total municipality employment in 1990 (Statistics Sweden, 2022d), 1995 (Statistics Sweden, 2022e), 2005, and 2018 (Statistics Sweden, 2022f) are collected from Statistics Sweden. Employment data for the year 1990 is based on "Årlig regional sysselsättningstatistik" (ÅRSYS) which was later renamed into RAMS (Statistic Sweden, 2015). Employment data for 1995, 2005, and 2018 are extracted from RAMS.

Data on the share of unemployed in the municipalities is based on the database STATIV (Statistics Sweden, 2022g). The measure of unemployment is the share of people that has been registered at the Swedish Public Employment Service during the present year. Unemployment data are not available for 1995 and only for age groups 20–24, 25–34, 35–44. Therefore, we cannot use the preferred year of 1995 and isolate our sample to 16 to 39-year-olds. Instead, we use 1997 as a proxy when calculating the changes in the share of unemployed between 1995–2005, and 2005–2018, as well as a sample of young adults aged 20–44. The aggregated average of the share of unemployed individuals is divided by the number of age groups.

Some municipalities do not exist for the entire period of time and are therefore excluded from our data set. The excluded municipalities are Bollebygd (part of Borås until 1995), Knivsta (part of Uppsala until 2003), Lekeberg (part of Örebro until 1995), Nykvarn (part of Södertälje until 1999), Trosa (part of Nyköping until 1992), and Gnesta (part of Nyköping until 1992). This is done whenever municipal aggregates are handled. Municipalities are assigned to their respective region using the Swedish regional and municipal classification from Statistics Sweden (Statistics Sweden, 2022h).

5.3 Income data

We use income data from Statistics Sweden for the years 1995, 2005, and 2018 (Statistics Sweden, 2022i). The data consist of the average of total earned income divided by gender, age group, municipality, and income level for all individuals registered as residents of Sweden as of December 31. Total earned income includes income from employment, self-employment, pension, and social security. Income data are adjusted to Swedish annual inflation rates with 2018 as the reference year. The annual averages of the CPIs, with fixed index numbers (1980=100), are taken from Statistics Sweden (Statistics Sweden, 2022j). Since we aggregate five age groups to obtain the sample of 16–39 years old for both males and females, we divide the aggregated average total earned income by the number of age groups. We define the change in total earned income by taking the natural logarithm of the averages.

5.4 Data on marriage, fertility and children's living circumstances

Data on an individual's marital status and fertility are also collected from Statistics Sweden. Marital status data include information on the number of married, divorced and never married women in Swedish municipalities (Statistics Sweden, 2022k). If an individual is currently married, we cannot determine if she was previously divorced. To study the change in fertility rates, we use data on the number of born children by mother's age and registered municipality (Statistics Sweden, 2022l). The number of married individuals and born children is aggregated at the municipality level for the years 1995, 2005, and 2018. To study changes in children's living circumstances, we use two sources of data, unfortunately neither available for the entire time period of interest. First, data on household structure at the municipality level for the time period 2000 to 2014, include information about whether the parents are married and cohabiting, not married and cohabiting, or single parenting (Statistics Sweden, 2022m). Second, we collect data from the National Board of Health and Welfare on the number of households registered to receive social assistance, which is available for the years 2000 and 2009 (Statistics Sweden, 2022n).

5.5 Data on municipality characteristics

Data on the number of people in the municipality with at least a college degree in 1995 and 2005 (Statistics Sweden, 2022o), the number of women employed in 1995 (Statistics Sweden, 2022p), the share of women employed in the municipality 2005 (Statistics Sweden, 2022q), and the number of foreign-born in the municipality 2000 and 2005 (Statistics Sweden, 2022r) are all extracted from Statistics Sweden. Data on the number of foreign-born in 1995 are not available; hence we use 2000 data as a proxy. We use data from Statistics Sweden for the total population of Sweden for 1995 and 2005 (Statistics Sweden, 2022s). The number of deaths in the municipality during the years 1995, 2005, and 2018 also comes from Statistics Sweden (Statistics Sweden, 2022t).

6 Empirical strategy

The aim of this study is to estimate the casual effect of local labor market shocks on different social factors central to human life, such as marriage and fertility. Simply running an OLS regression of changes in employment on marriage and fertility rates comes with problems of endogeneity. Since we cannot control for all potential factors that could be correlated with both the change in manufacturing employment and the change in marriage and fertility rates, a OLS regression will not provide a casual interpretation. For instance, if the educational level increases among women, they might become less prone to seek employment within the manufacturing industry. This might also affect their choice to get married or to have children. To try to identify the causal effect of local labor market shocks, and thus solve the problem of omitted variable bias, we employ an instrumental variable design. We include an instrument that is exogenous to our model and that impacts the outcome of interest, marriage and fertility rates only through its effect on the independent variable, imports from China to Sweden.

Our empirical strategy is based on a specific first difference IV approach developed by Autor et al. (2019). We use the increase in Swedish imports from China as a local labor market shock. In addition to the possibility of omitted variables in the observed association between employment changes and social factors, we must also consider the risk of omitted variable bias with respect to the local labor market shock. It could be the case that some factors simultaneously impact increased trade exposure from China and employment within Swedish manufacturing industries. For example, if production costs for manufacturing industries in Sweden increase, this could lead to increased demand for cheaper products imported from China. At the same time, if demand for Chinese products increases, this could deter demand for Swedish manufacturing goods, resulting in increased unemployment for Swedish manufacturing workers. Thus, we need an instrument that is correlated with Swedish import exposure but uncorrelated with domestic shocks to be able to identify the supply-driven component of the change in import exposure in Sweden.

The analysis consists of three main parts. First, we build an instrument that isolates the supply-driven component of Swedish imports from China using import data to eight other high-income countries. Second, we estimate the effect of the change in the supply-driven component on Swedish manufacturing employment. Third, given that the supply-driven component has an effect on manufacturing employment, we use the same import shock to estimate the effect on marriage, fertility, children's living circumstances, idleness, and absence. To adopt the approach of Autor et al. (2019) to the Swedish setting, we select municipalities as the geographical unit of analysis, as they adequately delimit the boundaries of local labor markets in Sweden[8]. Similar to the previous study, we use a Bartik instrument (also called a shift-share instrument) to estimate the change in a municipality's manufacturing employment due to increased exposure of imports from China. Moreover, we allow our analysis to distinguish between employment shocks that differently affect male and female intensive industries. The next sections will present our empirical strategy in detail.

6.1 First difference model

As we are interested in estimating changes across two time periods, where each time period consists of the change between two years (1995 to 2005 and 2005 to 2018), we estimate the model as a stacked first-difference model. Similarly to a three-period fixed effects model, first differencing between the first and the last year in each decade eliminates time-invariant unobserved factors varying across municipalities but are constant over our chosen periods. Therefore, we do not need to include municipality fixed effects in our specifications. For the estimator to be consistent, the differenced error term and the independent exogenous variable must be uncorrelated in all periods (Woolridge, 2002). In our setting, this means that the change in imports must not be correlated with other confounders of changes in Swedish manufacturing patterns. This is achieved when the IV method is adopted and the supply-driven component of the change in the exposure of Swedish imports from China is isolated. To be able to use a first difference model, we also need variation in the variables over time and that the first difference of the idiosyncratic errors are serially uncorrelated (Woolridge, 2002). We therefore use Newey-West standard errors in all specifications to account for spatial correlation across municipalities.

6.2 The Bartik instrument

The Bartik instrument, named after Timothy Bartik (1991), and further developed by Blanchard and Katz (1992), is widely used across many fields in economics. The approach was initially developed to obtain an exogenous predictor of labor demand to estimate the inverse labor supply in US counties. The idea was to interact local employment rates in different industries with the industries' national growth rates. The Bartik instrument used in this study follows the structure of Autor et al. (2019). The instrument aims to isolate the supply-driven component of imports from China on employment rates in Swedish manufacturing industries. By combining the instrument with a first difference model, it separates the effect of Chinese imports from other time-varying and municipality-specific characteristics. An obvious difference between the

[8]Statistics Sweden offers alternative divisions of Swedish local labor markets such as "Lokala arbetsmarknader" (LA) which base the division on commuting patterns. However, we use municipalities due to data availability.

instrument employed by Autor et al. (2019) and ours is that we use Swedish municipality data rather than constructed commuting zones. Due to data limitations, we also moderately change the base years and time periods used. Before explaining the instrument further, the independent endogenous variable is presented below. It is also constructed as a Bartik instrument and is the measure of the local labor market shock in Sweden; the industry's initial employment share in the municipality weighted by the increase in imports from China:

$$\Delta imports^{swe}_{i,\tau} = \sum_{j=1}^{J} \frac{L_{i,j,95}}{L_{i,95}} \Delta imports^{swe}_{j,\tau} \tag{10}$$

where $\Delta imports^{swe}_{i,\tau}$ is the change in the exposure of Swedish imports from China in time period τ (1995–2005 and 2005–2018) in municipality i. The share component $\frac{L_{i,j,95}}{L_{i,95}}$, is the employment share in industry j in municipality i in the start-of-period 1995. The shift component $\Delta imports^{swe}_{j,\tau}$ is the change in the exposure of Swedish imports from China in industry j in time period τ. The share and the shift component are aggregated for all 20 manufacturing industries j. Hence, the only variation in $\Delta imports^{swe}_{i,\tau}$ stems from the local industry structure in 1995, which in turn depends on the concentration in manufacturing and non-manufacturing employment as well as specialization in import-intensive industries within municipalities. To calculate the shift component, $\Delta imports^{swe}_{j,\tau}$, we use the following equation:

$$\Delta imports^{swe}_{j,\tau} = \frac{\Delta total\ imports^{swe}_{j,\tau}}{total\ production^{swe}_{j,96} + total\ imports^{swe}_{j,96} - total\ exports^{swe}_{j,96}} \tag{11}$$

which is the normalized measure of the change in exposure to Swedish imports from China. The nominator $\Delta total\ imports^{swe}_{j,\tau}$ is the change in realized Swedish imports from China in industry j in time period τ. The denominator $total\ production^{swe}_{j,96} + total\ imports^{swe}_{j,96} - total\ exports^{swe}_{j,96}$ is the initial absorption in industry j in 1996, close to the start of the Chinese export boom.

Next, we introduce the gender-specific components to our independent endogenous variable. Given that $\Delta imports^{swe}_{i,\tau}$ captures the overall import exposure in the municipality, it does not differentiate between shocks to manufacturing employment that variously affects male and female workers. To include this aspect, we modify the independent endogenous variable to be able to distinguish between male and female intensive industries that might be differently affected by the local labor demand shock. The equations below include $female_{i,j,95}$, which is the industry-specific share of female employees in the municipality in the start-of-year 1995:

$$\Delta imports^{male,swe}_{i,\tau} = \sum_{j=1}^{J} \frac{(1 - female_{i,j,95}) L_{i,j,95}}{L_{i,95}} \Delta imports^{swe}_{j,\tau} \tag{12}$$

$$\Delta imports^{female,swe}_{i,\tau} = \sum_{j=1}^{J} \frac{female_{i,j,95} L_{i,j,95}}{L_{i,95}} \Delta imports^{swe}_{j,\tau} \tag{13}$$

To isolate the trade channel of the change in imports from China on manufacturing employment in the US, Autor et al. (2019) use the change in imports from China to eight other high-income countries. When doing so, they intend to isolate the change in imports to the US that originates from productivity gains in the Chinese manufacturing industry and cost reductions due to lowered trade barriers. In other words, it isolates the import effect driven by supply changes in China rather than import demand changes or technological improvements in the US, and thus exclude circumstances specific to the US that have an effect on import choices. We adopt their approach by investigating imports from China to eight high-income countries: Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain and Switzerland [9]. These countries are expected to be exposed by the same intensity to world trade as Sweden, but facing different domestic shocks. This results in a weak correlation between high-income countries' industry import demand shocks. The underlying assumption is that the common within-industry component of increased imports from China to Sweden and to the eight other countries is due to China's rising comparative advantage. Therefore, this will make it possible for us to identify the supply-driven component of the change in exposure to Swedish imports from China. The instrument is presented below:

$$\Delta imports^{oc}_{i,\tau} = \sum_{j=1}^{J} \frac{L_{i,j,90}}{L_{i,90}} \Delta imports^{oc}_{j,\tau} \tag{14}$$

where $\Delta imports^{oc}_{i,\tau}$ is the change in the exposure of the other high-income countries' imports from China to municipality i in time period τ. The share component, $\frac{L_{i,j,90}}{L_{i,90}}$, is the employment share in industry j in municipality i, and is calculated for the 5-year-lag 1990. Similar to Autor et al. (2019), we use the lagged employment rate to take into account that current employment rates could be affected by anticipated trade with China. By using a lagged level of employment, we mitigate for potential simultaneity bias. The shift component, $\Delta imports^{oc}_{j,\tau}$, is the change in exposure of the other high-income countries' imports from China in industry j. The shift component is calculated as follows:

$$\Delta imports^{oc}_{j,\tau} = \frac{\Delta total\ imports^{oc}_{j,\tau}}{total\ production^{swe}_{j,93} + total\ imports^{swe}_{j,93} - total\ exports^{swe}_{j,93}} \tag{15}$$

where the nominator, $\Delta imports^{oc}_{j,\tau}$, now represents the average change in total imports to the eight other high-income countries in industry j in time period τ. The denominator is the initial absorption in industry j in the 3-year-lag 1993. In the next section, we will move on to the first stage regression, in which we instrument the instrumental variable on the independent endogenous variable to make it exogenous.

6.3 Model specifications

To identify the supply-driven component of the change in Swedish imports from China, we specify the first stage regression accordingly:

$$\Delta imports^{swe}_{i,\tau} = \rho + \gamma_1 \Delta imports^{oc}_{i,\tau} + \gamma_2 \mathbf{X}^{'}_{i,t} + \eta_{i,\tau} \tag{16}$$

[9]These are the same countries used in Autor et al. (2019).

where $\Delta imports^{swe}_{i,\tau}$ is the independent endogenous variable, ρ is a constant, $\Delta imports^{oc}_{i,\tau}$ is the instrument, the control vector $\mathbf{X}^{'}_{i,t}$ contains the manufacturing employment share in the start-of-period 1995 and the start-of-period covariates in the municipalities: the share of the population with at least a college degree, the share of foreign-born and the share of women employed. $\eta_{i,\tau}$ is the error term, varying by municipality i and time period τ. By instrumenting the independent endogenous variable, we exclude the part of the change in Swedish imports from China that is specific to labor demand factors that affect manufacturing industries in Sweden. If product demand shocks are correlated across Sweden and the eight other high-income countries, the specific labor demand factors in Sweden may not be fully removed by the instrument. This would create attenuation bias in which correlated product demand shocks might bias our estimate against finding an effect of the change in Swedish imports from China on Swedish manufacturing employment. Hereafter, the instrumented independent variable will be referred to as the overall trade shock.

In order to differentiate between male and female intensive industries, the gender-specific components are also separately included in the first stage regressions. The instrumented independent variable for male intensive industries will hereafter be referred to as the male-specific trade shock, and the instrumented independent variable for female intensive industries as the female-specific trade shock. All three trade shocks are separately included in the main specification of the reduced form regressions:

$$\Delta employment_{s,i,\tau} = \alpha + \delta_t + \beta_1 \Delta \hat{imports}^{swe}_{i,\tau} + \beta_2 \mathbf{X}^{'}_{i,t} + \epsilon_{s,i,\tau} \tag{17}$$

where $\Delta employment_{s,i,\tau}$ is the change in manufacturing employment among gender groups s (males, females or both) in municipality i in time period τ, α is a constant and δ_t is the time-fixed effect that accounts for changes over time correlated with the common trend of change in imports. As we estimate regressions in first differences, we do not include municipality fixed effects. β_1 is the coefficient of interest that measures the estimated average effect on the change in manufacturing employment due to changes in the supply-driven component of the exposure to Swedish imports from China. The control vector $\mathbf{X}^{'}_{i,t}$, contains the manufacturing employment share in the start-of-period 1995 which should ensure that the independent variable does not pick up the general declining trend of manufacturing in Sweden, a trend that is likely to be stronger in regions more dependent on manufacturing. The control vector also include the start-of-period covariates in the municipalities. $\epsilon_{s,i,\tau}$ is the error term and given that the errors in first difference specifications require less restrictive assumptions as they tend to follow a random walk, we use Newey-West standard errors in all specifications clustered on Swedish regions. Therefore, our estimates should be robust to variations in the error structures in the stacked and decade-specific regressions. Each of the three trade shocks are entered in separate regressions, estimated with different dependent variables and for different samples (males, females or both).

Lastly, we estimate the change in the exposure of Swedish imports from China on several other dependent variables: marriage, fertility, children's living circumstances, idleness, and absence. The procedure for constructing and summary statistics of the first differenced dependent variables is provided in Appendix I and Appendix Table C1, respectively. The following specification is identical for all dependent variables:

$$\Delta marriage_{s,i,\tau} = \pi + \delta_t + \theta_1 \Delta \hat{imports}^{swe}_{i,\tau} + \theta_2 \mathbf{X}'_{i,t} + \upsilon_{s,i,\tau} \qquad (18)$$

where θ_1 is the coefficient of interest estimating the average effect of a change in the exposure of Swedish imports from China on the share of married young women, births per 100 young women, the share of male residents and deaths per 1,000 young adults. All regressions are weighted by the product of the length of the time periods (10 and 13 years, respectively) and the municipality i's share of total population in the start-of-periods 1995 and 2005. This is appropriate since we use sample averages and the sample size is known.

6.4 Identifying assumptions

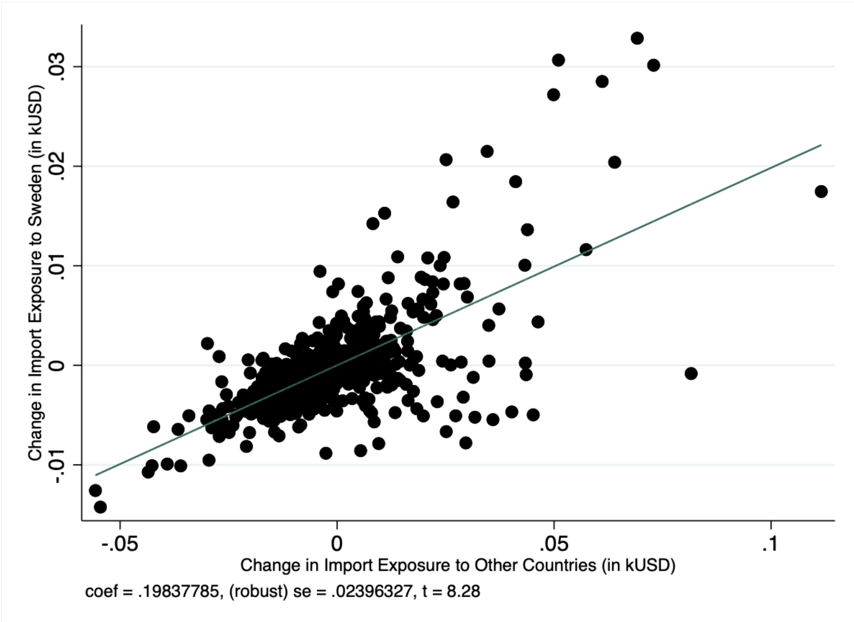

Figure 4: First Stage Regression 1995–2018

To motivate our choice of identification strategy, we need to address two underlying assumptions. First, we argue and test for the relevance criteria and second, argue for the exclusion restriction by proclaiming for exogeneity of the shares in our Bartik instrument. For the instrument to be relevant, it needs to have a statistically significant effect on Swedish imports from China. Figure 4 illustrates the positive relationship between the change in import exposure to the eight other high-income countries that we use in our instrument and the change in import exposure in Sweden. This is discussed in detail in Section 7.1.

The exclusion restriction implies that an instrument should only affect the dependent variable through its effect on the independent variable, conditional on observables (Cunningham, 2021). In our setting, the growth in industry-specific imports from China to other high-income countries should only have an impact on Swedish manufacturing employment through its effect on the growth in industry-specific Swedish imports from China. This is not directly testable and requires theoretical motivation for the 20 manufacturing industries in the time periods. The exclusion restriction can instead be fulfilled by arguing for exogeneity in the shares. Therefore, we rely our identification of the Bartik instrument on the assumption of the exogeneity of the industry-specific employment shares in the municipalities used to construct the instrument, following the framework in Goldsmith-Pinkham et al. (2020). The fulfillment of the exclusion restriction for Bartik instruments is traditionally based on two separate assumptions. One focuses on the exogeneity of the shares, and the other focuses on the exogeneity of the shift component (Cunningham, 2021). As argued in Borusyak et al. (2022), researchers using a Bartik instrument should decide on one of the two assumptions and perform suitable diagnostics. The share assumption is sufficient to identify a causal effect but not necessary. This means that if the research design does not satisfy the exogeneity condition of the shares, one solution is to prove that the shifts are exogenous. According to Goldsmith-Pinkham et al. (2020), the identification strategy is based on the share assumption if the researchers: (i) describe their research design as reflecting differential exogenous exposure to common shocks, (ii) emphasize a two-industry example, and/or (iii) emphasize shocks to specific industries as central to their research design. As we are interested in estimating the effect of a trade shock on manufacturing employment in different industries, both (i) and (iii) are fulfilled. Our research strategy relies on the assumption that industries' employment shares in the municipalities are differently affected by a common local labor market shock, i.e. the change in the exposure to Swedish imports from China[10]. For example, a municipality with a high share of manufacturing employment within a specific industry will probably be more affected by increased imports from China. We also assume that male and female intensive manufacturing industries are differently affected by increased imports from China. Hence, we have variation in municipal import exposure as well as in import exposure between industries. As a result, we can argue that industry-specific employment shares need to be exogenous. This is accomplished by instrumenting other countries' imports from China on Swedish imports, and this is the exclusion restriction underlying our instrumental variable strategy.

[10]See Appendix Table H1 for a presentation of Swedish regional differences in import exposure.

7 Results

7.1 First stage estimates

Table 3: Instrumenting Trade Shocks in Sweden by Trade Shocks in Other High-Income Countries, 1995–2018

	Sweden:						
	(1) Overall Shock	(2) Overall Shock	(3) Overall Shock	(4) Male Shock	(5) Male Shock	(6) Female Shock	(7) Female Shock
Other Countries:							
Overall Shock	0.195***	0.179***	0.198***				
	(0.019)	(0.025)	(0.024)				
Male Shock				0.200***	0.206***		
				(0.019)	(0.023)		
Female Shock						0.174***	0.177***
						(0.021)	(0.028)
Controls:							
Manufacturing Share	No	Yes	Yes	No	Yes	No	Yes
Other Municipality Characteristics	No	No	Yes	No	Yes	No	Yes
R^2	0.592	0.593	0.652	0.599	0.654	0.542	0.623
$F statistics$	110.25	110.25	68.532	110.65	87.801	67.99	35.949

Notes: Observations = 568 (284 municipalities x 2 time periods). Dependent variables: the growth in overall Swedish import exposure from China and the growth with gender-specific components. The regressions include a dummy for the second time period (2005–2018), the start-of-period manufacturing share as well as the municipality characteristics; the share of college-educated, the share of women employed, and the share of foreign-born. Models are weighted by the product of the length of the time period and municipality share of the start-of-periods 1995 and 2005 total population in Sweden. Robust standard errors in parentheses are clustered on regions. * $p < 0.05$, ** $p < 0.01$., *** $p < 0.001$

In Table 3, we present the results of the first stage regression. In Column 1, the coefficient is 0.195 and statistically significant at the 0.1 percent level without adding any control variables. In Column 2, when controlling for the initial manufacturing employment share in the municipality, the coefficient decreases to 0.179 and remains statistically significant. In Column 3 we include the municipality characteristics and the coefficient increases to 0.198, also statistically significant at the 0.1 percent level. The R-squared is 0.652 and the F-statistic is 68.532, suggesting that the instrument is relevant. The magnitude of the coefficient suggests that instrumenting Swedish import exposure corresponds to approximately 20 percent of the eight other high-income countries import exposure. This implies that the instrument is somewhat predictive and has sufficient explanatory power for changes in domestic import exposure. Columns 5 and 7 show the instruments that include gender-specific components and all control variables. The coefficients are statistically significant at the 0.1 percent level and is 0.206 for trade shocks affecting male intensive industries and 0.177 for female intensive industries. To conclude, all instruments have an F-statistic greater than 10, exceeding the rule-of-thumb value for a weak instrument[11]. This suggests that using import exposure to the eight other high-income countries is a valid approach for all three instruments.

[11]However, there is a current debate on IV inference and the rule of thumb of an F-statistic greater than 10. See Lee et al. (2021).

7.2 The impact of trade shocks on employment

Table 4: Estimated Effect of Trade Shocks on Manufacturing Employment and the Male-Female Gap in Employment Status, 1995–2018

Panel A: 2SLS Estimates	Manufacturing Employment					Male-Female Gap in Employment Status	
	(1) M+F	(2) M+F	(3) M+F	(4) Male	(5) Female	(6) Employed	(7) Unemployed
Overall Shock	-2.817***	-1.366*	-1.428*	-1.982*	-0.919*	0.383	0.071
	(0.433)	(0.577)	(0.571)	(0.898)	(0.365)	(0.418)	(0.429)
Male Shock	-1.617***	-0.754*	-0.796*	-1.214*	-0.395	0.253	0.027
	(0.284)	(0.333)	(0.341)	(0.534)	(0.224)	(0.255)	(0.256)
Female Shock	-8.135***	-3.651*	-3.718*	-3.056	-4.643***	0.240	0.527
	(0.715)	(1.582)	(1.471)	(2.212)	(0.968)	(0.765)	(0.962)
Panel B: OLS Estimates							
Overall shock	-2.078***	-1.039*	-1.236*	-1.766*	-0.678*	0.713*	-0.355
	(0.375)	(0.474)	(0.452)	(0.734)	(0.262)	(0.293)	(0.297)
Male Shock	-1.197***	-0.585*	-0.689*	-1.055*	-0.300	0.420*	-0.191
	(0.226)	(0.269)	(0.261)	(0.426)	(0.148)	(0.177)	(0.176)
Female Shock	-5.449***	-2.690*	-3.347*	-3.095	-3.685***	1.360*	-0.895
	(0.945)	(1.236)	(1.256)	(1.686)	(0.945)	(0.645)	(0.714)
Mean outcome variable	-2.191	-2.191	-2.191	-3.260	-1.112	-2.087	0.020
Level in 1995	13.177	13.177	13.177	19.310	6.498	6.776	7.811
Controls:							
Manufacturing Share	No	Yes	Yes	Yes	Yes	Yes	Yes
Other Municipality Characteristics	No	No	Yes	Yes	Yes	Yes	Yes

Notes: Observations = 568 (284 municipalities x 2 time periods). Dependent variables in Panel A and B: the change in total, male and female manufacturing employment and the male-female differential in overall employment and unemployment. Trade shocks are entered separately into the regressions and each cell is the result of one regression. The regressions also include a dummy for the second time period (2005–2018), the start-of-period manufacturing share as well as the municipality characteristics; the share of college-educated, the share of women employed, and the share of foreign-born. Models are weighted by the product of the length of the time period and municipality share of the start-of-periods 1995 and 2005 total population in Sweden. Robust standard errors in parentheses are clustered on regions. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4 presents our main results. Each cell represents the result of one regression and the three trade shocks are entered separately[12]. Panel A shows the 2SLS reduced form coefficients from the stacked first difference model estimating the effect of the trade shocks on manufacturing employment. The analogous OLS estimates are presented in Panel B where the trade shocks are the independent endogenous variables. In 1995, 13.2 percent of young men and women aged 16 to 39 were employed in manufacturing. In Panel A, Column 1, the overall trade shock is estimated on total manufacturing employment (the sample of both males and females) without controls, showing a coefficient of -2.817, which is statistically significant at the 0.1 percent level. In Column 2, we control for the initial manufacturing employment share in the municipality. This addresses the concern that the change in exposure of imports from China may partly pick up an overall declining trend in Swedish manufacturing employment rather than due to differences across manufacturing industries in their exposure to rising trade competition from China. The coefficient drops to -1.366, less than half the size compared to the endogenous specification in Column 1. In Column 3, inclusive of all controls, the estimate increases to -1.428. This suggests that a one-unit overall trade shock decreases total manufacturing employment by 1.428 percentage points. Despite the high correlation between the gender-specific measures ($\rho = 0.78$), there is sufficient power for distinguishing the independent effects of the trade shocks. A one-unit

[12]All tables presented in Section 7 are structured in the same way.

male-specific trade shock reduces manufacturing employment by 0.796 percentage points, and a one-unit female-specific shock reduces manufacturing employment by 3.718 percentage points. All estimates in Column 3 are statistically significant at the 5 percent level. Furthermore, we use the trade shock averages in Appendix Table D1, to calculate the average exposure of increased imports to Swedish municipalities. The coefficient $\hat{\beta}_1$ = -1.428 is multiplied by the average overall trade shock and implies a decline of 1.01 percentage points in manufacturing employment among young adults over the 23-year period. This translates to a 7.7 percent decline in overall manufacturing employment. The male-specific shock is associated with a 7.3 percent decline in overall manufacturing employment and the female specific-shock with a 5.4 percent decline. Therefore, the results are both statistically and economically significant.

In Table 5, presented in the next section, Columns 1 and 2 present the estimates for the time period-specific regressions, separating the first and second time periods: 1995 to 2005 and 2005 to 2018. The coefficients are negative in both decades, implying a decrease in manufacturing employment due to increased import exposure, in line with the results from the stacked first difference models presented in Table 4. The average of the time periods' estimates are also close in magnitude to the stacked model results. However, almost all the coefficients in the decade-specific model are statistically insignificant. This is likely due to the fact that the decade-specific models contain only half of the observations, which impacts the statistical power of the estimates, as the probability of finding an affect that actually exists depends on the sample size. The only coefficient that is statistically significant is the effect on total manufacturing employment during the later time period due to the female-specific trade shock. A one-unit increase in the female-specific trade shock decreases total manufacturing employment by 1.87 percentage points between 2005 and 2018, corresponding to a 2.7 percent decline in total manufacturing employment.

In Table 4, we run the regressions on a gender separated sample of young adults working in manufacturing presented in Columns 4 and 5. In 1995, 19.3 percent of young men and 6.5 percent of young women were employed in manufacturing industries. The overall trade shock decreases manufacturing employment for both samples: a one-unit increase in the overall import exposure reduces male workers by 1.982 percentage points and female workers by 0.919 percentage points. This translates into a 7.3 percent decrease of male workers, and a 10 percent decrease of female workers. Both coefficients are statistically significant at the 5 percent level. In Column 4, the sample of male employees decreases by 1.214 percentage points by a one-unit increase in the male-specific trade shock. The coefficient is statistically significant at the 5 percent level and corresponds to a 7.5 percent decline. The male-specific shock on the female sample shows a negative but not statistically significant effect. However, the sample of female manufacturing employees decreases by 4.643 percentage points by a one-unit increase in the female-specific import shock and is statistically significant at the 0.1 percent level, which corresponds to a 13.6 percent decline. Similarly, the female-specific import shock has a negative but not statistically significant effect on the sample of male manufacturing workers. In summary, the results indicate that an increase in import exposure from China has a negative effect on the share of manufacturing employment among young adults in Sweden.

The OLS regressions in Panel B present similar results. Overall, the OLS and IV estimates are relatively similar in magnitude, and all estimates point in the same direction, suggesting that almost all of the variation in the change in imports from China to Sweden is driven by the exogenous supply shock. Thus, the observed association between changes in manufacturing employment and increased import exposure does not appear to be driven by omitted variables such as factors causing an increase in demand for imports from China to Sweden.

To investigate whether trade shocks have an effect on relative economic stature, Columns 6 and 7 in Table 4 present results for the male-female gap in overall employment and unemployment in the municipality. The coefficients indicate a positive effect on the male relative to female municipality-to-population rate, however, none of the coefficients are statistically significant. In Appendix Table E1 shows only statistically insignificant estimates for overall employment and unemployment using the sub-samples of males and females. Therefore, we cannot say whether trade shocks affect overall employment or unemployment differently for men and women or whether trade shocks had any effect on overall employment status among young adults.

7.2.1 Robustness checks

Table 5: Estimated Effect of Trade Shocks on Manufacturing Employment Per Time Period, 1995–2005 and 2005–2018 and in the Pre-Period, 1990–1995

Panel A: 2SLS Estimates	Total Manufacturing Employment			
	(1) 1995–2005	(2) 2005–2018	(3) 1990–1995	(4) 1990–1995
Overall Shock	-2.934	-0.252	-1.804**	-1.267*
	(1.785)	(0.458)	(0.552)	(0.500)
Male Shock	-1.479	-0.053	-1.323***	-0.827**
	(0.890)	(0.300)	(0.380)	(0.299)
Female Shock	-11.655	-1.870*	-0.683	-2.831
	(8.374)	(0.934)	(1.198)	(1.720)
Panel B: OLS Estimates				
Overall shock	-1.387	-0.955	-0.591	0.358
	(0.901)	(0.499)	(0.483)	(0.404)
Male Shock	-0.723	-0.532	-0.397	0.209
	(0.479)	(0.290)	(0.295)	(0.243)
Female Shock	-5.672	-2.849	-0.683	0.878
	(3.671)	(1.372)	(1.198)	(0.997)
Mean outcome variable	-2.039	2.344	-0.03	-0.03
Level in 1995	13.177	13.177	16.084	16.084
Controls:				
Manufacturing Share	Yes	Yes	No	Yes
Other Municipality Characteristics	Yes	Yes	No	Yes

Notes: Observations = 284 (284 municipalities). Dependent variables: the change in total manufacturing employment per time period, 1995–2005 and 2005-2018 and the falsification test with future period import exposure on manufacturing employment in the pre-period, 1990–1995. Trade shocks are entered separately into the regressions and each cell is the result of one regression. The regressions include a dummy for the second time period (2005–2018) and the municipality characteristics; start-of-period manufacturing share, the share of college-educated, the share of women employed, and the share of foreign-born. Models are weighted by the product of the length of the time period and municipality share of the start-of-periods 1995 and 2005 total population in Sweden. Robust standard errors in parentheses are clustered on regions. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

In Table 5, Columns 3 and 4 we perform a falsification test to see whether a similar negative effect of the trade shocks can be found on manufacturing employment in the pre-period, i.e., before the large increase in Swedish imports from China. Ideally, we would have run a falsification exercise on manufacturing employment data from 1970 and 1980, more than a decade prior to China's large export boom. This would ensure that the significant effects are specific for the time periods and that the increased exposure to Swedish imports from China is not caused by some other factor that affects both the fall in manufacturing employment and the increase in imports. Since we only have data available from 1990 on manufacturing employment in Swedish industries, we perform the analysis for the year 1990 until our initial start-of-year 1995. Thus, we estimate the effect of future changes in the exposure of Swedish imports from China on past manufacturing employment shares. In Columns 3 and 4, we note that there still are negative effects on manufacturing employment among young adults due to the trade shocks in the pre-period. When including the control variables in Column 4, the coefficient is -1.267 and statistically significant at the 0.1 percent level. However, it is smaller in magnitude compared to our main coefficient of -1.428 presented in Table 4, Column 3. Furthermore, the negative effects of the China trade shocks are only present for the overall and male-specific trade shocks when estimating the regressions for the time period prior to our chosen start-of-year. Since 1995 is very close to our start-of-year, we did expect to find a negative effect. Nonetheless, the results in Table 5 still add some robustness to our main findings, though to a limited extent. It would have been more appropriate to perform the falsification test in an earlier time period to test the underlying assumption of our empirical strategy. This would have allowed us to rule out the possibility, with a higher degree of certainty, that the negative effect on the manufacturing employment share is rather a symptom of the secular decline in Swedish manufacturing employment during the years 1995 and 2018.

To further test the robustness of our main results, we limit the number of countries in the instruments by dropping Australia, Japan, and New Zealand. The results are presented in Appendix Table F1. The instruments are still valid but increase the negative effect on manufacturing employment, except for the female-specific trade shock on the sample of female workers, which modestly decreases the effect size. The remaining countries used in the instrument are now all European, which could be the reason why the estimated effects become larger for all trade shocks and samples. Overall, this speaks in favor of the robustness of our Bartik instrument given that all coefficients remain negative and of similar magnitude and that no country alone affects the main results to a large extent. Moreover, we exclude the municipality that experienced the largest population growth in Sweden[13]. We do this to ensure that the results are not driven by the construction of our dependent variable: the share of manufacturing workers in the municipality. A large population growth will lead to a mechanical reduction in the share of manufacturing employment, even though no manufacturing jobs are actually lost. The results are presented in Appendix Table G1, Columns 1, 2, and 3. The main coefficients barely change compared to the estimates in Table 4 and remain statistically significant.

Another concern of ours is that certain industries' import demand shocks are correlated across countries, potentially generating bias towards zero in our estimated results. Due to common innovation patterns in the use of information technology across the chosen high-income countries in our instrument, we experiment by dropping the industry for computers, electronics and optical

[13]The population growth in Stockholm between 1995 and 2018 was 35 percent (Statistics Sweden, 2022u).

products which we consider suspect to such a bias. The results are presented in Column 4 in Table 5. The coefficient increases to -1.628, compared to -1.428 as in the main specification in Table 4. Furthermore, to investigate whether the results are driven by certain consumer goods industries, we drop textiles and wearing apparels for which China has had a dominating role in, presented in Column 5. This modestly decreases the coefficient to -1.220. As a final exercise, we drop the industry for motor vehicles, trailers and semi-trailers in Column 6, which is one of the industries with the largest percentage growth in imports from China during the last decades while absorbing the largest manufacturing employment share in Sweden. This slightly decreases the coefficient to -1.329. All results remain statistically significant when we exclude these industries. Having established the robustness of our baseline model, we will continue the analysis using the main specification.

7.3 Income and idleness effects

Table 6: Estimated Effect of Trade Shocks on the Male-Female Gap in Annual Earned Income and Idleness, 1995–2018

Panel A: 2SLS Estimates	Log Annual Earned Income			Male-Female Gap in Idleness	
	(1) Male-Female Gap	(2) Male	(3) Female	(4) College Educated	(5) Not Employed
Overall Shock	-0.169	-0.793	-0.624	0.069	-0.383
	(0.487)	(0.703)	(0.780)	(0.194)	(0.418)
Male Shock	-0.084	-0.438	-0.354	0.054	-0.253
	(0.290)	(0.417)	(0.453)	(0.113)	(0.255)
Female Shock	-1.089	-2.539	-1.451	-0.250	-0.240
	(1.191)	(1.994)	(2.216)	(0.558)	(0.765)
Panel B: OLS Estimates					
Overall shock	0.382	-1.014	-1.395*	0.073	-0.713*
	(0.433)	(0.599)	(0.615)	(0.151)	(0.293)
Male Shock	0.191	-0.624	-0.815	0.050	-0.420*
	(0.252)	(0.350)	(0.356)	(0.089)	(0.177)
Female Shock	0.960	-1.826	-2.785	-0.139	-1.360*
	(1.084)	(1.567)	(1.569)	(0.429)	(0.645)
Mean outcome variable	-0.019	0.185	0.204	-5.509	2.087
Level in 1995	0.311	5.114	4.803	-2.918	-6.776

Notes: Observations = 568 (284 municipalities x 2 time periods). Dependent variables: the change in the male-female gap in log total annual earned income among young adults, the change in log total earned income separately for males and females, the change in the male-female gap in the share with at least a college degree and the male-female gap in the share of not currently employed. Trade shocks are entered separately into the regressions and each cell is the result of one regression. All regressions include a dummy for the second time period (2005–2018) and the municipality characteristics; start-of-period manufacturing share, the share of college-educated, the share of women employed, and the share of foreign-born. Models are weighted by the product of the length of the time period and municipality share of the start-of-periods 1995 and 2005 total population in Sweden. Robust standard errors in parentheses are clustered on regions. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

In this section, we quantify the effects of trade shocks on total annual earned income and idleness to see whether trade shocks have an effect on male relative to female economic stature. The dependent variable in Column 1 in Table 6 is the change in the male-female gap in log total annual earned income. The male-female gap was positive in 1995, suggesting that male earnings were higher than female earnings on average. The estimates of the effect on the gap by the different trade shocks in Column 1 are all negative but not statistically significant. However, the negative estimates suggest that the male-female earnings gap has narrowed over time, on average. Columns 2 and 3 show the change in income, separated by gender. The coefficients are also negative, but not statistically significant. Columns 4 and 5 report the results of the change in import exposure on the change in male relative to female idleness: the change in the male-female gap in the share of college educated and in the share of not currently employed. The effects are close to zero and not statistically significant. The estimated effects on the male-female gaps of not employed are negative for all shocks and also not statistically significant. The OLS results in Panel B, Column 4 show small coefficients on the male-female gap in college education. In Column 5, larger and statistically significant OLS estimates are found for the male-female gap in the share of not currently employed. Overall, we find no evidence that trade shocks have any effect on annual earnings or on the relative gap in idleness.

7.4 The impact of trade shocks on absence and mortality

Table 7: Estimated Effect of Trade Shocks on the Male Share of Adult Residents and the Number of Deaths, 1995–2018

Panel A: 2SLS Estimates	Residents	Deaths Per 1,000 Young Adults		
	(1) Male	(2) Male-Female Gap	(3) Male	(4) Female
Overall Shock	0.122	-4.991	-0.140	4.851
	(0.161)	(11.989)	(11.391)	(5.324)
Male Shock	0.070	-2.575	0.008	2.584
	(0.094)	(7.448)	(6.884)	(3.296)
Female Shock	0.245	-15.526	-0.555	14.971
	(0.363)	(21.771)	(21.442)	(12.368)
Panel B: OLS Estimates				
Overall Shock	0.089	8.122	6.708	-1.413
	(0.096)	(10.173)	(8.493)	(6.412)
Male Shock	0.052	5.198	4.274	-0.923
	(0.055)	(6.253)	(4.998)	(3.778)
Female Shock	0.181	12.167	10.732	-1.434
	(0.287)	(17.651)	(18.989)	(15.926)
Mean outcome variable	0.461	-0.059	-0.062	-0.003
Level in 1995	0.518	0.422	0.774	0.384

Notes: Observations = 568 (284 municipalities x 2 time periods). Dependent variables: the change in the share of young male residents, the change in the male-female gap in the number of deaths per 1000 young adult, and the change in the male and female death rate per 1,000 young adult. Trade shocks are entered separately into the regressions and each cell is the result of one regression. All regressions include a dummy for the second time period (2005–2018) and the municipality characteristics; start-of-period manufacturing share, the share of college-educated, the share of women employed, and the share of foreign-born. Models are weighted by the product of the length of the time period and municipality share of the start-of-periods 1995 and 2005 total population in Sweden. Robust standard errors in parentheses are clustered on regions. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

In Table 7, we turn to our estimation of how the loss of manufacturing jobs affects two non-market measures: the change in the share of young male residents and deaths per 1,000 young adults in the municipality. The share of male residents in Swedish municipalities was on average 51.8 percent in 1995. Panel A, Column 1, show positive estimates, implying an increase in the share of male residents due to the three trade shocks. However, the results should be interpreted with caution since they are not statistically significant. The OLS estimates in Panel B show similar results. Moreover, the effects on the male-female death gap in Column 2 are negative, but not statistically significant. Column 3 shows the effect on death rates for the male-specific sample. The coefficients are close to zero suggesting that trade shocks do not affect male death rates.

However, this result is not statistically significant. The estimate for the female sample is larger and presented in Column 4: a one-unit female-specific trade shock is associated with an increase of 14.97 deaths per 1,000 young women, on average. This corresponds to a 7.4 percent increase in the number of deaths per 1,000 young women during the period of interest. This should also be interpreted with caution since neither of the coefficients are statistically significant.

7.5 The impact of trade shocks on marriage, fertility and children's living circumstances

Table 8: Estimated Effect of Trade Shocks on Women's Marital Status and Births Per 100 Women, 1995–2018

Panel A: 2SLS Estimates	Marital Status			Fertility
	(1) Married Women	(2) Never Married Women	(3) Divorced Women	(4) Births Per 100 Women
Overall Shock	0.943***	-0.701	-0.234	34.557*
	(0.320)	(0.375)	(0.137)	(17.338)
Male Shock	0.621**	-0.485*	-0.133	22.859*
	(0.209)	(0.236)	(0.076)	(10.901)
Female Shock	0.707	-0.124	0.550	21.699
	(0.477)	(0.602)	(0.416)	(25.925)
Panel B: OLS Estimates				
Overall shock	0.524	-0.389	-0.152	5.359
	(0.251)	(0.299)	(0.074)	(11.664)
Male Shock	0.343*	-0.263	-0.090*	4.870
	(0.146)	(0.174)	(0.041)	(6.601)
Female Shock	0.147	0.076	-0.261	-35.632
	(0.730)	(0.809)	(0.245)	(32.467)
Mean outcome variable	-3.712	4.135	-0.414	0.116
Level in 1995	32.699	62.626	4.502	7.576

Notes: Observations = 568 (284 municipalities x 2 time periods). Dependent variables: the change in the share of married, never married and divorced young women and the change in births per 100 women. Trade shocks are entered separately into the regressions and each cell is the result of one regression. All regressions include a dummy for the second time period (2005–2018) and the municipality characteristics; start-of-period manufacturing share, the share of college-educated, the share of women employed, and the share of foreign-born. Models are weighted by the product of the length of the time period and municipality share of the start-of-periods 1995 and 2005 total population in Sweden. Robust standard errors in parentheses are clustered on regions. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

The last part of the analysis examines whether trade shocks and its associated decrease in manufacturing employment has an effect on other social outcomes, such as women's marital status and fertility. The outcome variables in Table 8 are the change in the share of married, never married, and divorced young women, and the number of births per 100 women. Panel A, Column 1 shows that a one-unit overall trade shock increases the share of married young women by 0.943 percentage points. The effect is statistically significant at the 1 percent level and translates into a 2.1 percent increase in marriage rates for women. Similarly, the male-specific shock reports a positive coefficient of 0.621, corresponding to a 1.3 percent increase in the share of married women, which is also statistically significant at the 1 percent level. The female-specific trade shock also shows a positive coefficient, but it is not statistically significant. Column 2 only presents a statistically significant effect on the share of never married women by the male-specific trade shock: a one-unit male-specific trade shock is associated with a 0.485 decrease in the share of never married young women. This corresponds to a 0.9 percent decrease in the share of never married women. Column 3 shows negative effects on the share of divorced women, but the estimates are not statistically significant.

Aligned with the results for married young women, Column 4 presents statistically significant effects of the overall and male-specific trade shocks on fertility. In 1995, the number of births per 100 women aged 16–39 was 7.6 in an average municipality. The estimated effect on fertility by a one-unit overall trade shock corresponds to an increase of 34.6 births per 100 women over the estimated period. The male-specific shock increases the number of births per 100 women by 22.9 births. Both results are statistically significant at the 5 percent level. This corresponds to a 323.9 percent and 362.1 percent increase in the births per 100 women, respectively. The female-specific trade shock shows a positive but statistically insignificant effect on the number of births.

Table 9: Estimated Effect of Trade Shocks on Children's Household Type, 2000–2014 and Households with Social Assistance, 2000-2009

Panel A: 2SLS Estimates	Children's Household Type				Social Assistance
	(1) Married Parents	(2) Cohabiting Parents	(3) Single Mothers	(4) Single Fathers	(5) Households with Children
Overall Shock	0.294	-0.558*	0.053	0.211*	-0.156
	(0.259)	(0.223)	(0.202)	(0.097)	(0.658)
Male Shock	0.180	-0.353*	0.054	0.119*	0.024
	(0.159)	(0.131)	(0.115)	(0.058)	(0.368)
Female Shock	0.530	-0.727	-0.324	0.520*	-2.439
	(0.539)	(0.526)	(0.530)	(0.211)	(0.033)
Panel B: OLS Estimates					
Overall shock	0.703***	-0.722***	0.001	0.018	-0.958
	(0.175)	(0.186)	(0.143)	(0.059)	(0.572)
Male Shock	0.426***	-0.441***	0.010	0.006	-0.469
	(0.146)	(0.105)	(0.082)	(0.035)	(0.331)
Female Shock	1.262*	-1.140*	-0.259	0.137	-4.170*
	(0.484)	(0.454)	(0.447)	(0.148)	(0.033)
Mean outcome variable	-0.025	0.020	-0.001	0.006	0.000
Level in 2000	51.348	25.510	18.046	5.067	11.440

Notes: Observations = 568 (284 municipalities x 2 time periods). Dependent variables: the change in the share of total households with children aged 0–17 years that are: cohabiting married parents, cohabiting not married parents, single mothers and single fathers, for the two time periods 2000–2005 and 2005–2014, the change in the share of household with children receiving social assistance in the two time periods, 2000–2005 and 2005–2009. Trade shocks are entered separately into the regressions and each cell is the result of one regression. All regressions include a dummy for the second time period (2005–2018) and the municipality characteristics; start-of-period manufacturing share, the share of college-educated, the share of women employed, and the share of foreign-born. Models are weighted by the product of the length of the time period and municipality share of the start-of-periods 1995 and 2005 total population in Sweden. Robust standard errors in parentheses are clustered on regions. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Finally, in Table 9 we test for impacts of trade shocks on children's living circumstances, namely, the child's household type and the share of households receiving social assistance. We see positive but not statistically significant effects on the change in the share of married parents in Column 1. However, the share of cohabiting parents who are not married decreases due to the overall trade shock, as well as for the male-specific trade shock, in Columns 2 and 3. Both coefficients are statistically significant at the 5 percent level. A one unit-overall trade shock decreases the share of cohabiting but not married parents by 0.558 percentage points, which corresponds to a 1.6 percent decrease over the period 2000 to 2014. The male-specific shock reduces the share of not married but cohabiting parents by 1.7 percent. The female-specific shock does not have a statistically significant effect for married or not married but cohabiting parents. When investigating the impact of trade shocks on single households in Columns 3 and 4, the only statistically significant effect is found for single fathers; a one-unit overall trade shock is associated with an increase in the share of single father households with 3 percent. The male and female-specific trade shocks increase the share of single fathers with 2.8 percent and 1.9 percent, respectively. We cannot see any effect on the share of single mothers. As seen in Column 5, we find no evidence of any statistically significant effects of trade shocks on the share of households with children receiving financial support through the social assistance system.

All dependent variables in Table 9 have a mean close to zero which implies that the choice to use a first-difference model for these variables is disputable. For example, in addition to the likelihood that there is actually no effect from trade shocks, the mean of the outcome variable is zero, suggesting that there is no change in the share of households with social assistance over the time periods 2000 to 2005 and 2005 to 2009.

8 Discussion

Our finding of a declining share of manufacturing workers in Sweden is in line with the theoretical trade model by Autor et al. (2013) and many other empirical studies investigating the relationship between increased trade opportunities and domestic labor market outcomes in high-income countries (Autor et al., 2019; Balsvik et al., 2015; Dauth et al., 2014; Donoso et al., 2014; Utar, 2014). To benchmark the economic significance of our results, we compare the estimated decline in the manufacturing employment share caused by trade shocks with the overall observed decline in the employment share between 1995 and 2018. This is plausible under the assumption that increased import exposure from China affects the absolute level of Swedish manufacturing employment, and not only relative employment across municipalities. Given the large increase in imports from China to Sweden during 1995 and 2018 and considering the size of the Chinese manufacturing industry in relation to the Swedish industry, it implies that changes in import exposure from China also have an absolute effect on Swedish manufacturing employment. Also, previous Nordic evidence from Balsvik et al. (2015) show that the emergence of China as the world's largest manufacturing exporting country affected manufacturing employment in Norway over a similar time window.

The average levels of manufacturing employment in 1995, 2005 and 2018 are presented in Appendix Table B1. Overall manufacturing employment in Sweden decreased by 4.4 percentage points among young adults in the 20 industries we study. Since we estimate a decrease in overall manufacturing employment equal to 1 percentage point on average due to the overall trade shock[14], it suggests that increased import competition from China can explain 22.6 percent of the overall decline in manufacturing jobs. Although it is important to benchmark our estimates to convey the economic significance of our results, it should be considered with caution. The 2SLS estimate of the decline in manufacturing employment is due to supply shocks in China, whereas the average import exposure in Appendix Table D1 is the total change in the import exposure, taking both demand and supply changes into account. Thus, the approximations could be overstated if the demand-driven component of Swedish imports from China has a smaller ef-

[14] Calculated as the coefficient -1.428 from Table 4 multiplied by the average exposure of the overall trade shock in the municipalities (0.71) from Appendix Table D1.

fect on employment than the supply-driven component. To control for this, we follow the Theory Appendix in Autor et al. (2013) and use the relationship of the OLS and 2SLS estimates to perform a simple variance decomposition to isolate the supply-driven component also in the measure of the total trade shock. This is described in detail in Appendix J. Derived from the variance decomposition, we find that the effect on manufacturing employment of a one-unit trade shock is scaled by the total change in import exposure and discounted by the fraction of the variance that is not driven by supply factors of the trade shock. We find that a large part, almost 80 percent of the change in imports is explained by China-specific supply factors[15]. Our calculation yields a greater value than in the US case where Autor et al. (2013) find that the supply-component accounts for only roughly half of the variation in imports from China to the US. However, our result is similar to Balsvik et al. (2015), who state that 91 percent of the variation in the increase in imports from China to Norway is driven by the supply-driven component. This stems from the fact that our estimated effects obtained from the OLS and 2SLS specifications are similar in magnitude, and hence, most of the variation in the increase in imports from China to Sweden is driven by the exogenous supply shock.

Once we have isolated the supply-driven part of the average trade shock, the more conservative interpretation is that increased exposure to Swedish imports from China can explain 18.4 percent of the overall decline in manufacturing jobs among young adults. This can be compared to the US where 21 percent of the decline in manufacturing employment for the working-age population can be explained by increased imports from China, between the years 1990 and 2007 (Autor et al., 2013) and in Norway where the equivalent estimation was 10 percent (Balsvik et al. (2015). Interestingly, our results are notable compared to previous insignificant results on Swedish manufacturing in Jiang et al. (2022). Nevertheless, their study considers the employment effects for the entire working-age population, while we focus on young adults aged 16–39. Also worth mentioning is that we do not intend to estimate whether increased domestic export opportunities to China can compensate for the loss in manufacturing jobs (Liang, 2021; Dauth et al., 2014), or if an increase in non-manufacturing employment can absorb workers initially coming from the trade-exposed sector (Donoso et al., 2014). Such compensating factors in overall employment could be interesting to investigate in the Swedish setting in future research, as our results indicate a relatively large decline in manufacturing employment, but no average increase in overall unemployment.

Another important contribution of our study is that we allow for variation in how trade shocks affect male and female intensive industries. The estimate of how a trade shock affecting male intensive industries suggests a decrease of the share of men employed in manufacturing by 1.1 percentage points on average and from Appendix Table B1 we see that the overall male manufacturing employment declined by 6.5 percentage points. Conservatively calculated, the estimate implies that increased exposure to imports from China accounts for roughly 16.9 percent of the overall decline in male employment[16]. A trade shock targeting female intensive industries can

[15]The regression coefficients $\hat{\beta}_{OLS} = -2.078$, $\hat{\beta}_{IV} = -2.8178$ from Table 4, Column 1, and $\hat{\beta}_{\epsilon} = 0.689$ from our data implies that the weight on the supply-component equals the fraction of the total variance explained by the supply factors $\sigma^2_{IV}/(\sigma^2_{IV} + \sigma^2_{\epsilon}) = 0.799$. For the benchmark exercise, the magnitude of the estimated effect is calculated as $\hat{\beta}_{IV}$ x $\Delta imports$ x 0.799.

[16]From our data, the coefficients from the regression without control variables are $\hat{\beta}^{male}_{OLS} = -1.736$, $\hat{\beta}^{male}_{IV} = -2.378$ and $\hat{\beta}_{\epsilon} = 0.655$. This implies that the weight of the supply-component is equal to the fraction of the total variance explained by the supply factors $\sigma^2_{IV}/(\sigma^2_{IV} + \sigma^2_{\epsilon}) = 0.782$. For the benchmark exercise, the magnitude of the estimated effect is calculated as $\hat{\beta}^{male}_{IV}$ x $\Delta imports$ x 0.782.

explain about 28.6 percent of the overall decline (by 2.2 percentage points from Appendix Table B1) in the share of women employed in manufacturing[17]. It also seems as if the gender-specific shocks only result in significant effects when the shock and outcome variable match with respect to gender, that is, male shock on male intensive manufacturing employment and female shock on female intensive manufacturing employment. These results are in line with the gender-specific shocks in Autor et al. (2019) and speak in favor of the validity of our instruments and the fact that the instruments pick up the actual variation in the gender structure within manufacturing industries.

Next, we discuss our findings on the effect on economic stature. Although we find absolute declines in the share of manufacturing workers within Swedish municipalities for both genders, the question regarding male relative to female economic stature remains unanswered. Given that we do not find any effects of trade shocks on the male-female gap in overall employment, unemployment, or total annual income, we cannot draw any conclusions about changes in the economic stature of males. Furthermore, we cannot say that the decline in manufacturing jobs leads to a higher degree of idleness among young men in Sweden. Thus, we do not know if people affected by the decline start studying, enter another job position, or remain unemployed. Our results can be seen as conflicting with earlier findings by Autor et al. (2019), who instead find large negative effects on men's relative employment and earnings, thus a significant contraction of economically secure young men in the US. We therefore find it difficult to test for the predictions in Becker's model of the gains from marriage, since we find no evidence of declines in the relative economic stature. Nevertheless, we find evidence of an absolute drop in the share of manufacturing workers for both men and women. Our results could therefore be seen in line with the hypothesis in Wilson (1987), namely, that manufacturing contraction shrinks the pool of economically secure young adult men. Since we find no absolute increase in unemployment among men as Autor et al. (2019), we cannot with certainty link the decline in manufacturing employment to our estimated increase in marriage and fertility since we find no evidence that men have become unemployed and thus less marriageable. Therefore, it is not straightforward to evaluate the theory that declines in manufacturing jobs should have a negative impact on marriage, fertility, and children's living circumstances in a Swedish context. In other words, we do not find the same support for the theory of Wilson (1987) as in Autor et al. (2019).

On the other hand, our analysis indicates that the overall and male-specific trade shocks increased the share of married young women. The results are quite surprising in the sense that they show an opposite relationship between declines in manufacturing employment and marriage rates compared to previous findings in the US. Although, as argued above, we cannot with the same confidence as Autor et al. (2019) identify the channel between manufacturing employment and marriage rates, who finds evidence of increased unemployment in the commuting zones. Also, we did not expect our results to exactly resemble the findings in US data, considering the Swedish welfare state and history of progressive norms of gender-equality. Reviewing empirical evidence of the relationship between unemployment and marriage rates in the Nordic region, Jensen and Schmitt (1990) and Eliasson (2012) find significant effects of a negative relation between male job loss and marital stability. As such, our findings on marriage rates can be seen as conflicting with

[17] From our data, the coefficients from the regression without control variables are $\hat{\beta}_{OLS}^{female} = -4.492$, $\hat{\beta}_{IV}^{female} = -6.123$ and $\hat{\beta}_{\epsilon}^{female} = 0.587$. This implies that the weight of the supply-component is equal to the fraction of the total variance explained by the supply factors $\sigma_{IV}^{2,female}/(\sigma_{IV}^{2,female} + \sigma_{\epsilon}^{2,female}) = 0.714$. For the benchmark exercise, the magnitude of the estimated effect is calculated as $\hat{\beta}_{IV}^{female}$ x $\Delta imports$ x 0.714.

previous research on Denmark and Sweden. Yet, we find no statistically important effects for female divorce rates. Instead, our analysis could be considered as support for the claim by Shore (2010) and Stevenson and Wolfers (2007) that marriage is considered as an insurance against poor economic conditions. This leaves the question of why marriage increases when manufacturing jobs disappear in Sweden unanswered and opens up the need for further empirical studies of potential mechanisms behind the relationship. Our estimated positive effects on fertility rates due to declines in manufacturing employment in Sweden are similar to the findings in Kolk and Barclay (2021). Moreover, our findings are contrary to Lundström and Andersson (2012) showing that unemployed individuals in Sweden are less likely to start a family. A potential explanation that could be explored in future research is whether economic insecurities among men induce women to marry and start a family. It is plausible to imagine that as Swedish women have become more gender equal compared to their male partners, the norm of a male-breadwinner has diminished and been replaced by a new gender role of a female-breadwinner.

Compared to Autor et al. (2019), we find no effects on death rates and children's living circumstances. First, and as previously specified, we do not know whether the declining effect on manufacturing employment results in unemployment among workers formerly employed within manufacturing. Taking this into account, it seems unlikely that we would have found any significant effects of trade shocks on the number of deaths among young adults in Sweden. Also, taking into consideration the structure of the Swedish welfare system, it is not convincing that losing your job in Sweden should impact the likelihood of dying between the age of 16–39. Second, the fact that we do not see any effect on the share of families receiving social assistance could also be explained by the lack of evidence of an increase in overall unemployment. Regarding children's household type, we find that trade shocks affecting male intensive industries decrease the share of cohabiting parents and increase the fraction of single-father households. A possible mechanism behind these results could be that trade shocks affect fathers' employment status more heavily compared to mothers', making them less attractive on the marriage market. This is because manufacturing industries tend to be dominated by men.

There are some caveats in this study that need to be acknowledged. First, and most importantly, the lack of pre-period data of manufacturing employment is a threat to the validity of our results. Without being able to examine whether increased imports from China affected manufacturing employment in Sweden before China's export boom started in the early 1990s, the robustness of our main result of a decline in manufacturing remains unclear. This is an obvious drawback of our analysis compared to Autor et al. (2013) and Autor et al. (2019), who can test for the risk of some other factor that impacts both the fall in manufacturing employment and the increase in US imports from China. Data limitations also impact the years used to construct the lagged share of manufacturing employment in the instrument. To mitigate this, we use the first year available which is the employment level in 1990, only 5 years prior to the start-of-year 1995. This potentially creates a risk of simultaneity bias. Similarly to Autor et al. (2013), we would have wanted to access employment data from 1985 and use employment levels from the prior decade, to account for the degree that contemporaneous employment in a municipality is affected by anticipated trade with China, causing the bias.

Another concern is our industrial classification procedure. To make the data on manufacturing employment comparable over the time period, we had to use keys to convert the different versions of SNI-classifications. There is a risk of conversion errors since the number of code digits differed between data sets, which could mean that some workers have been coded into the wrong industry.

Related to the overarching issue of data availability, we use 284 municipalities as a measure of local labor markets instead of using alternative constructions of Swedish commuting zones. Autor et al. (2013) emphasize that commuting zones are appropriate since they are based on economic geography creating strong commuting ties within zones but weak ties across. A potential problem of using Swedish municipalities could be that there are still commuting ties between municipalities. During the observed period, some municipalities also split or merged, which could lead to imprecise estimations. Furthermore, the data used to estimate the effect on wages are flawed. In an optimal scenario, we would have preferred register data over individual wages to be able to implement the Chetverikov et al. (2016) technique, as do Autor et al. (2019), and thus perform IV estimation of trade shocks on the male-female gap in earnings over different percentiles of the distribution. Instead, we only estimate the average total earned income within the municipality for men and women, and thus we cannot study within-group differences.

9 Conclusion

The decline in manufacturing jobs and the increase in import competition from China is a well-studied topic. At the same time, uncertainties in the labor market have been repeatedly associated with the occurrence of marriage and family formation. Yet, little work has been done to reveal the plausible connections between the two, especially in the context of Sweden. By building a data set, mapping Swedish manufacturing employment and the increase in imports from manufacturing industries in China, this study shed light on the effect of increased globalization and its impact on local labor markets. Additionally, our study links trade shocks that differently affect male and female intensive industries to social outcomes. We employ an instrumental variable strategy and find statistically significant effects of trade shocks that decrease the share of manufacturing employment and increase marriage and fertility rates in Sweden during the years 1995 and 2018. However, we cannot with certainty establish the link between the decline in manufacturing jobs with overall employment status. Given that the impact of trade shocks on marriage and fertility rates is determined by the country-specific context in which they occur, our result could contribute to a more comprehensive understanding of what happens when manufacturing jobs disappear. In particular, it adds to the already existing literature on the role of Chinese import competition in Nordic labor markets. As a final note, more research is needed to address potential mechanisms that shape gender norms, as well as the importance of relative economic stature in family formation.

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Appendix A

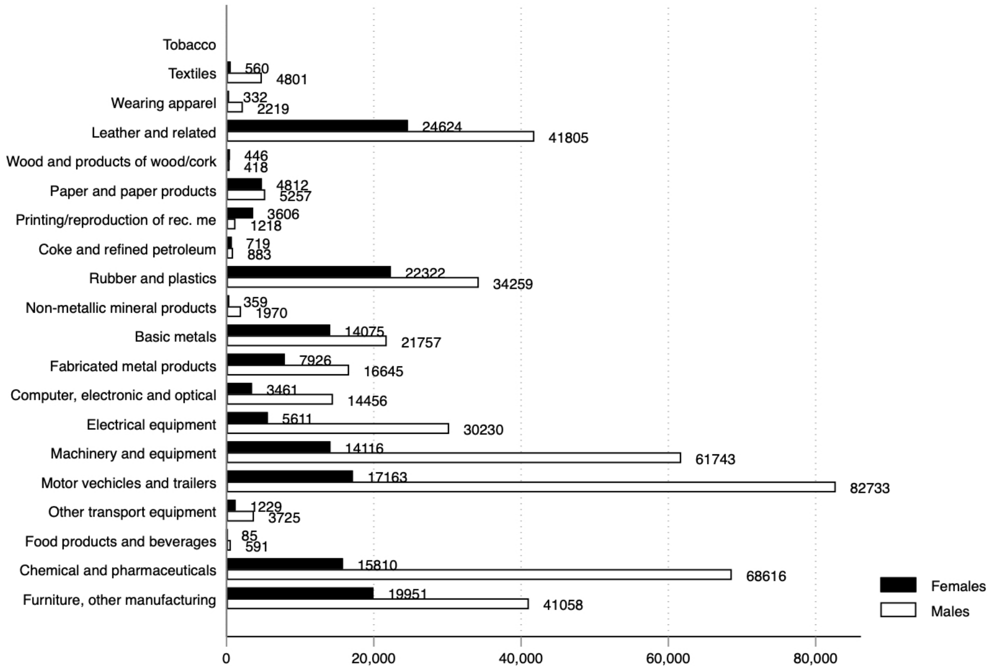

Figure A1: Swedish manufacturing employment with gender composition in 1995

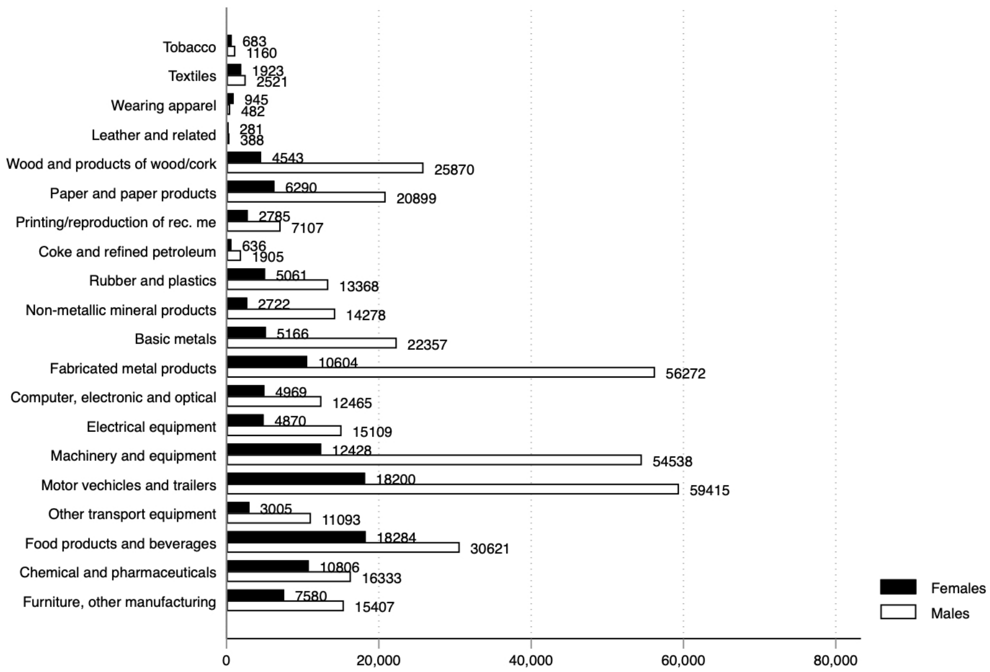

Figure A2: Swedish manufacturing employment with gender composition in 2018

Appendix B

Table B1: Summary Statistics over Manufacturing Employment

Summary Statistics over Manufacturing Employment

	Mean		
Variable	1995	2005	2018
Total Manufacturing Employment	13.177	11.137	8.793
	(6.405)	(5.812)	(5.343)
Male Manufacturing Employment	19.310	16.478	12.789
	(9.047)	(8.444)	(7.563)
Female Manufacturing Employment	6.498	5.328	4.273
	(4.078)	(3.379)	(2.961)

Notes: Summary statistics over the manufacturing employment share in the years 1995, 2005 and 2018.

Appendix C

Table C1: Summary Statistics over the Dependent and the Control Variables

Summary Statistics over the Dependent and the Control Variables

	1995–2005				2005–2018			
Variable	*Mean*	*Median*	*Min*	*Max*	*Mean*	*Median*	*Min*	*Max*
I. Dependent Variables								
Share of Manufacturing Employment	-2.04 (2.75)	-1.70	-14.14	6.14	-2.34 (3.51)	-2.36	-15.09	17.11
Male Share of Manufacturing Employment	-2.83 (3.79)	-2.47	-20.47	9.42	-3.69 (5.15)	-3.64	-24.07	22.58
Female Share of Manufacturing Employment	-1.17 (2.21)	-0.82	-13.35	4.60	-1.05 (2.27)	-1.15	-8.17	10.39
Male-Female Gap in Total Municipal Employment	-1.81 (3.83)	-1.87	-18.40	12.21	-2.36 (3.05)	-2.31	-11.18	9.06
Male-Female Gap in Log Total Annual Earned Income	0.69 (3.89)	0.59	-12.51	14.31	-4.46 (5.53)	-4.88	-16.09	14.96
Log Total Annual Earned Income for Males	20.67 (2.31)	21.16	1.82	32.14	16.33 (4.56)	16.35	-0.49	42.04
Log Total Annual Earned Income for Females	19.98 (4.88)	20.37	6.14	32.97	20.79 (5.79)	21.25	3.80	41.22
Male-female Gap in the Share of College Educated	-5.90 (1.86)	-5.85	-12.35	-0.28	-4.21 (2.37)	-4.34	-10.10	3.70
Male-female Gap in the Share of Not Employed	1.81 (3.83)	1.87	-12.21	18.40	2.36 (3.05)	2.31	-9.06	11.18
Share of Male Residents	-0.07 (0.94)	-0.10	-3.38	3.49	0.99 (1.16)	0.90	-3.68	5.31
Male-Female Gap in Share of Deaths	0.00 (0.12)	0.00	-0.59	17.35	0.01 (0.12)	0.00	-0.55	0.51
Share of Male Deaths	0.00 (0.09)	0.00	-0.40	0.39	0.00 (0.09)	0.00	-0.39	0.35
Share of Female Deaths	0.00 (0.07)	0.00	-0.31	0.26	0.00 (0.07)	0.00	-0.33	0.32
Share of Married Women	-7.56 (3.09)	-7.56	-17.46	-0.12	0.13 (2.97)	0.31	-10.11	9.07
Share of Never-Married Women	8.10 (3.12)	7.89	0.56	17.78	0.17 (3.29)	0.04	-9.02	11.11
Share of Divorced Women	-0.49 (0.79)	-0.54	-3.81	2.03	-0.34 (0.76)	-0.36	-2.75	1.98
Share of Women Giving Birth	-0.49 (0.98)	-0.49	-3.31	2.34	0.72 (1.35)	0.69	-3.17	4.31
Share of Married Parents	-3.92 (1.91)	-3.86	-10.93	0.69	-0.98 (2.51)	-0.90	-9.22	7.95
Share of Unmarried Parents	3.02 (1.41)	2.94	-0.19	9.12	0.91 (2.03)	0.86	-4.49	6.99
Share of Single Mothers	0.26 (1.40)	0.27	-3.70	3.87	-0.55 (1.91)	-0.71	-7.35	6.20
Share of Single Fathers	0.64 (0.64)	0.65	-1.62	2.59	0.62 (0.83)	0.59	-2.90	3.78
Share of Households with Children with Social Assistance	0.00 (0.04)	0.00	-0.13	0.12	0.00 (0.04)	0.01	-0.12	0.11
II. Control Variables								
Share of Female Employment	58.98 (4.27)	58.64	47.62	71.72	74.75 (3.75)	74.65	60.10	83.30
Share of College Educated	15.50 (6.39)	13.70	0.00	50.78	20.99 (8.18)	18.97	3.66	59.93
Share of Foreign-Born	9.10 (5.23)	7.79	2.28	39.56	10.20 (5.44)	8.87	3.05	40.4

Notes: The dependent variables are calculated as the change in the share across the two time periods, 1995–2005 and 2005–2018. The dependent variables are the change in percentage points and the control variables are the shares in percent multiplied by 100.

Appendix D

Table D1: Summary Statistics over the Time Period Changes in the Independent Variable and the Instrument

Summary Statistics over the Time Period Changes in the Independent Variable and the Instrument

	1995–2005				2005–2018				1995–2018
Import Exposure	*Mean*	*Median*	*Min*	*Max*	*Mean*	*Median*	*Min*	*Max*	*Mean*
I. Sweden:									
Overall Shock	0.79	0.66	0.16	4.24	0.63	0.43	0.08	4.35	0.71
	(0.57)				(0.60)				(0.59)
Male Shock	1.31	1.07	0.23	6.69	1.09	0.74	0.14	7.90	1.20
	(0.93)				(1.09)				(1.02)
Female Shock	0.24	0.18	0.04	2.15	0.14	0.10	0.01	0.89	0.19
	(0.24)				(0.13)				(0.20)
II. Other Countries:									
Overall Shock	3.59	2.86	0.78	17.35	3.79	3.26	1.00	14.22	3.69
	(2.31)				(2.24)				(2.27)
Male Shock	5.98	4.79	1.30	26.41	6.45	5.56	1.55	24.96	6.21
	(3.83)				(3.86)				(3.85)
Female Shock	1.14	0.88	0.09	8.25	1.08	0.867	0.15	6.13	1.11
	(0.92)				(0.74)				(0.84)

Notes: Summary statistics over the independent endogenous variables (the measure of the change in exposure of Swedish imports from China) and the instruments (the measure of change in exposure of the eight other countries imports from China) separated for the time periods. The last column show the stacked averages for the entire time period, 1995–2018. The measurements are expressed in percent and multiplied by 100.

Appendix E

Table E1: Change in Overall Employment Status

Estimated Effect of Trade Shocks on Employment Status for Males and Females, 1995–2018

Panel A: 2SLS Estimates	Employment		Unemployment	
	(1) Males	(2) Females	(3) Males	(4) Females
Overall Shock	-0.292	-0.675	0.019	-0.052
	(0.475)	(0.475)	(0.446)	(0.602)
Male Shock	-0.099	-0.352	-0.115	-0.014
	(0.280)	(0.268)	(0.267)	(0.374)
Female Shock	-1.940	-2.181	2.679	2.151
	(1.318)	(1.372)	(1.665)	(1.493)
Panel B: OLS Estimates				
Overall shock	-1.810***	-1.572***	-0.008	-1.010
	(0.211)	(0.272)	(0.782)	(0.866)
Male Shock	-1.040***	-0.877***	0.001	-0.595
	(0.134)	(0.177)	(0.462)	(0.525)
Female Shock	-4.739***	-5.042***	0.063	-2.084
	(0.723)	(0.837)	(2.155)	(2.103)
Mean outcome variable	0.020	0.040	-0.095	-0.074
Level in 1995	58.982	65.759	32.615	35.219

Notes: Observations = 568 (284 municipalities x 2 time periods). Dependent variables: the change in male and female overall employment and overall unemployment in the municipalities among young adults. Trade shocks are entered separately into the regressions and each cell is the result of one regression. All regressions include a dummy for the second time period (2005–2018) and the municipality characteristics; start-of-period manufacturing share, the share of college-educated, the share of women employed, and the share of foreign-born. Models are weighted by the product of the length of the time period and municipality share of the start-of-periods 1995 and 2005 total population in Sweden. Robust standard errors in parentheses are clustered on regions. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Appendix F

Table F1: Robustness Test of The Instrument

Robustness Test of the Instrument and of the Estimated Effect on Manufacturing Employment, 1995–2018

Panel A: 2SLS Estimates	Manufacturing Employment (1) Total	(2) Male	(3) Female
Overall Shock	-2.100**	-2.885*	-1.375**
	(0.784)	(1.168)	(0.499)
Male Shock	-1.177*	-1.720*	-0.660*
	(0.467)	(0.691)	(0.303)
Female Shock	-5.263**	-5.189	-5.630***
	(1.963)	(2.869)	(1.200)
Mean outcome variable	-2.191	-3.260	-1.112
Level in 1995	13.177	19.310	6.498
Panel B: First Stage Estimates	Overall Shock	Male Shock	Female Shock
Other Countries Overall Shock	0.174***		
	(0.030)		
Other Countries Male Shock		0.187***	
		(0.033)	
Other Countries Female Shock			0.144***
			(0.024)
R^2	0.585	0.594	0.5218
$F statistics$	37.56	35.92	28.88

Notes: Observations = 568 (284 municipalities x 2 time periods). Dependent variables in Panel A: the change in total, male and female manufacturing employment. Dependent variables in Panel B: the growth in overall Swedish import exposure from China and the growth with gender-specific components. The instruments only include the average of five other countries imports from China (Denmark, Finland, Germany, Spain and Switzerland). Trade shocks are entered separately into the regressions and each cell is the result of one regression. All regressions include a dummy for the second time period (2005–2018), the start-of-period manufacturing share as well as the municipality characteristics; the share of college-educated, the share of women employed, and the share of foreign-born. Models are weighted by the product of the length of the time period and municipality share of the start-of-periods 1995 and 2005 total population in Sweden. Robust standard errors in parentheses are clustered on regions. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Appendix G

Table G1: Robustness Test by Dropping Municipalities with Highest Population Growth and Industries

Robustness Test of the Effect of Trade Shocks on Manufacturing Employment, 1995–2018

	Manufacturing Employment					
	(1) Total	(2) Male	(3) Female	(4) Total	(5) Total	(6) Total
Overall Shock	-1.377*	-1.876*	-0.920*	-1.220*	-1.628***	-1.329*
	(0.574)	(0.896))	(0.362)	(0.613)	(0.464)	(0.551)
Male Shock	-0.755*	-1.148*	-0.397			
	(0.352)	(0.530)	(0.219)			
Female Shock	-3.757*	-2.942	-4.631***			
	(1.622)	(2.234)	(0.997)			
Mean outcome variable	-2.192	-3.262	-1.111	-2.192	-2.192	-2.192
Level in 1995	13.201	19.350	6.506	13.201	13.201	13.201
Dropping Municipality with Largest Population Growth	Yes	Yes	Yes	No	No	No
Dropping Textiles and Wearing Apparel	No	No	No	Yes	No	No
Dropping Computer, Electronic and Optical products	No	No	No	No	Yes	No
Dropping Motor Vehicles, Trailers and Semi-Trailers	No	No	No	No	No	Yes
N	566	566	566	568	568	568

Notes: Dependent variables in Panel A: the change in total, male, and female manufacturing employment using a sample excluding Stockholm and different industries, separately. Trade shocks are entered separately into the regressions and each cell is the result of one regression. All regressions include a dummy for the second time period (2005–2018), the start-of-period manufacturing share as well as the municipality characteristics; the share of college-educated, the share of women employed, and the share of foreign-born. Models are weighted by the product of the length of the time period and municipality share of the start-of-periods 1995 and 2005 total population in Sweden. Robust standard errors in parentheses are clustered on regions. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Appendix H

Table H1: Regional Differences in Import Exposure

Regional Differences in Import Exposure

1995–2005				2005–2018			
Least exposed		*Most exposed*		*Least exposed*		*Most exposed*	
Dorotea	0.16	Filipstad	4.24	Vännäs	0.08	Oxelösund	4.35
Bjurholm	0.20	Sotenäs	3.89	Umeå	0.12	Hofors	4.28
Olofström	0.20	Götene	3.56	Tanum	0.14	Munkfors	4.08
Strömstad	0.20	Bjuv	3.05	Strömstad	0.15	Sandviken	3.19
Bräcke	0.21	Kumla	3.02	Storuman	0.15	Degerfors	3.10
Vännäs	0.22	Skara	2.78	Bjurholm	0.18	Storfors	2.33

Notes: Summary statistics over how the independent endogenous variable (the measure of change in exposure of Swedish imports from China) differs between municipalities. The measurement is expressed in percent and multiplied by 100.

Appendix I

Construction of the first-differenced variables and the male-female gap

Since we do the analysis in first-differences, we follow the same procedure when constructing the dependent variables. The example below demonstrates the procedure for one of the variables, the share of manufacturing employment:

$$\Delta employment_{i,\tau} = employment_{i,t_1} - employment_{i,t_0}$$

where t_1 is the last year in the time period τ (2005 or 2018), and t_0 is the first year in the time period τ (1995 or 2005). The variables later referred to as the male-female gap is constructed by subtracting the change in the employment share for the sample of males by the female sample change. The following example is the male-female gap in total employment:

$$gap\,employment_{i,t} = total\,employment_{i,t,males} - total\,employment_{i,t,females}$$

which is the male-female gap in total employment in municipality i in year t. The time period difference is calculated as:

$$\Delta gap\,total\,employment_{i,\tau} = gap\,employment_{i,t_1} - gap\,employment_{i,t_0}$$

where t_1 is the last year in the time period τ (2005 or 2018), and t_0 is the first year in the time period τ (1995 or 2005).

Appendix J

Variance decomposition of imports from China into supply and demand components

Autor et al. (2013) use a simple variance decomposition to isolate the fraction of the variance in the trade shock that is not driven by demand factors, i.e. isolating the supply-driven component. The effect of changes in imports from China to Sweden on manufacturing employment can be written as:

$$\Delta employment_{i,\tau} = \alpha + \delta_t + \beta_1 \Delta im\hat{po}rts^{swe}_{i,\tau} + \epsilon_{i,\tau}$$

The OLS coefficient can be expressed as:

$$\hat{\beta}_{OLS} = \frac{\sigma_{manu,imp}}{\sigma^2{}_{imp}}$$

which is the covariance of the change in imports from China to Sweden and the change in manufacturing employment divided by the variance of the change in imports from China to Sweden. The 2SLS coefficient can similarly be written as:

$$\hat{\beta}_{2SLS} = \frac{\sigma_{manu,imp_{IV}}}{\sigma^2{}_{imp_{IV}}}$$

which is the covariance and variance isolated by the IV estimator. The change in imports from China to Sweden can be divided into an exogenous component and a residual:

$$\Delta imports = \Delta imports_{IV} + \Delta imports_{\epsilon}$$

and $\hat{\beta}_{OLS}$ can therefore be rewritten as:

$$\hat{\beta}_{OLS} = \frac{\sigma_{manu,imp_{IV}} + \sigma_{manu,imp_{\epsilon}}}{\sigma^2{}_{imp_{IV}} + \sigma^2{}_{imp_{\epsilon}}}$$

Using the fact that $\Delta imports_{IV} + \Delta imports_{\epsilon}$ are orthogonal, substituting yields:

$$\hat{\beta}_{OLS} = \hat{\beta}_{IV} \times \frac{\sigma^2{}_{imp_{IV}}}{\sigma^2{}_{imp_{IV}} + \sigma^2{}_{imp_{\epsilon}}} + \hat{\beta}_{\epsilon} \times \frac{\sigma^2{}_{imp_{\epsilon}}}{\sigma^2{}_{imp_{IV}} + \sigma^2{}_{imp_{\epsilon}}}$$

The equation shows the decomposition of the demand and supply-driven components of the total variance in Chinese imports. The factor $\sigma^2{}_{imp_{\epsilon}}$ discounts the fraction of interest with the part of the variance that is not driven by the supply-component of the trade shock, $\frac{\sigma^2{}_{imp_{IV}}}{\sigma^2{}_{imp_{IV}} + \sigma^2{}_{imp_{\epsilon}}}$. This suggests that the effect of the supply-driven component of imports from China to Sweden on manufacturing employment is given by $\hat{\beta}_{IV} \times \Delta imports \times \frac{\sigma^2{}_{imp_{IV}}}{\sigma^2{}_{imp_{IV}} + \sigma^2{}_{imp_{\epsilon}}}$.