DISSERTATION

GLOBALIZATION, GENDERED LABOR MARKETS, AND FERTILITY PATTERNS IN THE UNITED STATES, 1990-2018

Submitted by

Emily C. Hrovat

Department of Economics

In partial fulfillment of the requirements

For the Degree of Doctor of Philosophy

Colorado State University

Fort Collins, Colorado

Summer 2026

Doctoral Committee:

Advisor: Elissa Braunstein

Alexandra Bernasek
Courtenay Daum
Sammy Zahran

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ABSTRACT

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Over the last half-century, the United States has experienced several monumental social and economic shifts, including decreased fertility, increased women's employment, decreased men's labor force participation, deindustrialization and a subsequent transition from a manufacturing to a service economy, and an ever-growing trade deficit. Given the body of literature that attests to the relationship between trade and employment and between fertility and employment, it stands to reason that there may also be a relationship between trade exposure and fertility. Furthermore, as the male-dominated manufacturing industry has declined, the service industry has risen to take its place in the American economic structure. Women have historically been more likely to work in services than any other industry, from clerical and domestic work in the early twentieth century to now, where they make up more than half of service workers overall (Bureau of Labor Statistics, 2021; Jacobs & Bahn, 2019). Thus, it is possible that any impact of trade exposure on fertility may also have a gendered explanatory dimension. Through regression analysis of local labor markets, this paper attempts to tease out these relationships between trade, labor, gender, and fertility. I find that the relationship between trade, labor, and fertility is not as clear as I'd hypothesized. Instead, my results show that secular fertility decline cannot easily be related to these economic dimensions over time; however, there are differential impacts across space, indicating that, in a particular year, trade and gendered labor dynamics are associated with fertility within localities. These results complicate the existing evidence by

separating out the time-series and cross-sectional aspects of these data and relationships to demonstrate that economic factors may impact fertility choice at a local level, but do not tell the full story of fertility decline over time.

ACKNOWLEDGEMENTS

Writing a dissertation is HARD, y'all. I also have the sneaking suspicion that, true to character, I accidentally made this harder than it needed to be – cleaning, merging, and collapsing seven datasets in various configurations to make "frankendata" is probably rarely necessary. Furthermore, it is even harder when you take a year off to plan a wedding and get married, and harder still when you quit your university assistantship and get a full-time job instead. While it has been nice not teaching or having to deal with the traditional job market while finishing up, the tradeoff is all of your evenings and weekends and hoarding your very limited free time (like, an hour or so at a time) like a dragon hoards gold. As such, I owe many thanks to many people, without whom this never would have gotten done and I would be languishing in ABD hell in perpetuity.

For my advisor, Dr. Elissa Braustein, who provided excellent advice and mentorship throughout this (very long) process, and who listened to me whine about how tired I was of working on this paper every two weeks for the last three years.

For the rest of my committee (Drs. Alexandra Bernasek, Sammy Zahran, and Courtenay Daum), who gave me excellent and thoughtful feedback to help me get across the finish line.

For my cohort, whose collaboration in our coursework was basically the only reason I made it through those classes. Shout out to us also for taking our qualifying exams and celebrating our newfound free time…in January 2020. That free time didn't last very long, but we spent some good times in the bars while it lasted.

For the good folks at the University of Colorado – Boulder library who allowed me to use their Comtrade access so I could get the trade data for this paper. I literally could not have produced this research without their assistance. Thanks also to the CSU librarians who, when

discovering that we didn't have access to this database, reached out to CU and connected me to this vital resource.

For my colleagues and managers at OSPB, who offered support and commiseration, and who let me take a sabbatical (read: a week of PTO) once budget season wrapped up this year to get through a good chunk of the final stretch of this work. Special shoutout to Clint Saloga, who agreed to proofread for me in exchange for a bottle of bourbon. I owe you one.

For my family and friends, who were always there to support me through this process and who came out to Colorado to celebrate my graduation, even if I ended up actually graduating a little later (read: a year) than I'd expected.

For Daisy and Frankie, who were always there for a snuggle when I needed a break. You may not always have been jazzed about it, but you're good sports. Good girls. Have some treats. Daisy, don't steal your sister's.

And finally, for Sinjhen, who is probably the sole reason I actually finished my Ph.D. You believed in me when I didn't believe in myself. You did not let me give up, even when I really really wanted to. You reminded me of my end goals, kept me accountable, and gave me the tough love I needed to get it done, and I will always be grateful for it. I love you. Let's go to the beach or something.

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OVERVIEW

Over the last half-century, the United States has experienced several monumental social and economic shifts, including decreased fertility, increased women's employment, decreased men's labor force participation, deindustrialization and a subsequent transition from a manufacturing to a service economy, and an ever-growing trade deficit. Given the body of literature that attests to the relationship between trade and employment (e.g., Autor, Dorn, & Hanson, 2013; Baily & Bosworth, 2014; Ngoc Ngo et al., 2021) and between fertility and employment (e.g., Hamilton et al., 2021; Hunter, 2012; Tavernise, Miller, Bui, & Gebeloff, 2021), it stands to reason that there may also be a relationship between trade exposure and fertility. Furthermore, as the male-dominated manufacturing industry has declined, the service industry has risen to take its place in the American economic structure. Women have historically been more likely to work in services than any other industry, from clerical and domestic work in the early twentieth century to now, where they make up more than half of service workers overall (Bureau of Labor Statistics, 2021; Jacobs & Bahn, 2019).[1] Thus, it is possible that any relationship between trade exposure and fertility may also have a gendered explanatory dimension. Through regression analysis of local labor markets (defined by commuting zones, or CZs), this paper attempts to tease out these relationships between trade, labor, gender, and fertility. To this end, I use county-level gender-disaggregated demographic data from the U.S. Census Bureau alongside international trade data from the United Nations Comtrade database, industry data from the Economic Census's County Business Patterns, and natality data from the

[1] For example, in 2019, women accounted for 52.6% of the finance industry, 74.8% of education and health services, 51.2% of leisure and hospitality, and 53.9% of other services, including 72.9% of employment in personal and laundry services and 55.6% of employment in membership associations (Bureau of Labor Statistics, 2021).

National Center for Health Statistics within the Centers for Disease Control and Prevention to attempt to quantitatively answer these questions.

In Section I of this paper, I introduce the topic and the research questions that will be addressed throughout the paper. Section II provides a contextual background and literature review, while Section III discusses data sources and dataset construction. The analytical chapters take a three-pronged approach to analyzing the three key relationships of interest. Section IV, my first analytical chapter, establishes a baseline for later chapters by analyzing the relationship between net imports as a share of total trade and employment rates and real earnings (both gender-disaggregated and not) within a CZ. Through an OLS panel regression analysis, I find that the relationship between trade and employment writ large is inconclusive; instead, employment rates and earnings are more strongly related to other factors determining labor supply and demand. Next, Section V presents the relationship between fertility and the labor market, through employment and earnings. Specifically, I explore this relationship by regressing relative female employment rates and earnings (measured as the ratio of female to male employment or earnings) on fertility, which allows me to test the association with relative economic gender equality, while incorporating various additional controls, such as income and education. Since several of the control variables are highly correlated but measure different areas of interest, I utilize a stepwise approach to explore these relationships separately from one another. I find that, at a cross-sectional level, economic gender equality is negatively associated with fertility, though the relationship is stronger in relation to earnings. This indicates that, when women work and earn income on a similar basis as men, fertility rates are lower, suggesting that when women have options other than being a wife and mother, fewer women are likely to devote the same time and effort to childrearing as they would if it were the only option. However, this

relationship largely disappears when controlling for time, indicating that the association with trade and other economic factors cannot be cleanly separated from secular fertility decline. This trend holds in Section VI, in which I connect the previous two analyses by building on the fertility-labor model and adding net imports as an additional independent variable to determine its association with fertility, while controlling for the same relationships as in the previous analysis. I find that, cross-sectionally, net imports have a consistently negative and significant relationship with fertility – more so than the gender equality variables, which frequently lose significance when controlling for trade, but generally keep the same signs. Like in Section V, these results are not robust when controlling for year. Section VII synthesizes all these results and concludes with a discussion of their meanings and policy implications.

This paper contributes to the emerging literature regarding trade shocks and fertility by examining whether the patterns documented by other scholars (e.g., Autor, Dorn, & Hanson, 2019; Giuntella, Rotunno, & Stella, 2021) hold across different contexts and time periods. I find that the relationship between trade, labor, and fertility is not as clear as I'd hypothesized. Instead, my results show that secular fertility decline cannot easily be related to these economic dimensions over time; however, there are differential relationships across space, indicating that, in a particular year, trade and gendered labor dynamics are associated with fertility within localities. These results complicate the existing evidence by separating out the time-series and cross-sectional aspects of these data and relationships to demonstrate that economic factors may correspond to fertility choice at a local level, but do not tell the full story of fertility decline over time.

I. INTRODUCTION

Over the last several decades, U.S. labor markets have undergone dramatic shifts, driven by deindustrialization, automation, and globalization. Manufacturing decline due to outsourcing and offshoring production has transformed the U.S. into a service economy, while falling union membership, erosion of workers' rights, and stagnating wages have made many jobs increasingly precarious. Furthermore, the advent of generative artificial intelligence and large language models is stoking fears of automation of the high-skill service jobs that were previously considered safe. At the same time, U.S. suppliers and consumers have increasingly relied on other countries for affordable clothing, electronics, cars, and nearly all other goods that the U.S. no longer has the infrastructure to produce. This trade exposure has been linked to manufacturing job losses, and its impact has been highly gendered: men have seen significant employment declines, while the largest employment gains have been made in female-dominated service sectors like health care. All this has happened alongside falling fertility rates, a trend that has been connected to a rise in women's reproductive autonomy which has, in turn, allowed them to enter the labor market.

While gendered labor, the impact of trade on labor markets, and fertility choice have been studied extensively on their own, there is little literature that bridges all three of these topics. The impact of trade on women's employment and labor force participation has been underexplored, as has the relationship between trade and fertility. Most research in the realm of trade and labor has been with respect to manufacturing employment specifically or, more generically, men's overall employment (e.g., Autor, Dorn, & Hanson, 2013; Krause & Sawhill, 2017). Occupational segregation by gender and trends in women's employment have been similarly well-documented, but these trends have, to my knowledge, not been linked explicitly to trade exposure and

globalization. Fertility, too, has been analyzed with respect to labor market trends (especially regarding women's employment), but not other macro trends like trade. This paper aims to rectify these gaps by exploring and untangling the relationships between gendered labor markets, trade, and fertility.

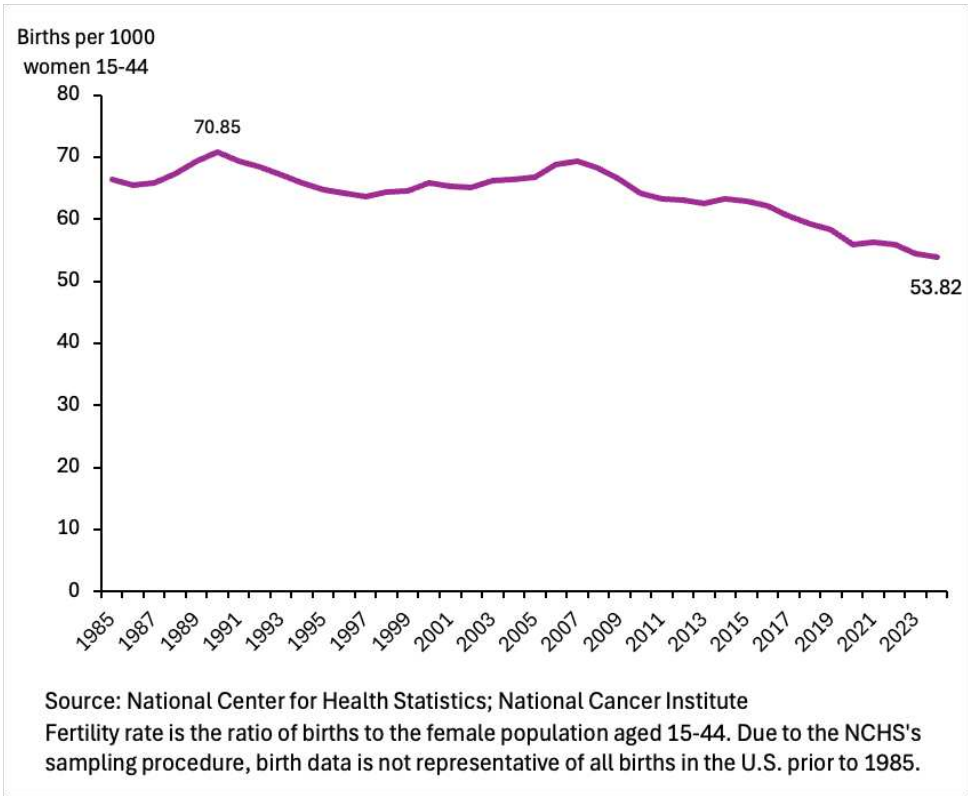
As in most economies worldwide, fertility in the U.S. has been falling steadily over the last half-century. In particular, between the end of the baby boom in 1964 and 2023, the U.S. total fertility rate (TFR, measured as the average number of children each woman bears throughout her life) dropped from 3.2 to 1.6 (World Bank, 2026).[2] Ideally, a population's TFR should be close to the "replacement rate," defined as 2.1. This means that the average woman would bear 2.1 children throughout her life; assuming a relatively even sex ratio, each woman must then bear one child to "replace" herself and one to "replace" a man (United Nations, 2007).[3] This ensures that a population can remain sustainable in the long term by keeping the working population – whose tax contributions fund public goods and social services and whose labor provides care – roughly equal to the non-working population (mostly children and the elderly) who uses those resources. The U.S., like many other advanced economies, has a fertility rate well below replacement that is likely to continue to drop. For instance, between the recent peak in 2007 and 2024, the fertility rate fell 29% (Figure 1). Furthermore, the COVID-19 pandemic, which began in March 2020, may have accelerated the drop in fertility, due to uncertainty surrounding public health, physical isolation from partners (or potential partners), and the economic downturn (Tavernise, 2021; Morse, 2021; Filopovic, 2021). Figure 1 shows

[2] This paper uses "woman" as shorthand for people who can bear children, and "man" as shorthand for people who cannot bear children. I acknowledge that gender is a construct, not every woman can bear children, and not everyone who can bear children is a woman; however, given that fertility measures across the world are in terms of "woman" as an exclusively biological category, this is the terminology I use.

[3] For simplicity, I assume an even sex ratio, but there is substantial evidence that sex ratios in many countries are biased towards men (Sen, 1992; Bongaarts & Guilmoto, 2015; Canetto, 2018).

the overall decrease in the U.S. fertility rate since 1985, from a peak of 70.85 births per 1,000 women of reproductive age (15-44) in 1990 to 53.82 in 2024 – a whopping 31.6% decrease over 34 years.

Figure 1. U.S. Fertility Rate, 1985-2024



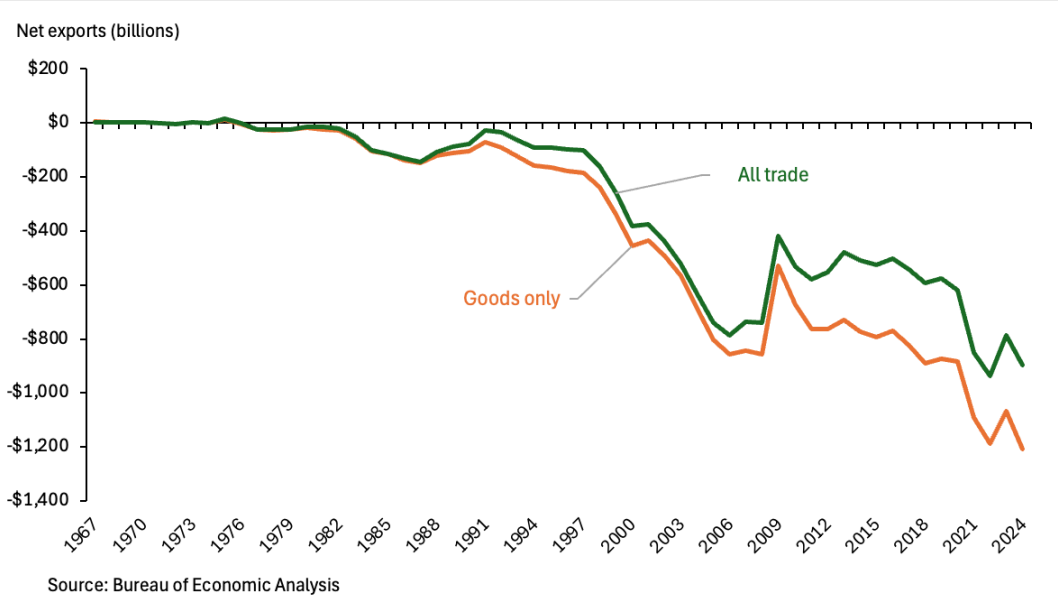
Historically speaking, fertility and birth rates have always been closely tied to economic conditions.[4] Prior to industrialization, fertility tends to be high to reflect the needs of an agrarian society with the primary economic unit being the family. Post-industrialization, fertility fluctuates based on economic conditions – during the Great Depression, fertility fell dramatically, and rose again during the economic prosperity following World War II. But since the baby boom, recessions have had the opposite effect, as we have seen an increase in fertility

[4] Throughout this paper, when I say "fertility" or "births" and leave out the word "rate," I am referring to the general concept of fertility. Fertility rate is defined differently from birth rate and the terms are not interchangeable, so when I use the word "rate" it's because I'm specifically referring to these as separate concepts.

during every major recession since 1980 (Hamilton et al., 2021).[5] This correlation is evident at the more localized level as well, as evidence suggests that economic development and the state of the local economy tend to be inversely related to fertility, with births falling more in counties with stronger job growth (Tavernise, Miller, Bui, & Gebeloff, 2021; Hunter, 2012). So, why this reversal in trend since the 1970s?

While many studies have attempted to explain fertility decline by examining wages and labor market conditions, little attention has thus far been paid to the impact of international trade, particularly with respect to import competition. This dramatic decrease in fertility over the last thirty years has coincided with a near-exponential increase in the trade deficit. As shown in Figure 2, trade was relatively balanced until net exports began dropping modestly in the 1980s, then plummeted in the 1990s through the present.[6]

Figure 2. U.S. Trade Balance, 1967-2024

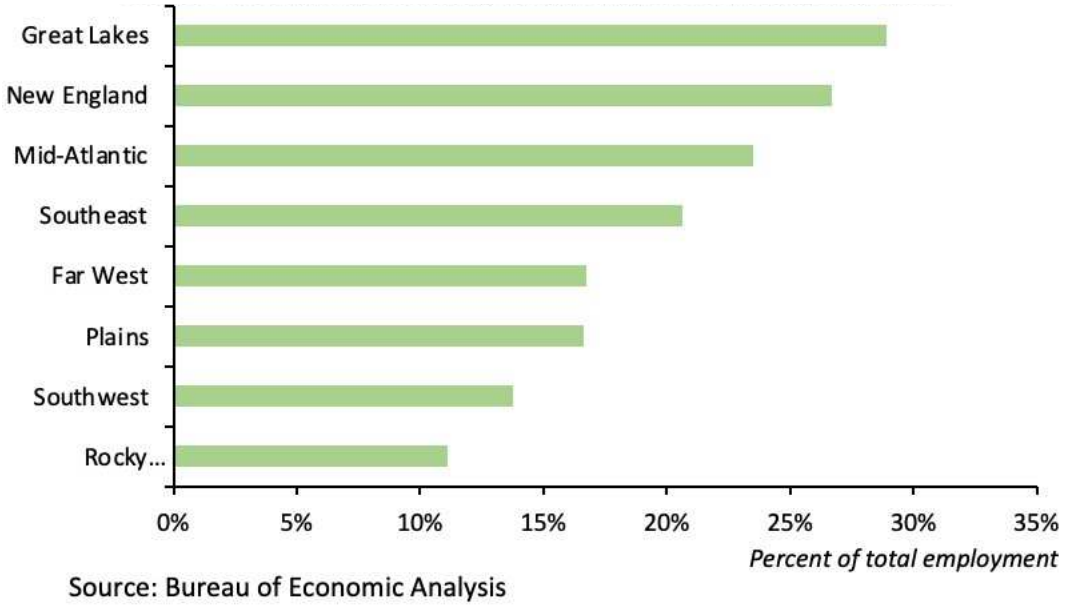


[5] This is not true for the brief COVID-19 induced recession in the spring of 2020, both because it was extremely short and because it was not a "typical" recession (i.e., caused by a public health emergency rather than economic conditions).

[6] Barring the significant decrease in the deficit in 2009, mostly driven by a 22%-decline in U.S. imports of consumer goods in the midst of the Great Recession (Irwin, 2017).

There is a large body of work that associates this increase in trade (especially trade in goods) with the decimation of the American manufacturing industry and the loss of millions of jobs (e.g., Autor, Dorn, & Hanson, 2013; Baily & Bosworth, 2014; Ngoc Ngo et al., 2021). Together with the existing literature on employment and fertility, these factors suggest a possible relationship between births and net imports via trade's impact on employment. Theoretically speaking, trade exposure can have vastly different impacts on employment: while trade may be associated with job loss in some sectors, mainstream trade theory predicts that these losses will be offset by job growth in other, comparatively more efficient sectors. However, this perspective implicitly presumes full employment and fails to account for the localized dynamics of industry concentration and job losses and gains, as well as the gender distribution of these effects. This is especially true for manufacturing, an industry that is highly localized in the U.S.: at its midcentury peak, it made up nearly a third of total employment in the Great Lakes region of the U.S., roughly a quarter of employment in New England and the Mid-Atlantic, and less than a fifth of employment in the western half of the country (Figure 3).

Figure 3. Share of Manufacturing Employment by Region, 1970



Source: Bureau of Economic Analysis

As a result, manufacturing decline has had a larger effect on states in the eastern U.S. (particularly in the so-called "Rust Belt"), many of which have never fully recovered from the loss of such a large source of employment (Armstrong, 2021; High, 2002). Male employment has been deeply impacted by manufacturing decline, and there is a substantial literature documenting the long-term negative impact of the decline in manufacturing jobs on men's employment and the structural economic failure to replace these mid-wage jobs with new opportunities in the growing service sector (e.g., Autor, Dorn, & Hanson, 2019; Krause & Sawhill, 2017). Considering the impact on fertility, births have fallen most in metro areas, which, depending on the region and makeup of the local economy, may be more or less affected by manufacturing decline (Tavernise et al., 2021).

Given these intertwined relationships, this paper explores three primary questions. First, how does trade exposure differentially affect men and women's employment? To this end, I hypothesize that, due to occupational segregation, import penetration negatively corresponds to male employment but negligibly to positively to female employment. Men are more likely to work in industries that are more likely to be impacted by trade exposure, while women work in sectors that are more insulated from it – but that may grow to make up the manufacturing jobs lost. Second, how does economic gender equality correspond to fertility rates? I hypothesize that, based on Becker's (1960, 1973), Wilson's (1996), and other frameworks on fertility and marriage and the necessary conditions that have come to pass, greater equality – measured by the ratio of women's employment rate or earnings to men's – reflects that greater economic opportunity for women is associated with lower fertility as women substitute paid market work for unpaid house work. Third, how does trade exposure relate to fertility rates? This relationship is expected to be informed by the previous results, since it is a logical progression. Therefore,

given the earlier hypotheses, I hypothesize that, since I expect trade exposure will have a negligible to positive relationship with women's employment (which, given the state of the gendered division of labor, is the primary determinant of fertility within a household), but that increased women's employment will likely result in decreased fertility, then increased trade is also likely to be negatively associated with fertility.

To test these hypotheses, I construct a panel of observations at the U.S. Commuting Zone (CZ) level for the years 1990, 2000, 2010, and 2018. By using decadal data, I am able to take advantage of the detailed demographic data from the U.S. Census, much of which is gender disaggregated. CZs, which are made up of groups of counties whose economies are dependent on one another due primarily to the exchange of workers who commute to another county within the same CZ, provide a way to analyze local labor markets, which are likely differently affected by trade shocks depending on the industry makeup of economically related counties. I use county industry data from the Census Bureau's County Business Patterns and trade data from the UN's Comtrade database. To proxy for import penetration at the local level, I utilize Autor, Dorn, and Hanson's (2013) method of matching industry codes to determine the employment and import level within a particular industry in a CZ in a particular year. By matching the codes, I can approximate the industries that are most prevalent in a particular labor market and therefore most likely to have been impacted by import competition. I then collapse to estimate the aggregate effect of imports on all industries in a CZ. Finally, I perform a series of OLS panel regression models to estimate the relevant relationships. Note that while the ideal methodological approach would utilize an instrumental variable strategy, as in Autor, Dorn, & Hanson (2013, 2019), it was not practical for my model due to the lack of a good instrument. The cited papers instrument for Chinese import growth in other high-income markets in order to capture the effects of Chinese

import competition on the U.S. specifically; however, because my trade variable is calculated using aggregate net imports to the U.S. from all other countries, a similar approach was not practicable in my analysis. The results of my models therefore provide correlational evidence, rather than causal, and should be interpreted in consideration of this limitation.

My three analyses do not reflect the expected relationship among these variables and do not provide support for my hypotheses. Rather, they illustrate the complexity of the relationship between demographic and economic change, particularly when separating the cross-sectional and time-series associations. In Analysis 1 (Section VI), I find that net imports as a share of total trade have no consistent significant relationship with employment, whether overall or gender-disaggregated. Net imports are only significantly related to manufacturing employment (negative) and women's earnings (positive), but these associations in general do not provide support for my main hypotheses. Instead, the labor supply and demand controls are much stronger predictors of employment outcomes, most notably educational attainment and growth in real income. These results are unexpected and may reflect either that trade is less associated with employment than has been previously assumed, or that any relationship is felt more on the macro than the local level given that states have open borders that allow workers to move to find work. With respect to gender, the null aggregate results may indicate a "canceling out" effect consistent with Becker (1973) and Autor, Dorn, & Hanson (2019), which respectively theorized and found that increased trade exposure is differentially associated with men's and women's employment and earnings depending on whether the trade shock is to male- or female-intensive manufacturing sectors. Not disaggregating the sectors in this way may therefore obscure this underlying trend.

In Analysis 2 (Section V), I find that increased economic gender equality (i.e., higher employment and earnings for women relative to men) is negatively related to fertility in a spatial sense; however, this association disappears when controlling for time. When I exploit the time series aspect by controlling for year, the relationship either loses significance or switches direction, indicating that cross-sectional variation in gender equality is associated with fertility differences, but they cannot be cleanly distinguished from secular fertility decline. This is consistent with a broader trend in the literature (e.g., Piriu, 2022), which overall reflects the fundamental challenge of separating out any specific relationship in an era of ongoing demographic transition. One explanation is that the regressors – including gender equality – may actually reflect a moderating effect of institutional change over time that encourages increased fertility as potential parents are better able to adjust to the social changes that make childrearing more difficult than it had been when a clear gendered division of labor for household production was the norm, but this is not easily quantifiable and therefore cannot be tested for.[7] In addition, recent research indicates that a substantial portion of birth rate decline since 1990 can be attributed to a 75% drop in the rate of births to teenage mothers, which presumably has more to do with improved sex education and public health initiatives than economic conditions (Kearney, Levine, & Pardue, 2022).

In Analysis 3 (Section VI), I find that net imports as a share of total trade are consistently negatively and significantly associated with fertility, though, consistent with Analysis 2, this relationship only holds at the cross-sectional level. This analysis is essentially a robustness check for Analysis 2, as several versions of the model simply add trade as an additional control

[7] At least for middle-class white families – this household structure was largely not available to poor families and families of color, in which both parents typically had to work to support the family due to racist policies that allowed Black people to be paid less and hired less often than white people.

variable. However, I also conduct analyses of the relationship between trade and fertility when controlling for additional variables for economic conditions (e.g., labor productivity and total output) and industry mix. These controls moderate the effects of trade, indicating that trade exposure is only one of a set of economic conditions that can affect fertility in a particular locality. Otherwise, the overall results and robustness checks are consistent with those presented in Analysis 2.

Fertility decline and its determinants is a complicated topic with multiple competing explanations. This dissertation primarily investigates an economic channel with an emphasis on trade shocks; however, the evidence also suggests broader institutional, cultural, and gender-based mechanisms as well. In a purely technical sense, my results are consistent with Becker's (1960, 1973) substitution effect argument, in that, as women's labor market opportunities increase, their opportunity cost of household labor rises, and fertility declines. However, because Becker's argument is fundamentally one of a household separation of labor, then a "solution" would rely on increasing men's economic status to increase their marriageability and so that women would not need to work. This is not realistic or desirable, nor would it be consistent with more recent work (e.g., Folbre, 1994; Goldin, 2025) which argues that fertility decline is not simply a function of changing economic opportunities for men and women, but is also informed by a necessary shift in household labor that has not occurred. As such, any policy recommendations to address fertility decline must also be accompanied by social and cultural changes regarding gendered labor norms as well.

This paper is organized as follows. Section II presents an overview of the relevant literature regarding gender, trade, labor markets, and fertility, and Section III provides a review of the data sources and dataset construction. Section IV presents my analysis of how trade

exposure is related to gendered labor markets, Section V presents the relationship between gendered labor markets and fertility, and Section VI presents the relationship between trade exposure and fertility. Section VII concludes.

II. BACKGROUND & LITERATURE

There is a well-documented body of literature linking the relationship between trade and employment, and between fertility and employment, but little work has been done to connect fertility and trade. The few studies that exist in this arena have thus far focused on different cultures or subgroups. Giuntella, Rotunno, & Stella (2021) evaluate the impact of trade on fertility in German states as a function of family income and hours worked, finding that trade exposure, specifically imports from Eastern Europe, has a small negative effect on fertility that is most pronounced among individuals with lower levels of education and men. Wilson (1996) is less explicit; he examines the impact of manufacturing decline on Black family formation in the inner city and finds that decreased male employment (specifically in the manufacturing industry) is negatively related to marital status, but not fertility, emphasizing the changes in social norms that have largely destigmatized nonmarital births and complicating the core of Becker's model. Autor, Dorn, & Hanson (2019) find similar results when relating manufacturing decline to gender differences; namely, that the impact of manufacturing decline on male employment negatively affects fertility as the gains from household formation fall, while the shocks to female employment have a positive impact on fertility as their household labor becomes more valuable and the gains from marriage rise. Their approach characterizes the effect of trade as labor demand shocks that differentially impact men and women based on what specific manufacturing sub-industries are affected – that is, whether the trade-induced shock is to a subsector that predominantly employs either men or women.

To my knowledge, this paper is the first to examine the relationship between trade and fertility through labor market relationships (a) across the entire U.S. population, (b) analyzing trade with all countries, and (c) using a broad range of gender disaggregated controls. I build on

the work of researchers listed above to tease out these relationships, acknowledging the complexity of each factor. The following section provides background information and important context to help ensure full understanding of each of these three elements. First, I discuss trends in employment since 1980 and document the decline of the manufacturing industry and its gendered effects. Second, I provide an overview of U.S. trade policy over that same period and highlight critical events that have helped to shape the U.S. economy through this period. Third, I describe fertility trends, the importance of maintaining population stability, and immigration trends in the U.S.

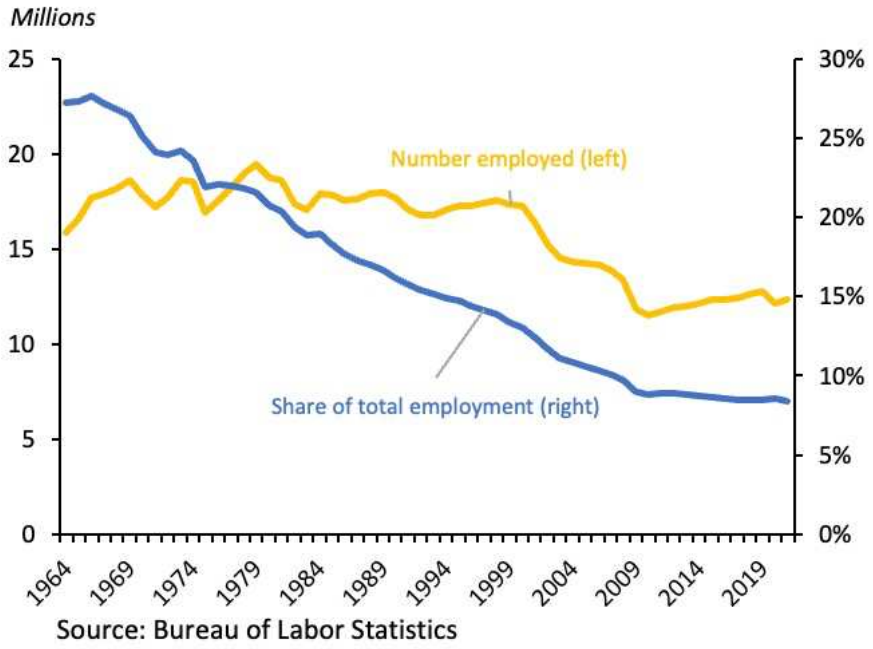
II.A. U.S. labor dynamics

The year 1980 can be considered a turning point in modern economic history due to the implementation of the neoliberal world order, characterized by state deregulation of corporate power, liberalization of trade, and a dramatic expansion of the profit share at the expense of labor and wages (Steger, 2020; Palley, 2018). Neoliberalism followed the Great Stagflation crisis of the 1970s and represents, in Marxian terms, a reaction to the tendency of the rate of profit to fall. This occurs because labor productivity grows over time, causing a relative decrease in the value of the capital used to produce the good. With a constant rate of exploitation, since capitalists are spending relatively more on wages as a share of production costs, the rate of return on the capital invested drops, thus decreasing the rate of profit (Marx, 1894). After the stagflation crisis hit in the 1970s, the government policy response in the U.S. was to try to boost profits in a top-down approach to "fixing" the economy. This meant tax breaks to the wealthy, low interest rates to increase the return on capital, trickle-down economics, trade liberalization, and sweeping deregulation to allow capitalists free rein in profit maximization (Shaikh, 2010). Neoliberal ideology posits that the smaller the role of the state, the better; markets are self-regulating and most efficient when free of any interference on the part of governments or other actors. In

Northern economies, particularly in the U.S., the neoliberal regime led to globalization and deindustrialization, an explosive rise in income inequality, and a "precarization" and polarization of jobs (Piketty, 2013; Standing, 2014).

These changes led to two fundamental shifts in the U.S. labor market: first, its economy shifted from one based in manufacturing to services; and second, laborers and their rights were sidelined in the pursuit of profit maximization. The low-skill labor market since 1980 has been characterized by the decimation of the American manufacturing sector and the rise of low-wage service jobs to replace them, as well as the decline in union membership, discussed in more depth below. Manufacturing had long been a cornerstone of the American economy, not only for its role in producing consumer goods and exports, but also for providing stable employment, particularly for low-skill men in urban centers (Krause & Sawhill, 2017; Wilson, 1996). However, all that changed starting in the 1970s and 1980s, when changes in the global economic structure resulted in a precipitous drop in the supply of manufacturing jobs.

Figure 4. Manufacturing Employment, 1964-2021



Many of these jobs, especially labor-intensive ones like in apparel and electronics, were offshored to other countries where production costs (especially wages) are lower; many more were automated out of existence as capital improvements increased productivity and made human labor obsolete in certain industries (Autor, Dorn, & Hanson, 2013; Irwin, 2017). As a result, manufacturing output has largely remained stable, but manufacturing employment has decreased by 43.7% since its peak in 1979, as shown in Figure 4 (Baily & Bosworth, 2014). Worse, these jobs were largely replaced by low-wage, part-time service jobs characterized by instability, part of the trend of the precarization of labor (Held & McGrew, 2008; Standing, 2014).

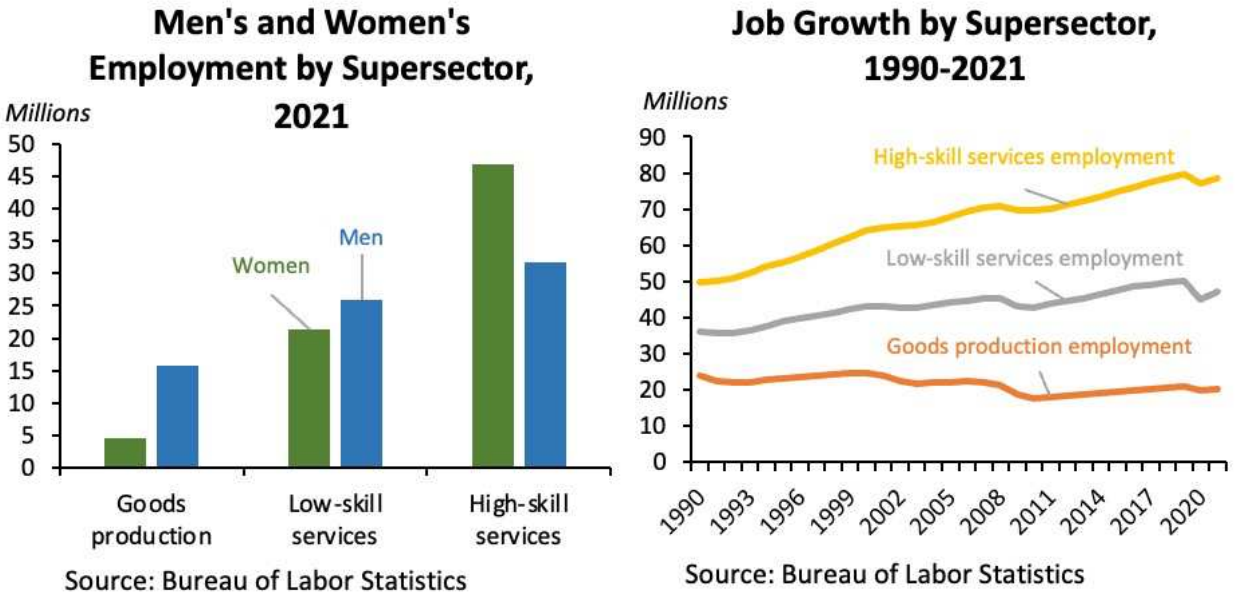
Prior to the 1970s, unions were an integral part of the American workforce, in which a quarter to a third of the labor force were members (Ingraham, 2018). Western & Rosenfeld (2011) argue that unions played a pivotal role in wage growth for workers even in nonunionized sectors, institutionalizing norms of equity and exerting indirect pressures on nonunion employers to raise wages to avert the "threat" of unionization. This power vanished with the advent of neoliberalism. The ideological shift towards market liberalization paired with the technology boom led to a drastic decrease in travel and information costs, spurring a wave of globalization characterized by the capitalist drive to increase profits by any means necessary (Palley, 2018). The opportunity cost of doing business somewhere other than a company's headquarters dropped to negligible levels, and these corporations elected to export their production to countries with lower wages and labor standards to cut costs, particularly the labor-intensive piecework at the bottom of the global value chain (Gereffi, 1994). Other corporations have elected to keep production in the U.S. but outsource to prison labor at wages low enough to compete against developing countries (Stevenson, 2020; Brewer & Heitzeg, 2008). The reserve army of the

unemployed has now grown to be global in scope, reflecting Marx's predictions regarding the reserve army growing larger than what is needed to keep pace with accumulation, depressing wages and decreasing workers' bargaining power. Perhaps the best illustration of workers' loss of bargaining power came in 1981, in which Ronald Reagan was able to fire over 11,000 striking air traffic controllers, then rehire new workers to replace them almost immediately, effectively crippling labor organization in the U.S. (Schalch, 2006). Today, American union membership as a share of the labor force has dropped to the single digits, a decline that accounts for a fifth to a third of the growth in wage inequality since the 1980s (Western & Rosenfeld, 2011).

These shifting dynamics in the low-skill labor market have had distinctly gendered effects, both in terms of occupational segregation and labor force participation. Men have historically made up the majority of manufacturing workers – since 1970, their share has remained relatively constant at about two-thirds of the industry (Laughlin & Christnacht, 2017). As a result, they have been far more sensitive to job losses in manufacturing. More broadly, men are overrepresented in goods-producing sectors, which have experienced negative growth since 1990, while women are overrepresented in high-skill services, which are the fastest-growing industries over that time period.[8]

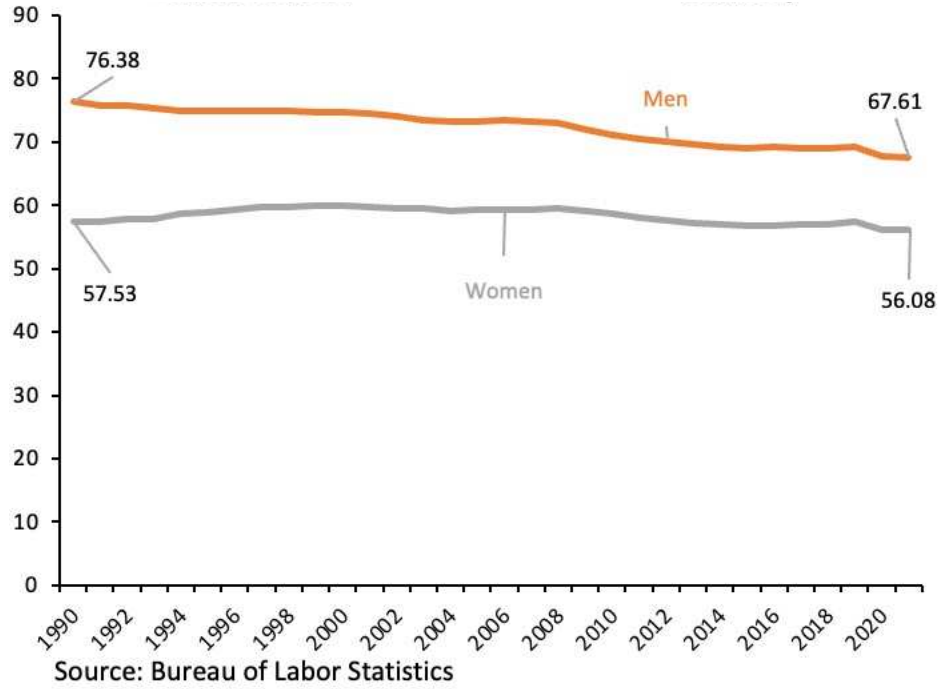
[8] Goods production includes the mining, construction, and manufacturing industries. Low-skill services are defined as service industries in which most jobs, by and large, do not require a bachelor's degree: transportation, trade, and utilities; retail trade, and wholesale trade. High-skill services are those that generally do require at least a bachelor's degree, and encompass finance, insurance, and real estate; information; professional and scientific services; education and healthcare; and public administration. These categorizations are not perfect and there are exceptions in each service sector, but this assessment was made on balance.

Figure 5. Trends in Supersector Employment



Krause & Sawhill (2017) posit that this is a major factor leading to the overall decline in male labor force participation (LFP) since 1990, particularly among men with a high school education or less (Figure 5). The Bureau of Labor Statistics estimates that male LFP has fallen from 76.4 in 1990 to 67.6 in 2021; over this same period, as stated above, the manufacturing sector lost 43.7% of its employment and is one of the fastest shrinking industries in the U.S. (Figure 4). Meanwhile, women's LFP has remained virtually unchanged, while the fastest growing industries are all within the health care and social services sectors, which are historically female dominated (U.S. Bureau of Labor Statistics, 2022).

Figure 6. Labor Force Participation Rate by Gender, 1990-2021



The fastest growing sectors for low-skill workers in particular are similarly service-based, primarily in the retail and food service industries, which are not only lower-paying and have less job security compared to manufacturing jobs, but are also female dominated and therefore unattractive to men who may see this as "beneath" them (Krause & Sawhill, 2017). These factors all lead to a skills and cultural mismatch between the jobs lost and those created, leaving many – mostly men – without the training for a good job, or the desire for a bad one. For many of these people, the preferable option was to take advantage of disability or other benefits and leave the labor force altogether in hopes of keeping their dignity and their identities as workers intact (Irwin, 2017).

II.B. U.S. trade since 1990

The decline of American manufacturing is often attributed to technological change or globalization (in particular, trade liberalization). Which is the primary cause has been debated at length in newspapers, college classrooms, academic journals, cable news, and more, but in

reality, a confluence of factors, including trade (particularly with China), automation, decreased demand for manufactured consumer goods, and production offshoring, as well as import competition, was largely responsible for the American manufacturing industry's demise following the recession of the early 1980s (Baily & Bosworth, 2014). As Irwin documents in *Clashing Over Commerce: A History of U.S. Trade Policy* (2017), trade liberalization and the proliferation of free trade agreements has characterized trade policy from the 1980s through the 2010s, with most of these actions occurring in the 1990s. Trade developments in this era have been accompanied by bitter public debate among competing interests, with labor unions and environmental organizations leading the charge against liberalization, and exporters and other corporate investors as proponents. In particular, three main trade partnerships have stood out as representing turning points in U.S. trade policy over the last thirty years: the North American Free Trade Association (NAFTA), the formation of the World Trade Organization (WTO) and China's accession to it, and the now-defunct Trans-Pacific Partnership (TPP).

The debate over and eventual passage of NAFTA was a defining early moment in modern trade policy because, for the first time, a trade proposal drew attention from interest groups that were not directly involved in production. Labor interests believed that NAFTA would accelerate American job loss by moving production to Mexico; human rights groups argued that Mexico's lower wages and labor standards would leave workers there more vulnerable to exploitation; environmental organizations feared that not only would increased production in Mexico exacerbate pollution, but also that American standards might be relaxed in order for firms to remain competitive north of the border. The proposed agreement's popularity also varied geographically – areas like the Great Lakes region where industries were more sensitive to import competition were opposed, whereas places like California that produced more export

goods were in favor (Irwin, 2017). Overall, the primary contention over NAFTA was its predicted impact on jobs – as O'Leary, Eberts, & Pittelko (2012) note of the Congressional debate, "Of the 141 statements against NAFTA in the House and Senate, 112 were of the form 'NAFTA will destroy jobs.' On the other hand, of the 219 pro-NAFTA statements, 199 were of the form 'NAFTA will create jobs'" (p. 8). The bill ultimately passed in 1994, thanks to the addition of side agreements to ensure protection of labor and the environment in participating countries, which are now included in all trade agreements involving the U.S. (O'Leary, Eberts, & Pittelko, 2012). Thirty years on, NAFTA has not proven to be nearly as catastrophic as was predicted; only the textile and apparel manufacturing sectors appear to have been measurably harmed by NAFTA (Hakobyan & McLaren, 2016; Irwin, 2017; O'Leary, Eberts, & Pittelko, 2012). However, Hakobyan & McLaren (2016) caution that this represents an "important minority" of workers concentrated in the South, where apparel manufacturing was predominant, and has had negative effects on not only manufacturing workers themselves, but on overall wage growth within the localities that are most dependent on this type of manufacturing.

The next major development in U.S. trade policy came only a year later with the creation of the World Trade Organization. The WTO replaced the General Agreement on Tariffs and Trade (GATT), which had been established in 1947 to facilitate international trade following World War II. However, by the 1980s, it became clear to world leaders that the GATT's provisions were no longer sufficient for the changing global economy, and they began to negotiate a new agreement that would be more inclusive of emerging economies, extend existing rules to cover intellectual property and trade in services, revise the policy on agricultural subsidies, and establish a procedure for trade disputes. The WTO faced little pushback in the

U.S., and Congress passed it easily (Irwin, 2017).[9] However, the situation turned more contentious once China, which spent the 1990s becoming a global exporting superpower, sought to join the WTO. Post-Mao, China's government opened the economy and pursued a market-oriented economic development strategy that prioritized industrialization over agriculture, particularly through their establishment of Special Economic Zones (SEZs) in which they enticed foreign corporations to set up shop – where they would be relatively free from government oversight. This was a major incentive for multinational firms, and between 1991 and 2013, China's share of manufacturing exports in the world economy ballooned from 2.3% to 18.8% (Autor, Dorn, & Hanson, 2016). The formerly-communist country had to make extreme concessions to prove its commitment to free markets, but was admitted in 2001 (Irwin, 2017). China's accession was accompanied by many of the same arguments that threatened NAFTA – namely from human rights, environmental, and labor groups – but in this case, the fear proved to be justified. Chinese trade has "toppled much of the received empirical wisdom about the impact of trade on labor markets" (Autor, Dorn, & Hanson, 2016, p. 3). While NAFTA and other trade agreements did not result in widespread job loss or an aberrant decline in manufacturing employment, the new avenue for trade with China certainly did – Autor, Dorn, & Hanson (2013) find that trade with China is responsible for 21% of job loss in the U.S. manufacturing industry since it joined the WTO.

China's impact on the U.S. economy since 2001 has led to an increasing anti-trade sentiment across the political spectrum and has resulted in a new protectionist wave, exemplified by the U.S. withdrawal from the Trans-Pacific Partnership (TPP) in 2017. The TPP, negotiated

[9] The atmosphere did become more antagonistic over time as various parties, such as interest groups that had opposed NAFTA and fringe anarchists, began to protest trade and globalization in the late 1990s. This eventually culminated in the "Battle in Seattle," in which protests outside the 1999 WTO ministerial meeting became violent, resulting in confrontations between protesters and the riot police (Irwin, 2017).

by the Obama administration, would have been a massive trade agreement among twelve countries bordering the Pacific Ocean – the U.S., Canada, Mexico, Japan, Malaysia, Vietnam, Singapore, Brunei, Australia, New Zealand, Chile, and Peru – that together make up 40% of the world's economic output. This agreement would have resulted in lower tariffs and decreased trade barriers among these nations and was intended to increase pressure on China (not a member of the partnership) to adhere to global standards rather than try to, as President Obama said, "write the rules of the global economy" (qtd. in Handley, 2015). China's size and corresponding influence were seen as a threat to the US's position in Asia and the Pacific, and the TPP would have given the U.S. access to a new market. Obama signed the agreement in early 2016; however, it became a major issue leading up to the 2016 presidential election, with candidates from both parties denouncing it: Republicans fought it on the grounds that it would send more jobs overseas and increase the trade deficit; Democrats argued it would, like previous trade deals, lower wages and environmental and labor standards, and that it was too friendly to major corporate interests. Consequently, on President Trump's third day in office in 2017, he withdrew the U.S. from the TPP without it having been ratified by Congress, thus ensuring the partnership would not go through (McBride, Chatzky, & Siripurapu, 2021). The Trump administration, contrary to the Republican position on trade for the last forty years, pursued a distinctly protectionist trade strategy in which he instituted new tariffs and erected new barriers to trade, a strategy that the Biden administration upheld (Bacchus, 2022). However, foreign policy analysts are now of the opinion that Trump's populist anti-trade crusade was a poor strategy to build U.S. economic power, considering that the rest of the world has continued to broker and benefit from trade deals without the U.S.'s involvement – for instance, after the TPP failed, the remaining eleven countries forged ahead with a modified deal; more than a dozen

more major multilateral trade partnerships have followed, none of which include the U.S. (O'Neil, 2019). According to U.S. trade negotiator Wendy Cutler, "By exiting the TPP, we created a vacuum. And that vacuum is being filled. …I think there was an expectation when we left that it would just fall apart. We were proven wrong. …Those countries wanted to show they could move ahead without us. And they wanted to gain the benefits of trade" (qtd. in Hirsh, 2022). Without the U.S., China has become the world's main trading partner, and without major change in American trade policy, we risk losing our status as a leader in the global economy. Indeed, President Trump's disastrous "on again, off again" tariff policy that defined his second term, far from punishing China, has only served to bolster trade between the rest of the world and China, as China presents itself as a more stable trading partner than the U.S. in light of the uncertainty surrounding Trump's tariffs (Bloomberg, 2025).

II.C. Fertility, births, and demographic change

Over the last half-century, the world has experienced a steady decline in fertility, from 5 births per woman in 1960 to 2.4 in 2020 (World Bank, 2022). On the macro level, this has been considered a positive advancement: voluntary fertility decline is associated with higher living standards, higher investment in children ("quality over quantity"), and women's labor force participation (LFP), all of which are generally good for both social well-being and economic growth (Braunstein, 2015; Yeoh, Lutz, Prachuabmoh, & Nurvidya, 2003). However, fertility decline may become problematic if population growth decreases to below its replacement level – defined as a TFR of 2.1 – as this endangers the sustainability of a population and its labor force. For example, most countries experiencing low fertility are in Europe, whose advanced economic status that leads to increased availability of contraception and abortion, delayed or deferred marriage, and increased female LFP has resulted in an average fertility rate of 1.5 (Garcia-Alexander et al., 2017; World Bank, 2022). These advances have undeniably benefited women

and society as a whole, but a fertility rate below replacement also results in rapid aging of the population, which threatens the future sustainability of an economy if it lacks sufficient labor supply to meet the demand. In Europe, whose fertility rate has been below replacement since 1976, the shrinking labor force is expected to result in an economic contraction due to lower productivity (Bloom, Canning, Fink, & Finlay, 2009). In addition, the increased dependency ratio – the ratio of nonworkers (children, elderly, and disabled) to workers, whose wages (and taxes) support social services – promises significant stress on an economy's social welfare provisioning. In Japan, for example, where the median age of the population is 48 and is projected to reach 55 in 2065, lawmakers cite a shortage of caring labor, increased pension costs, and a shrinking GDP and loss of economic power due to lack of labor in all sectors as some of the country's most pressing issues for the near future (Sadafumi, 2017).

With a TFR of 1.6 in 2024, the U.S. is in good company with its economic peers; however, the U.S. experience differs from the trajectory of other countries in two key ways. First, U.S. fertility has fallen faster than the EU's over the last 60 years, but this steeper decline means that the U.S. is only now beginning to experience the effects of an aging population, as the baby boom generation has begun to retire. In 2019, less than a third of Europe's population was under the age of 30, while nearly a fifth was over 65, showing the beginnings of an inversion of the typical "triangle" age distribution that is associated with a growing population. This comes 15 years after the number of elderly adults first surpassed the number of children in 2004; today, there are an estimated 67.8 million children and 90.5 million elderly people residing in the EU (Eurostat, 2020). In Japan, the demographically oldest country in the world, the rate of fertility decline has closely followed that of Europe, and their population has been shrinking since 2010. Their population is expected to shrink by nearly 30 million by 2050, and adults over 65 have

outnumbered children since 1997 (Nippon, 2014; D'Ambrogio, 2020). In contrast, this milestone is not projected to occur in the U.S. until 2034, suggesting that there may still be time to, if not reverse the trend, at least mitigate it based on how other countries are responding (Vespa, 2019).

Second, immigration to the U.S., particularly through the U.S.-Mexico corridor, has helped to slow (though not fully offset) population decline. The onset of fertility decline in the U.S. coincided with the passage of the Immigration and Naturalization Act of 1965, which overhauled and restructured U.S. immigration policy to what it broadly remains today. Since the 1920s, immigration in the U.S. had worked primarily on a quota system based largely on country of origin. However, the new law abolished quotas and instead prioritized family reunification, allowing naturalized citizens to sponsor their family members' immigration to the U.S. (Council on Foreign Relations, 2022). Following the passage of this law, the foreign-born population grew from its low point of 4.7% of the total U.S. population in 1970 to 15.4% in 2019, a level that surpasses the height of immigration in the early twentieth century (Budiman, 2020; United Nations, 2019). Throughout the rest of the twentieth century, subsequent immigration policy primarily focused on curbing the flow of undocumented immigrants, refugee resettlement, and prioritizing high-skill immigrants (Council on Foreign Relations, 2022). Today, one fifth of the world's migrants – over 50 million – reside in the U.S., about a quarter of which are from Mexico (United Nations, 2019).[10]

Given falling birth rates among the U.S.-born population over this same period and higher average fertility among foreign-born women, it is inevitable that immigration has had and will continue to have a massive effect on American demographics. A 2015 Pew Research study estimates that between 1965 and 2015, immigrants and their descendants increased the U.S.

[10] To put this in perspective, the country hosting the second-highest number of migrants is Russia, in which 11.6 million people are foreign-born (United Nations, 2019).

population by 55% (72 million).[11] The study also projects that 88% of population growth by 2065 will be attributed to immigrants, adding a projected 103 million people if immigration patterns and rates hold, putting the share of foreign-born individuals at 18% (Pew Research Center, 2015). However, a confluence of factors has changed the country's relationship with immigration significantly since 2015, resulting in a marked decrease in immigration and a decidedly more pessimistic outlook on future population growth, making the problems facing Japan and the EU more likely to occur in the U.S. than they were before.

Immigration has long been a contentious (and heavily racialized) issue in the U.S., particularly relating to labor concerns ("the immigrants are taking our jobs" has been a common right-wing refrain for decades), but the 2016 and 2024 elections of Donald Trump and the subsequent emboldening of white supremacists have exacerbated the divide. One week after his inauguration in 2017, Trump signed an executive order known colloquially as the "Muslim ban" that lowered the cap on refugee admission and prohibited individuals from the majority-Muslim countries Iran, Iraq, Libya, Somalia, Sudan, Syria, and Yemen from traveling to the U.S. (Council on Foreign Relations, 2022). This act set the tone for his first presidency, in which he signed more than 500 executive orders related to immigration, the highest share of any president in the postwar era. Among these actions were diverting government funding to build a wall at the southern border to keep out "rapists and criminals" from Mexico (a campaign promise that was highly popular with his voters) and instituting a policy of separating young children from their parents indefinitely upon crossing the border, detaining parents and often placing children in foster care or youth shelters with no mechanism in place to reunite families (Bolter, 2022; Southern Poverty Law Center, 2022). Trump's anti-immigration and white supremacist views

[11] 59 million of those were the immigrants themselves (Pew Research Center, 2015).

have also been highlighted in his rhetoric, contributing to, as Herman & Muldoon (2018) put it, a "Trumping [of] the mainstream." They, and other political scientists, argue that Trump, through tacit and explicit endorsement of these formerly fringe right-wing views, has normalized white supremacy and created space for racist conspiracy theories to proliferate with an air of legitimacy (Anspach, 2021; Herman & Muldoon, 2018; Davey & Ebner, 2019). As a result, immigration has slowed, not only because of policy changes, but also because potential migrants may be simply less likely to try to come to a country where the atmosphere is so apparently hostile towards immigrants. The COVID-19 pandemic also played a key role in immigration decline (Nowrasteh, 2021; Watson, 2022). Trump's reelection in 2024 is likely to exacerbate the downward pressure on immigration, as key pillars of his presidency thus far have included mass deportation and extraordinary rendition of immigrants (both authorized and undocumented); massively increasing the budget for Immigration and Customs Enforcement (ICE); increased ICE presence and raids of communities in Los Angeles, Portland, Minneapolis, and Chicago; attempting to end birthright citizenship; and dismantling the system by which immigrants may seek asylum (ACLU, 2024).

This white supremacist sentiment in conjunction with fertility decline among the U.S.-born has caused the racist "Great Replacement" conspiracy theory – that white people are being driven to extinction and "replaced" by immigrants and people of color – to gain momentum and mainstream recognition. Nativist movements and concern over birth rates are certainly nothing new – indeed, they have existed as long as immigration has and contributed in no small part to the eugenics policies and practices that were rampant throughout the twentieth century. Scholars of reproductive justice are quick to point out that a defining feature of reproductive politics over the last century has been restricting the reproductive capacity of Black and brown women

through involuntary sterilization or, more recently, attempts to discourage these women from having children through policy incentives (Roberts, 1997; Davis, 1981). At the same time, white women were encouraged to have children – for married women, through pro-family rhetoric and policy that led to the Baby Boom; for unmarried women, to forego abortion in favor of having children to be surrendered for adoption (Fessler, 2006; Solinger, 2001). As the (white) birth rate continues to decline and the U.S. continues its trajectory to becoming a "majority-minority" nation by 2050, white racial anxiety has elevated the racial tension in the country and led to a surge of white nationalism, culminating in the two elections of Donald Trump and his appointment of reactionary politicians, judges, and justices who have a vested interest in promoting the longevity of the white majority through limits on immigration and abortion, among other policies (Craig, Rucker, & Richeson, 2018). [12]

[12] On June 24, 2022, for example, the Supreme Court's conservative majority overturned Roe v. Wade (1973), severely restricting the right to abortion across the country – a decision that Illinois Republican Rep. Mary Miller called "a historic victory for white life" (Sullivan, 2022). Similarly, Nebraska Republican State Sen. Steve Erdman, arguing in favor of an abortion ban in his state, cited the increase of "those foreigners" and "refugees" in the state population as the reason to ban abortion to ensure more white babies are born (Zhang, 2023).

III. DATA

To conduct my analyses, I combine data from multiple sources to construct a panel for 348 commuting zones (CZs) covering 1990, 2000, 2010, and 2018 for a total of 1,383 observations for the Section IV analysis; with the fertility data, due to data suppression of small counties, that number falls to 258 CZs and 929 observations for the analyses in Sections V and VI. The bulk of the data comes from the U.S. Census for 1990 and 2000 and the Census Bureau-run American Community Survey (ACS) for 2010 and 2018. The decadal census includes a vast array of data and, prior to the implementation of the yearly ACS in 2005, is the most complete source of U.S. population data. For all years in my sample except 1990, I downloaded the county-level social and economic characteristics summary tables from data.census.gov. These tables provide data on income and employment, employment by broad industry, educational attainment, and demographics, such as total population, race, ethnicity, immigrant status, veteran status, and marital status, nearly all of which is gender disaggregated. Data before 2000 is not available for download from the Census Bureau, so for 1990, I exported the relevant data from each state's PDF summary files to Excel tables. From there, I reshaped the data to match with the other years' files and combined them all to create my base dataset.

The trade dataset is constructed following the methods of Autor, Dorn, & Hanson (2013) and combines county-level employment data by industry with international trade data. The county-level data comes from the U.S. Census Bureau's County Business Patterns (CBP) dataset, which provides payroll and employment values for each industry in each county per year. [13]

[13] Both the Census/ACS and CBP refer to their unit of measure as "industries," though in the Census and ACS, this refers to the broad categories of industries, while in CBP, the industries are broken down much further. For instance, the Census and ACS refers only to "manufacturing," but the same category in CBP represents 387 subindustries

However, for industries with fewer than three establishments within a particular county, exact numbers are not given; instead, the industry is assigned a flag for a particular bracket in which the total employment (or payroll, though this data is not used in this study) falls.[14] In order to make this data usable for researchers, Eckert et al. (2021) perform imputations on the data to estimate a value for the employment in suppressed industries. This data is then combined with trade data from the UN's Comtrade database, which provides data on imports and exports for all countries by industry codes. Trade is measured using monetary value in 2018 U.S. dollars, using a price deflator from the Bureau of Economic Analysis (BEA). Unlike Autor, Dorn, & Hanson (2013), I do not examine U.S. trade with a specific country or region, but I instead use the aggregate value of trade between the U.S. and the rest of the world.

Industries in both CBP and Comtrade are assigned numeric codes to identify them, but these codes differ over time, both between and across classification systems. For 1991-1997, CBP uses SIC codes; from 1998 on, industries are classified by NAICS codes, which are updated every five years. Eckert et al. (2021) provide their dataset standardized to the 2012 iteration of NAICS codes, except 2017 and 2018, which use 2017 NAICS codes. However, Comtrade uses the Harmonized System (HS) classification for its industries, which are updated every four years. To match Comtrade with CBP, I conduct a multi-step process to standardize all three classification systems. First, I use weighted crosswalks from Eckert et al. (2021), Pierce & Schott (2012), and of my own construction to convert the NAICS codes to each previous version: 2017 to 2012, 2012 to 2007, 2007 to 2002, and 2002 to 1997. Second, I convert the 1997 NAICS codes to SIC codes. Third, I use a similar method to concord the HS codes over time – Autor,

within my data file. I therefore refer to the overarching categories as broad industries, while the subdivisions are referred to as industries.

[14] As of 2017, these flags are no longer used; industries with fewer than three establishments are omitted from the dataset altogether.

Dorn, & Hanson (2013) provide a weighted crosswalk of combined HS 1996 and 2002 codes, and I use Comtrade's own concordance files to standardize the remainder of the data, which is in HS 1992 codes, to those. Finally, I use Pierce & Schott's (2012) weighted crosswalk to convert the HS codes to SIC codes and match the CBP and Comtrade datasets by year and SIC code. Matching the trade and employment data by industry in this way allows me to proxy for how imports in a particular county affect the employment in that county that was or is engaged in producing the good that is now imported.

Once the main trade data is joined, I merge this dataset with the Census data and finalize the full data set. I calculate net imports in terms of monetary value, then collapse to aggregate estimated net imports and employment in all industries in a given year and county. I can then merge the trade and Census datasets by county and year. Finally, I aggregate the counties to commuting zones (CZs), which are collections of counties that represent localities that are economically linked – i.e., in which people commute from one county to another for work.[15] This allows me to analyze how import penetration has affected a local labor market in its entirety, rather than simply areas defined by administrative borders. I also aggregate employment overall rather than employment per industry, which shows how trade affects employment overall rather than simply individual industries that have been most affected by trade. This leaves me with an unbalanced panel of 1,383 observations to analyze in Section IV.

For the analyses in Sections V and VI, I also incorporate fertility data. This dataset is constructed from two sources: the National Center for Health Statistics (NCHS) and the National

[15] I have used the 2000 iteration of commuting zones for this project, but there are also official versions from 1980 and 1990. CZs were updated every ten years based on Census records, but the USDA discontinued updating them after 2000. Independent researchers at Pennsylvania State University constructed an updated system for 2010, but otherwise, CZs are no longer part of official government statistics. They are still quite useful for analyzing local labor markets, as I do here (USDA ERS, 2019).

Cancer Institute. The NCHS data, accessed through the CDC's National Vital Statistics System (NVSS)'s WONDER database, provides data for every birth in the U.S. at the county level in a given year. The public use data suppresses births from counties with a population below 100,000, so these counties are not included in the sample. As such, an important limitation of this study is that it is only representative of the most populous counties in the U.S. In addition, due to some counties' population changing or county lines being redrawn, not every county is represented in every year, resulting in an unbalanced panel. For example, CZ 1 contains eight counties across Arkansas, Mississippi, and Tennessee, of which only two (DeSoto County, MS and Shelby County, TN) meet the 100,000 threshold at any point in the analysis period. However, the suburban DeSoto County only crossed that threshold in 2010, meaning that in 1990 and 2000, CZ 1 was only made up of Shelby County (which contains Memphis, the urban core of the CZ), while in 2010 and 2018, CZ 1 included both counties. I chose this approach in order to be inclusive of various county dynamics and to exclude as few counties as possible, given the already small sample size (only 586 out of the 3,141 counties that existed in 2000 ever cross the 100,000 population threshold throughout the analysis period); however, a significant limitation of this method is that the composition of the CZs may change over time in potentially substantive ways. For example, in 2010, Shelby County contained 339,014 households with a median income of $43,990, while DeSoto County had 56,842 households with a median income of $60,385. Collapsing these to the mean therefore artificially inflates the median income of the CZ relative to the earlier years in a way that cannot be easily accounted for over time, and results should be interpreted with this limitation in mind.

For the counties that meet the population threshold, I combine the birth data with the National Cancer Institute's SEER population data to obtain each county's fertility rate (defined

as births/women aged 15-44). The SEER data sorts individuals into subgroups of age, sex, race, and ethnicity to make these calculations possible. The SEER data also allows me to create variables that represent gender disaggregated individual age brackets: the share of the population under 18, ages 18-39, and over 65. Once this dataset is finalized, I merge it with the non-collapsed trade dataset, drop the counties for which fertility data is unavailable, then collapse it following the same methods described for the Section IV analysis. This left me with a slightly smaller dataset for Sections V and VI: 258 CZs and 929 total observations.

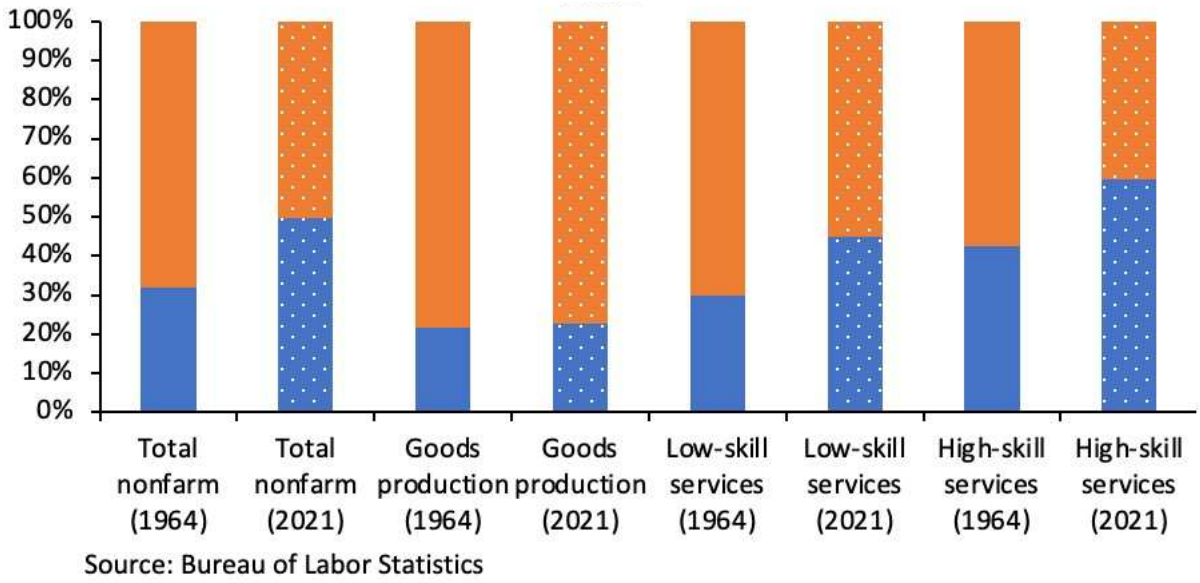
IV. ANALYSIS: TRADE EXPOSURE AND GENDERED LABOR MARKETS

IV.A. Theoretical framework

Based on the existing literature on gendered labor markets and occupational segregation, I hypothesize that trade exposure is negatively associated with men's employment, but negligibly to positively associated with women's. This is based primarily on (a) the dual labor market theory posited by Doeringer & Piore (1975), which argues that there exists a "primary" and "secondary" labor market, differentiated by the relative quality and stability of jobs; and (b) the theory of occupational segregation, which argues that workers are sorted into jobs in either segment of the labor market based on their relative social power (Bergmann, 1974). Since the Industrial Revolution, women have been systemically excluded from certain professions, through both law and custom. While formal gender discrimination was outlawed 60 years ago with the passage of the Civil Rights Act, this informal segregation still exists, particularly within the secondary labor market. This is illustrated in Figure 7, which shows that, while the ratio of male to female workers in total has gone from about 2:1 in 1964 to 1:1 in 2021, this has not been an even split across sectors. The share of women in goods production has stayed roughly the same at approximately 20%, and they now outnumber men in high-skill services – that is, sectors in which the bulk of jobs require a college degree.[16] Men still outnumber women in low-skill services (i.e., sectors in which the bulk of jobs do not require a college degree), but to a lesser extent.

[16] Note that there is a broad range of earnings even across high-skill jobs: teachers and childcare workers are included under this category, as are surgeons and engineers. So, while women outnumber men in high-skill sectors writ large, they are overrepresented in the relatively lowest-paying high-skill jobs, while men are overrepresented in the highest-paying jobs even in the same sectors.

Figure 7. Men's and Women's Employment Share by Sector, 1964 and 2021



Source: Bureau of Labor Statistics

Manufacturing was once a significant provider of stable, well-paying, low-skill jobs within the primary labor market, but was (and is) highly gender-segregated, with most of those jobs going to men. As such, increasing trade exposure, which primarily impacted the manufacturing industry, has had a much greater impact on men's employment and labor force participation than it has women's (Krause & Sawhill, 2017). The primary labor market is now dominated by jobs requiring a college degree, leaving no close substitutes for many men without a college education. For women, however, little has changed, as the low-skill sectors that have disproportionately employed women – such as the retail and hospitality industries – have only grown. The following section further explains these hypotheses and the theoretical context for better understanding the relationship between trade and gendered labor markets.

IV.A.1 Dual labor market

The dual (or segmented) labor market hypothesis states that there exist two labor markets. The primary labor market is characterized by secure jobs with specific points of entry and pathways for upward mobility, higher wages, and better working conditions. The secondary

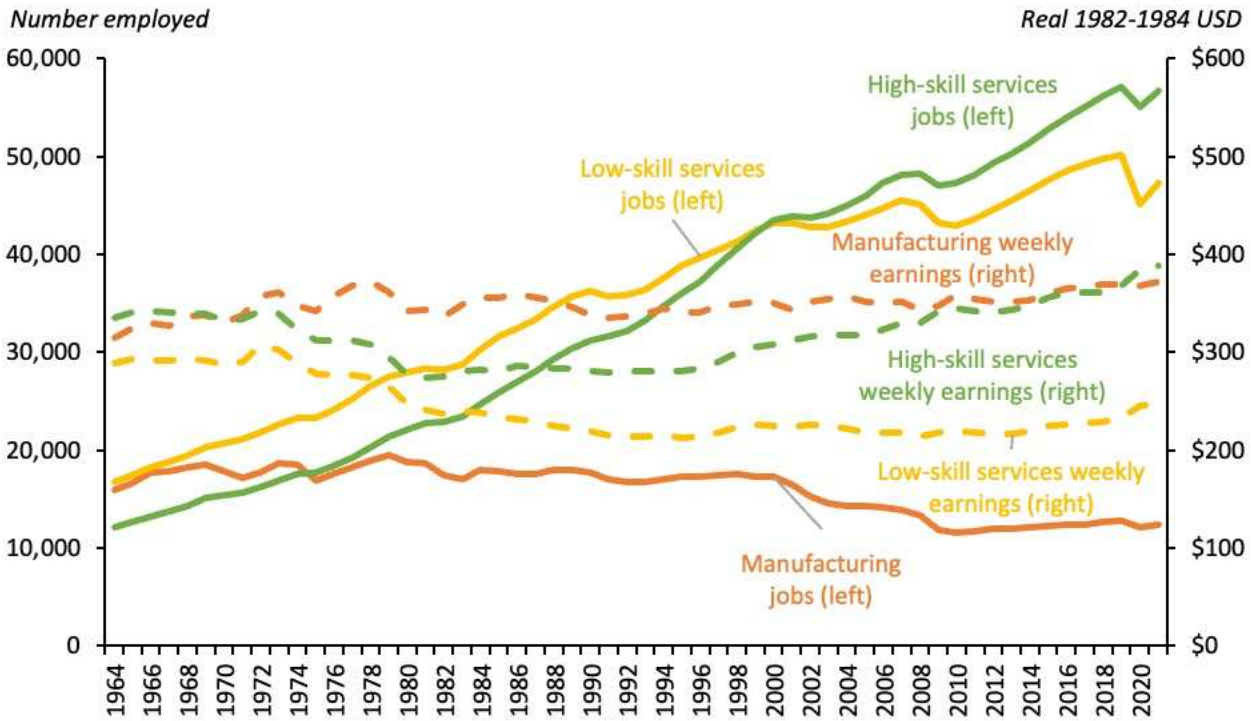
labor market is much less secure, with few to no barriers to entry and low wages (Doeringer & Piore, 1975). These divisions exist because the supply of labor being funneled into each are so substantially different that these workers generally cannot be substituted for one another. In particular, moving from the secondary to the primary labor market generally necessitates acquisition of new skills and training. For example, an individual cannot move straight from a job as a cashier to a physician without obtaining additional education. Conversely, a physician could become a cashier, but the low wages and lack of job security, particularly after the time and money they invested in building their human capital, make this an undesirable option.

The makeup of each segment of the labor market has not been constant over time, but has instead evolved in parallel with the labor and trade dynamics described in Section II. Today, educational attainment is the key factor that divides the primary and secondary labor markets, as a postsecondary education has become a key requirement for most "good jobs," defined by Strohl, Gulish, & Morris (2024) as those that pay a minimum of $43,000 and a median of $74,000 for workers aged 25-44, and a minimum of $55,000 and a median of $91,000 for workers aged 45-64.[17] In their report "The Future of Good Jobs," these authors find that, in 2021, 59% of all good jobs required a bachelor's degree or higher, 22% required an associate's degree or other postsecondary certification, and 19% required a high school education. By 2031, these shares are projected to be 66%, 19%, and 15%, respectively, indicating that higher education will be increasingly paramount in obtaining jobs in the primary labor market. However, prior to the U.S.'s shift to a service economy, education was not a prerequisite to good jobs in the primary market. As discussed in Section II above, low-skill jobs like mining and manufacturing were

[17] All values in real 2022 U.S. dollars and averaged across states, whose thresholds vary based on cost of living – e.g., the minimum threshold for a good job in Hawaii is $47,900, while in Mississippi, the minimum is $37,500 (Strohl, Gulish, & Morris, 2024).

plentiful, good jobs that came with benefits, pensions, stability, union backing, and wages that could and did support a family in the postwar economy. There were few barriers to entry, and the corporate regulation and wage-led nature of economic growth incentivized company loyalty to workers, ensuring that firms were good places to work.

Figure 8. Job and Wage Growth by Sector, 1964-2021



Source: Bureau of Labor Statistics
Government employment and wages excluded due to lack of earnings data

Today, average manufacturing wages remain relatively high (though stagnant), while wages have risen in high-skill industries and fallen in low-skill industries. However, manufacturing jobs today are split between high-skill technicians like engineers and machinists who earn high wages and exist in the primary market and low-skill assemblers, whose low wages place them in the secondary market alongside workers in retail, transportation, food services, and other low-skill sectors (Industries at a Glance, 2025). And yet, even as a college education becomes more and

more necessary, its ever-rising cost places it out of reach for many workers, therefore leaving many secondary laborers virtually no options to advance to the primary market.

IV.A.2 Occupational segregation

Worker sorting into each labor market is not random, but a product of "social patterns and institutional forces" – including race, sex, and shared social beliefs – that coalesce into a "social acceptability" factor that is key to obtaining a job in the primary sector (Doeringer & Piore, 1975). This effect, which Bergmann (1974) called "occupational segregation" (or, in the context of this paper, "industrial segregation"), refers to the systemic factors that force marginalized workers into lower-quality jobs (i.e., those in the secondary labor market). These factors may be formally exclusionary, like marriage bars that kept married women out of the workforce or Jim Crow laws that prohibited Black workers from certain jobs altogether, but in the modern U.S. labor market, these forces largely persist due to custom. Certain occupations and industries are culturally understood as being more "masculine" or "feminine," with the masculine-coded jobs almost always being higher-paid and considered more prestigious. In fact, Zhavoronkova, Khattar, & Brady (2022) find that white men make up the majority in all of the ten highest-paid jobs in the U.S., while women and people of color are the majority in all of the ten lowest-paid jobs.

Occupational segregation is a phenomenon as old as the industrial economy itself, and as such, these modern patterns in gendered labor markets largely reflect those of the 19th century. If women weren't outright barred from certain professions, they were often excluded from unions in an effort to drive them out of the workforce entirely so as to keep the labor supply low, wages high, and the nuclear family structure intact – all of which benefited men. This attitude pervaded even through the postwar era, when women were technically allowed to join unions but were

functionally excluded due to women's underrepresentation in traditionally unionized sectors (Porter, 2014). This vicious cycle made it difficult for women to make inroads in either unions or the good jobs that came along with them. In the peak union years of the 1940s through 1960s, union membership was concentrated in manufacturing, construction, mining, and transportation, all of which were low-skill, primary-sector, goods-producing, and male-dominated (Reuss, 2011). So, when manufacturing (and mining) jobs began to disappear, women in the workforce, whose systemic exclusion from these jobs meant they were overrepresented in the service sector, were relatively insulated from the employment effects of deindustrialization.

IV.B. Hypotheses

Given the existing literature discussed in Section II and the theoretical backing discussed in Section IV.A., I have three hypotheses, each relating to a different aspect of the labor market and its gendered dynamics. First, I hypothesize that employment rates as a whole will be largely unaffected by trade exposure since a decrease in manufacturing jobs does not preclude the addition of jobs in other sectors to supplant those jobs. The share of employment in manufacturing, then, is hypothesized to be negatively associated with trade exposure, while the share of employment in other sectors is hypothesized to be positively associated.

Second, I hypothesize that male earnings and employment are negatively associated with trade exposure. Men are more likely to work in the goods-producing (namely, manufacturing) sectors that are more directly affected by increased import penetration, since the goods that were once produced locally have been replaced by imports.

Third, I hypothesize that female earnings and employment are not associated with trade exposure. Women, due to the long history of occupational segregation, do not and have not historically held jobs within the manufacturing sector. Instead, the service-sector jobs in which women more typically work are relatively insulated from import penetration.

IV.C. Empirics

To test my hypotheses, I test a series of fixed-effects panel regressions, all variations of the following OLS model.

$$Y_{itg} = \beta_{0it} + \beta_{1it}X_{1it} + \beta_{2it}X_{2it} + \beta_{3it}X_{3it} + \beta_{4itg}X_{4itg} + a_{it}$$

This model tests the relationships between import penetration and various employment-related variables. In this model, Y_{itg} is a vector containing the various dependent variables used in different iterations. These include both gender-disaggregated and non-gender-disaggregated variables, denoted by the subscript *g*. X_{1it} represents the variable of interest, net imports as a share of total trade. X_{2it} is a vector containing additional economic control variables, X_{3it} is a vector containing demographic control variables, and X_{4itg} is a vector containing gender-disaggregated controls (namely, educational attainment). Finally, a_{it} is the error term.

Each version of the model utilizes a similar set of variables, designed to identify how trade is associated with various measures of labor market outcomes. In the first set of regressions, the dependent variables are swapped out in subsequent iterations, but the independent variables remain the same. In subsequent sets, the reverse is true, and different sets of independent variables are tested on the same dependent variable. In all models, the key independent variable (X_{1it}) is net imports, measured as net imports as a share of total trade (all in real 2018 dollars): $X_{1it} = \frac{imports_{it} - exports_{it}}{imports_{it} + exports_{it}}$. Measuring trade in this way ensures that small, less-integrated CZs will be treated similarly to larger, more-integrated ones, since the balance of trade is the important consideration in my analysis. However, this does obscure the fact that there are likely substantial economic differences between economies of similar sizes but different levels of isolation – e.g., a $10 billion economy that imports and exports $10,000 worth of goods is treated the same as if that economy imports and exports $100 million worth of goods. I attempt to

partially control for this through the slate of other variables which control for supply- and demand-side characteristics of the local labor market. On the supply side, I control for educational attainment, which accounts for the human capital available in the local labor force, and the share of the population that is foreign-born, because immigrant workers tend to have higher rates of labor force participation relative to native-born workers. On the demand side, I control for the overall size of the economy (total nonfarm economic output per capita), the industrial mix, growth in real per capita income (calculated as the percentage change in real per capita income between the present and previous time period), and the share of active-duty military within a commuting zone. These all control for potential systemic factors affecting the economic structure and therefore labor demand. For example, since active military members are excluded from calculations of labor force or employment, but otherwise contribute to their local economy, including the share of military members accounts for the ways in which the local economy may be shaped by a military presence, especially in localities that are home to a base or military academy.[18]

Where the models differ is in their overall analytical goal, and as such, possess certain differences in the sets of variables used. Model 1 is intended to establish a holistic representation of how import penetration shapes a local economy with respect to its labor force. Therefore, the set of independent variables remains the same, but different dependent variables are used for each variation. Employment rate provides an economy-wide analysis of labor market health,

[18] When calculating employment rates, I included active-duty military members in the numerator as "employed." Because this is a relatively small share of the workforce in most areas, the share of military members is not highly correlated with the employment rate even when those individuals are included. However, this was an important addition due to a handful of CZs with a major military presence in which employment rates were artificially low (especially for men), which affects, in particular, the gendered employment ratios used in Sections V and VI. Employment rates were also not measurably different when I instead removed military members from the denominator. I generally prefer an additive approach to a subtractive one, but the general results would have been the same using either method.

while the share of employment in different sectors (manufacturing, goods production, low-skill services, and high-skill services) indicate whether and how trade exposure impacts different sectors differently. Model 2, on the other hand, is intended to examine the differential relationships of trade with gendered employment outcomes. The dependent variables are the same (either male or female employment rate or earnings), as are most of the independent variables (though some are gender disaggregated); however, each successive version of the model includes a different one of the sector variables that had been used as dependent variables in Model 1. This facilitates an analysis in which occupational segregation's relationships with the respective employment of men and women can be operationalized – for instance, it would be expected that a higher share of employment in goods-producing industries would result in relatively higher employment for men and relatively lower employment for women.

Table 1. Summary Statistics, Trade and Gendered Labor Markets

VARIABLES	(1) Mean	(2) SD	(3) Min	(4) Max	(5) N
Employment rate, female	0.537	0.058	0.301	0.731	1,379
Employment rate, male	0.648	0.070	0.328	0.829	1,379
Employment rate	0.591	0.059	0.370	0.748	1,383
Median earnings for women, 2018 USD	32,536	10,030	10,039	64,528	1,383
Median earnings for men, 2018 USD	46,626	9,134	17,162	78,859	1,383
Median household income, 2018 USD	54,912	10,625	31,005	104,729	1,383
Share of employment in manufacturing	0.132	0.070	0	0.457	1,383
Share of employment in goods production	0.223	0.072	0	0.529	1,383
Share of employment in low-skill services	0.222	0.048	0	0.406	1,383
Share of employment in high-skill services	0.553	0.099	0	0.786	1,383
Net imports as a share of total trade[19]	0.112	0.219	-1	0.816	1,383
Share of population 25 and up with a bachelor's degree or higher	0.241	0.083	0.072	0.569	1,383
Share of women 25 and up with a bachelor's degree or higher	0.233	0.087	0.069	0.555	1,383
Share of men 25 and up with a bachelor's degree	0.250	0.083	0.069	0.585	1,383

[19] Due to the CBP reporting change in 2017 that suppressed employment in industries with fewer than three establishments (see footnote 14), the industry matching method I use results in 11 counties showing no imports and/or exports in 2018. Most of these were subsumed into the CZ as a whole once collapsed, but one (Spalding County, GA) is the only county represented in its CZ and as such the data indicates that the economy only exported and imported nothing in 2018.

or higher					
Share of population born outside the US	0.061	0.059	0.002	0.455	1,383
Share of population 16 and up in the Armed Forces	0.009	0.024	0	0.235	1,383
Total nonfarm output per capita (thousands of 2018 USD)	71,206	61,994	589.827	245,481	1,383
Nonfarm labor productivity (real value)	61.99	8.992	50.44	72.38	1,383
Growth in real income	0.076	0.108	-0.243	0.431	1,027

Because this paper uses decadal data from the U.S. Census to ensure the highest level of gender disaggregation (in particular, by county and industry), there are some limitations as to how the time series aspect of the panel can be exploited. In order to account for changes in economic structure over time, robustness checks use year dummy variables and lagged trade exposure. Furthermore, because many of the key regressors are measured as shares or ratios ranging from 0 to 1, the coefficients represent the correlative effect of a full one-unit change. In the discussion below, I therefore interpret substantively meaningful changes, such as a one- or ten-percentage-point change, depending on the variable.

Finally, it is of note that trade is not the only potential explanatory factor regarding changes in employment over the past 35 years; however, it is the variable of interest in this paper, and as such, other potential drivers of employment changes were purposefully excluded. For example, automation is another key factor that has driven changes in employment. This will be quantified and discussed in greater detail in robustness checks below. The relationship between employment and technology, particularly with the advent of generative AI/large language model technology like ChatGPT, is a promising area for further research, but is beyond the scope of this paper.

IV.D. Results and discussion

Results from the model testing the relationship between net imports and employment rates are shown in Table 2.

Table 2. Estimated Relationship Between Net Imports & Employment Rate

VARIABLES	(1) Employment rate	(2) Employment rate, male	(3) Employment rate, female
Net imports as a share of total trade	-0.001	-0.007	0.002
	(0.003)	(0.005)	(0.004)
Share of population[a] 25 and up with a bachelor's degree or higher	-0.012	-0.057	0.105***
	(0.031)	(0.041)	(0.025)
Share of population born outside the US	-0.011	-0.215**	-0.051
	(0.090)	(0.087)	(0.096)
Total nonfarm output per capita (thousands of 2018 USD)	-1.61e-07**	-5.05e-07***	1.18e-08
	(6.43e-08)	(9.42e-08)	(6.60e-08)
Growth in real income	0.150***	0.213***	0.090***
	(0.006)	(0.008)	(0.006)
Share of population 16 and up in the Armed Forces	0.344***	0.514***	0.166*
	(0.081)	(0.131)	(0.097)
Observations	1,027	1,023	1,023
R-squared	0.548	0.631	0.274
Number of CZ00	348	348	348

[a] *Gender disaggregated in 2 (male only) and 3 (female only)*

Fixed effects used; CZ-clustered robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Net imports as a share of total trade is not associated with employment rates, either generally or gender-specifically. It is negative for men and the total population and positive for women, but not meaningfully different from zero in any case. Other variables are much stronger predictors of employment on both the supply and demand side. On the supply side, educational attainment is only significant for women's employment, where a ten-percentage point increase in the share of women with a bachelor's degree or higher is associated with a 1.05-percentage point increase in women's employment rate – about one fifth of a standard deviation from the mean. That variable is negative and insignificant for men and for aggregate employment. The foreign-born share of the population is negative for all three groups, but only significant for men, in which a ten-

percentage point increase is associated with a 2.15-percentage point decrease in male employment. The demand-side variables are all significant for men and in aggregate: negative and significant for output per capita and military participation, and positive and significant for growth in real income, which is positive and significant for women also. However, income growth and military participation are the only variables with magnitudes large enough to be substantively meaningful, particularly for men: a ten-percentage point increase in income growth (military participation) is associated with a 2.13 (5.14)-percentage point increase in men's employment. All of the variables that are significant for women are positive, suggesting that incentives for women to be employed are stronger than incentives for them not to be.

The differential relationships between trade and median earnings by household, men, and women are shown in Table 3.

Table 3. Estimated Relationship Between Net Imports & Median Earnings

VARIABLES	(1) Median household income, 2018 USD	(2) Median earnings for men, 2018 USD	(3) Median earnings for women, 2018 USD
Net imports as a share of total trade	535.7	-59.24	1,422***
	(550.6)	(525.7)	(278.6)
Share of population[a] 25 and up with a bachelor's degree or higher	23,253***	5,769	28,701***
	(5,070)	(5,180)	(2,137)
Share of population born outside the US	9,605	-2,102	13,559*
	(14,842)	(11,385)	(7,808)
Total nonfarm output per capita (thousands of 2018 USD)	-0.016	-0.040***	0.018***
	(0.012)	(0.011)	(0.006)
Growth in real income	21,937***	2,023**	-2,194***
	(982.9)	(881.7)	(581.0)
Share of population 16 and up in the Armed Forces	-16,625	-62,819***	-5,617
	(12,453)	(17,070)	(5,972)
Observations	1,027	1,027	1,027
R-squared	0.452	0.059	0.537

Number of CZ00	348	348	348

[a] *Gender disaggregated in 2 (male only) and 3 (female only)*

Fixed effects used; CZ-clustered robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

While net imports are not associated with household or male earnings, they are associated with women's earnings: a one percentage point increase in net imports as a share of trade is associated with a $14.22 increase in women's annual wages. This number is too small to be meaningful, but overall reflective of the across-the-board trend that women's earnings are more significantly associated with these variables, with only the military share being insignificant. As such, these results indicate that women's earnings may be more sensitive to changes in local economic conditions than men's are. The most substantive associations are with educational attainment for women and households (in which a one-percentage point increase in the share of each group with a bachelor's degree is associated with an annual increase of $287.01 and $232.53, respectively) and military share for men (in which a one-percentage point increase in the share of the population in the Armed Forces is associated with an annual decrease of $628.19).

The next model utilizes sectoral employment shares as dependent variables, the results of which are shown in Table 4. All of the included variables are aggregated with no gendered differentiation.

Table 4. Estimated Relationship Between Net Imports & Industry Mix

VARIABLES	(1) Share of employment in manufacturing	(2) Share of employment in goods production	(3) Share of employment in low-skill services	(4) Share of employment in high-skill services
Net imports as a share of total trade	-0.008**	-0.003	-0.001	0.004
	(0.004)	(0.004)	(0.003)	(0.005)
Share of population 25 and up with a bachelor's degree or higher	-0.361***	-0.451***	-0.148***	0.660***
	(0.030)	(0.035)	(0.024)	(0.058)
Share of population born outside the US	0.083	0.210**	-0.139**	-0.265
	(0.065)	(0.086)	(0.066)	(0.172)

Total nonfarm output per capita (thousands of 2018 USD)	-2.63e-07*** (8.10e-08)	-2.15e-07** (9.10e-08)	-1.03e-07 (6.59e-08)	1.98e-07 (1.23e-07)
Growth in real income	0.091*** (0.007)	0.127*** (0.007)	0.018*** (0.005)	-0.138*** (0.009)
Share of population 16 and up in the Armed Forces	-0.332*** (0.119)	-0.322*** (0.095)	0.119 (0.078)	0.192*** (0.074)
Observations	1,027	1,027	1,027	1,027
R-squared	0.545	0.562	0.265	0.505
Number of CZ00	348	348	348	348

Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Overall, these results largely align with expectations. Net imports are only significantly, associated with manufacturing employment, where a ten-percentage point increase in net imports as a share of total trade is associated with a 0.08-percentage point decrease in the share of manufacturing employment, but that number is so small it is virtually zero. While the magnitude of the change is quite small, the significance aligns with my hypothesis stated in Section IV.B., given that trade in goods is expected to be primarily related to manufacturing as an industry.

The other variables are also as expected. On the supply side, both variables have the expected signs for sectoral employment shares, but not significant for employment rate in general (per Table 2), indicating that higher education and a greater share of the immigrant population are marginally associated with employment, but are more suggestive of the sectoral makeup of a local economy. Educational attainment in particular appears to have the most substantive relationship with the sectoral shares, showing negative association with manufacturing (3.61 percentage point decrease per ten percentage point increase in the share of individuals with a bachelor's degree), goods production (4.51), and low-skill services (1.48), and positive association with high-skill services (6.6 percentage point increase). The immigrant population share is the opposite: positively associated with manufacturing and goods production,

and negatively associated with low- and high-skill services. On the demand side, these variables have a stronger association with manufacturing and goods production, but are opposite in sign from the service sectors. Total output has a negligible association in terms of magnitude across the board, but is significantly and negatively associated with manufacturing, goods production, but insignificantly and positively associated with high-skill services, reflecting that the U.S. is an information economy rather than an industrial one, and most economic activity does not take place within goods-producing sectors. Income growth is positively and significantly associated with all variables except high-skill services, which is negatively and significantly associated. Because this is a growth variable, these results reflect economic development and suggest that more stable income growth is associated with full employment and thus less job creation. Finally, the military share of the population is negatively and significantly associated with manufacturing and goods production; and positively and significantly associated with high-skill services. One explanation could be that there are positive spillover effects for high-skill industries that support the military (such as defense contractors), but negative effects on all else, suggesting that low-skill workers may be more likely to be enlisted, thus removed from the labor force and indicating lower employment as a result.

The final model explores gender-differentiated employment and earnings data, including the sectoral shares as independent variables. The results for male and female employment are shown in Table 5 and Table 6, with goods production in Table 5 and services in Table 6.

Table 5. Estimated Relationship Between Goods-Producing Industry Share & Gender-Differentiated Employment

VARIABLES	(1) Employment rate, male	(2) Employment rate, female	(3) Employment rate, male	(4) Employment rate, female
Net imports as a share of total trade	-0.002	0.003	-0.004	0.002
	(0.005)	(0.004)	(0.004)	(0.004)

Share of employment in manufacturing	0.482***	0.156***		
	(0.050)	(0.046)		
Share of employment in goods production			0.494***	0.160***
			(0.043)	(0.041)
Share of population[a] 25 and up with a bachelor's degree or higher	0.091**	0.151***	0.147***	0.162***
	(0.042)	(0.029)	(0.042)	(0.028)
Share of population born outside the US	-0.139	-0.069	-0.184**	-0.087
	(0.085)	(0.096)	(0.078)	(0.092)
Total nonfarm output per capita (thousands of 2018 USD)	-3.11e-07***	4.48e-08	-3.17e-07***	3.80e-08
	(8.89e-08)	(6.65e-08)	(8.37e-08)	(6.73e-08)
Growth in real income	0.169***	0.076***	0.150***	0.070***
	(0.007)	(0.008)	(0.008)	(0.008)
Share of population 16 and up in the Armed Forces	0.658***	0.216**	0.656***	0.214**
	(0.171)	(0.100)	(0.159)	(0.096)
Observations	1,023	1,023	1,023	1,023
R-squared	0.689	0.291	0.712	0.298
Number of CZ00	348	348	348	348

[a] *Gender disaggregated to show male education in 1 & 3 and female education in 2 & 4*

Fixed effects used; CZ-clustered robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Net imports are not significant for either men or women when goods-producing industry shares are taken into account, but they are negative for men and positive for women, which aligns with the hypotheses discussed in Section IV.B. Notably, the shares of employment in manufacturing and goods production are significant for both men and women, though the magnitude is much larger for men (though still small). For instance, a ten-percentage point increase in the share of employment in manufacturing is associated with an increase of 4.82 percentage points in the male employment rate, but only 1.6 percentage points in the female employment rate. On the supply side, educational attainment is positive and significant across the board, but the immigrant share is significant only for men when goods production is considered, though it is negative in all cases. On the supply side, output per capita is negative and significant for men,

but positive and insignificant for women, while income growth and the military share are both positive and significant for all, but the magnitude is larger for men than for women.

Table 6. Estimated Relationship Between Service Industry Share & Gender-Differentiated Employment

VARIABLES	(1) Employment rate, male	(2) Employment rate, female	(3) Employment rate, male	(4) Employment rate, female
Net imports as a share of total trade	-0.007	0.002	-0.005	0.002
	(0.005)	(0.004)	(0.004)	(0.004)
Share of employment in low-skill services	0.024	-0.008		
	(0.076)	(0.073)		
Share of employment in high-skill services			-0.296***	-0.016
			(0.109)	(0.060)
Share of population[a] 25 and up with a bachelor's degree or higher	-0.054	0.104***	0.122*	0.113***
	(0.042)	(0.026)	(0.067)	(0.037)
Share of population born outside the US	-0.209**	-0.052	-0.160*	-0.053
	(0.089)	(0.098)	(0.090)	(0.095)
Total nonfarm output per capita (thousands of 2018 USD)	-5.01e-07***	1.12e-08	-3.56e-07***	1.59e-08
	(9.51e-08)	(6.66e-08)	(1.06e-07)	(6.73e-08)
Growth in real income	0.213***	0.090***	0.172***	0.088***
	(0.008)	(0.006)	(0.018)	(0.012)
Share of population 16 and up in the Armed Forces	0.510***	0.168*	0.562***	0.169*
	(0.131)	(0.097)	(0.136)	(0.098)
Observations	1,023	1,023	1,023	1,023
R-squared	0.631	0.274	0.684	0.275
Number of CZ00	348	348	348	348

[a] *Gender disaggregated to show male education in 1 & 3 and female education in 2 & 4*

Fixed effects used; CZ-clustered robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The demand-side control variables are extremely consistent between the sectorally-differentiated models, but the supply-side controls are slightly less so. The immigrant share is negative with varying significance, similar to the goods production regressions; education is still positive and significant for all models, except male employment in the model in which the low-skill service

share is accounted for. The low-skill service share itself is not significantly associated with either male or female employment, but the high-skill service share is negatively and significantly associated with the male employment rate, in which a ten-percentage point increase in the share of high-skill service employment corresponds with a 2.96-percentage point decrease in the male employment rate. For women, the relationship is not significant. All of the variables that are significantly associated with the female employment rate are positive, again suggesting that the incentives for women to be employed are stronger than incentives for them not to be.

Table 7 and Table 8 show the results of the same model using male and female earnings as the dependent variable rather than employment.

Table 7. Estimated Relationship Between Goods-Producing Industry Share & Gender-Differentiated Earnings

VARIABLES	(1) Median earnings for men, 2018 USD	(2) Median earnings for women, 2018 USD	(3) Median earnings for men, 2018 USD	(4) Median earnings for women, 2018 USD
Net imports as a share of total trade	53.68 (537.4)	1,446*** (282.4)	6.453 (528.3)	1,434*** (281.3)
Share of employment in manufacturing	10,491* (5,748)	2,931 (3,729)		
Share of employment in goods production			11,414** (5,384)	4,120 (3,396)
Share of population[a] 25 and up with a bachelor's degree or higher	9,046* (5,399)	29,556*** (2,518)	10,526* (5,647)	30,158*** (2,564)
Share of population born outside the US	-453.1 (11,440)	13,236* (7,833)	-1,410 (11,332)	12,642 (7,823)
Total nonfarm output per capita (thousands of 2018 USD)	-0.036*** (0.011)	0.019*** (0.006)	-0.036*** (0.011)	0.019*** (0.006)
Growth in real income	1,065 (1,017)	-2,455*** (717.2)	562.3 (1,077)	-2,706*** (748.5)
Share of population 16 and up in the Armed Forces	-59,651*** (16,203)	-4,689 (6,196)	-59,485*** (16,140)	-4,389 (6,143)

Observations	1,027	1,027	1,027	1,027
R-squared	0.065	0.538	0.068	0.539
Number of CZ00	348	348	348	348

[a] *Gender disaggregated to show male education in 1 & 3 and female education in 2 & 4*

Fixed effects used; CZ-clustered robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

These results largely align with those shown in Table 3 above. Women's earnings are significantly associated with net imports, while men's are not. However, the opposite is true for the sectoral shares. For instance, a one-percentage point increase in the share of employment in manufacturing is associated with an increase in men's median earnings of $104.91, but women's earnings are positively but insignificantly related. Education is positively and significantly associated with earnings across the board, but the magnitude is nearly three times higher for women than men. The immigrant share is positive for women and negative for men, but is only significant for women in the model that accounts for manufacturing share. On the demand side, output is significant in all models, but is negative for men and positive for women. Income growth is the opposite, but only significant for women. Finally, military share is negative in all cases, but only significant for men.

Table 8. Estimated Relationship Between Service Industry Share & Gender-Differentiated Earnings

VARIABLES	(1) Median earnings for men, 2018 USD	(2) Median earnings for women, 2018 USD	(3) Median earnings for men, 2018 USD	(4) Median earnings for women, 2018 USD
Net imports as a share of total trade	-74.80	1,415***	-9.427	1,407***
	(534.3)	(280.6)	(526.0)	(277.3)
Share of employment in low-skill services	-10,080	-17,059***		
	(9,041)	(5,603)		
Share of employment in high-skill services			-6,906**	3,747**
			(3,195)	(1,723)
Share of population[a] 25 and up	4,464	26,628***	10,106*	26,888***

with a bachelor's degree or higher	(5,403)	(2,217)	(5,644)	(2,384)
Share of population born outside the US	-4,472 (11,834)	11,463 (7,818)	-1,342 (11,239)	14,367* (7,861)
Total nonfarm output per capita (thousands of 2018 USD)	-0.042*** (0.011)	0.017*** (0.006)	-0.037*** (0.011)	0.017*** (0.006)
Growth in real income	2,208** (865.8)	-1,897*** (574.6)	1,056 (943.0)	-1,691*** (626.7)
Share of population 16 and up in the Armed Forces	-61,500*** (16,680)	-3,493 (6,039)	-61,752*** (16,838)	-6,160 (6,013)
Observations	1,027	1,027	1,027	1,027
R-squared	0.062	0.547	0.066	0.539
Number of CZ00	348	348	348	348

[a] *Gender disaggregated to show male education in 1 & 3 and female education in 2 & 4*

Fixed effects used; CZ-clustered robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The control variables follow the same trends as seen with goods production in Table 7, but the service industry shares tell an interesting story and almost all have a significant relationship with earnings. Low-skill services share is negatively associated with lower earnings for both men and women, but is only significant for women, in which case a one-percentage point increase in the low-skill service share is associated with a $170.59 decrease in women's annual median earnings. On the other hand, high-skill service share is significantly associated with both men's and women's earnings, but in opposite directions. A one-percentage point increase in the share of employment in high-skill services is associated with a $69.06 decrease in men's annual median earnings and a $37.47 increase in women's annual median earnings. Net imports remain highly associated with women's earnings as well as with high-skill service employment.

The final model is the base model again, but this time with labor market gender equality measures as the dependent variables.

Table 9. Estimated Relationship Between Trade Exposure & Labor Market Gender Equality

VARIABLES	(1) Ratio of female to male employment rate	(2) Ratio of female to male earnings 2018 USD
Net imports as a share of total trade	0.014 (0.008)	-0.006 (0.014)
Share of population 25 and up with a bachelor's degree or higher	0.426*** (0.053)	0.720*** (0.083)
Share of population born outside the US	-0.097 (0.131)	0.466*** (0.165)
Total nonfarm output per capita (thousands of 2018 USD)	5.24e-07** (2.10e-07)	7.76e-07** (3.68e-07)
Growth in real per capita income	-0.172*** (0.013)	-0.084*** (0.013)
Share of population 16 and up in the Armed Forces	-0.260* (0.149)	-0.045 (0.185)
Observations	668	668
R-squared	0.515	0.513
Number of CZ00	240	240

Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Net imports has no apparent relationship between women's relative employment or earnings – not statistically significant, nor large in terms of magnitude. As expected, education is the strongest predictor of equality – a ten percentage point increase in the share of the population with at least a bachelor's degree is associated with a rise of 0.043 (0.072) in the employment (earnings) ratio or 4.3 (7.2) percentage points, indicating an increase in women's relative economic status. Output is positively associated, but with a very small relationship, while income growth is the opposite, indicating that an increase in the income growth between periods $t - 1$ and t is associated with a decline in labor market gender equality.

IV.D.1. Robustness checks

To check robustness of these results, I first examine labor productivity, calculated as output in dollars per hour worked, another variable that may correspond to employment and has had a similar trajectory to the trade deficit over the last few decades. As discussed above, increased labor productivity reflects increased capital intensity (i.e., fewer workers are needed to produce the same amount, generally due to improved technology), including automation. Table 10 shows the results of this simple fixed-effects (FE) panel regression ($Y_{it} = \beta_{it}X_{it} + a_{it}$), indicating the relationships between trade and labor productivity and employment, both in general and in the manufacturing sector specifically.

Table 10. Estimated Relationship of Trade & Labor Productivity with Employment

VARIABLES	(1) Employment rate	(2) Employment rate	(3) Share of employment in manufacturing	(4) Share of employment in manufacturing
Net imports as a share of total trade	-0.022***		-0.022***	
	(0.004)		(0.005)	
Nonfarm labor productivity (real value)		-0.001***		
		(8.23e-05)		
Manufacturing labor productivity (real value)				-0.001***
				(3.03e-05)
Observations	1,383	1,383	1,383	1,383
R-squared	0.034	0.234	0.016	0.634
Number of CZ00	348	348	348	348

Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The relationships between net imports and labor productivity (measured here as output in real 2018 dollars divided by total hours worked) and employment are small in magnitude, but highly significant. A ten-percentage point increase in net imports as a share of total trade is associated with a decline of 0.002 percentage points both in the general employment rate and in the share of

employment in manufacturing. For nonfarm labor productivity, an increase in one dollar per hour of work is associated with a decline of 0.001 percentage points in the employment rate, with the same magnitude reported for the relationship between manufacturing labor productivity and the share of employment in manufacturing. As import penetration increases and as workers become more productive, employment tends to fall, as would be expected – more imports means fewer workers are needed to produce goods domestically, while higher productivity indicates that fewer workers are needed to provide the same amount of work, potentially due to increased capital intensity like automation technology or artificial intelligence.

For the rest of these robustness checks, I exploit the time series characteristics of these data by adding year fixed effects and lagging the trade variable. This is intended to control for changes in economic structure over time, as well as events like recessions (in 2001 and 2008), the formation of NAFTA (1994), and China's accession to the WTO (2002). These effects are tested on the same models shown above and presented in the same order.

Table 11. Estimated Relationship Between Net Imports & Employment Rate, with Time Variance

VARIABLES	(1) Employment rate	(2) Employment rate, male	(3) Employment rate, female	(4) Employment rate	(5) Employment rate, male	(6) Employment rate, female
Net imports as a share of total trade	0.003	0.003	0.001			
	(0.004)	(0.005)	(0.004)			
Change in net imports as a share of total trade				-0.001	-0.005	0.002
				(0.003)	(0.004)	(0.003)
Share of population[a] 25 and up with a bachelor's degree or higher	0.030	0.089	0.077*	-0.014	-0.067	0.108***
	(0.050)	(0.054)	(0.043)	(0.031)	(0.041)	(0.025)
Share of population born outside the US	0.053	0.096	-0.064	-0.009	-0.220**	-0.053
	(0.093)	(0.098)	(0.098)	(0.090)	(0.086)	(0.097)
Total nonfarm output per capita (thousands of 2018 USD)	-1.20e-07	-2.41e-07**	-1.90e-08	-1.68e-07***	-5.16e-07***	1.72e-08
	(7.79e-08)	(1.18e-07)	(7.45e-08)	(6.45e-08)	(9.86e-08)	(6.67e-08)
Growth in real income	0.123***	0.158***	0.091***	0.149***	0.212***	0.091***
	(0.010)	(0.012)	(0.011)	(0.006)	(0.009)	(0.007)

Share of population 16 and up in the Armed Forces	0.332*** (0.085)	0.435*** (0.157)	0.181* (0.099)	0.345*** (0.081)	0.517*** (0.127)	0.165* (0.097)
2000	0.007 (0.005)	0.026*** (0.005)	-0.004 (0.005)			
2010	-0.004 (0.003)	-0.002 (0.003)	-0.002 (0.003)			
Observations	1,027	1,023	1,023	1,027	1,023	1,023
R-squared	0.557	0.661	0.275	0.548	0.631	0.274
Number of CZ00	348	348	348	348	348	348

[a] *Gender disaggregated in 2 & 5 (male only) and 3 & 6 (female only)*
Reference year 1990; 2018 omitted due to multicollinearity
Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

These results are not meaningfully different from the model without an element of time variance. With respect to the year fixed effects, the only significant result is for male employment rates in the year 2000, indicating that, relative to 1990, male employment was 0.026 percentage points higher. There are also some minor differences in the control variables, largely in terms of the supply side: education and immigrant share are less significant and smaller in magnitude relative to the contemporaneous model (Table 2), while the demand-side variable coefficients are often smaller in magnitude, but not meaningfully so. The model version that uses change in net imports produces responses that are nearly identical in sign, significance, and magnitude to the contemporaneous model above.

The time variance effect is similarly applied to earnings, using the same dependent variables as shown in Table 3.

Table 12. Estimated Relationship Between Net Imports & Median Earnings, with Time Variance

VARIABLES	(1) Median household income, 2018 USD	(2) Median earnings for men, 2018 USD	(3) Median earnings for women, 2018 USD	(4) Median household income, 2018 USD	(5) Median earnings for men, 2018 USD	(6) Median earnings for women, 2018 USD
Net imports as a share of total	840.2	-890.9	689.4**			

trade	(619.3)	(565.4)	(299.1)			
Change in net imports as a share of total trade, 2018 USD				-40.36	274.1	1,095***
				(368.2)	(392.9)	(209.4)
Share of population[a] 25 and up with a bachelor's degree or higher	35,211***	22,719***	30,095***	23,938***	5,805	30,735***
	(8,491)	(6,288)	(3,611)	(5,061)	(5,120)	(2,137)
Share of population born outside the US	18,166	7,939	6,378	10,081	-2,507	12,628
	(15,623)	(13,393)	(8,054)	(14,887)	(11,403)	(7,846)
Total nonfarm output per capita (thousands of 2018 USD)	-0.004	-0.012	0.020***	-0.019	-0.038***	0.019***
	(0.015)	(0.012)	(0.007)	(0.013)	(0.011)	(0.006)
Growth in real income	19,974***	8,672***	2,833***	21,508***	2,425**	-1,738***
	(1,717)	(1,487)	(947.8)	(1,015)	(974.7)	(627.4)
Share of population 16 and up in the Armed Forces	-20,810	-72,604***	-7,274	-16,270	-63,220***	-6,317
	(12,895)	(16,998)	(6,770)	(12,670)	(17,104)	(5,901)
2000	1,483*	1,281**	-359.5			
	(790.2)	(543.0)	(403.4)			
2010	301.0	2,862***	1,339***			
	(462.9)	(376.0)	(277.2)			
Observations	1,027	1,027	1,027	1,027	1,027	1,027
R-squared	0.457	0.146	0.573	0.451	0.060	0.538
Number of CZ00	348	348	348	348	348	348

[a] *Gender disaggregated in 2 & 5 (male only) and 3 & 6 (female only)*
Reference year 1990; 2018 omitted due to multicollinearity
Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Change in net imports is similarly robust as in the prior model's results (shown in Table 11), with magnitude and significance slightly depressed relative to the contemporaneous model but overall not meaningfully different. The one exception is median earnings for men and for households, for whom the magnitude and direction of the relationship with net imports has changed; however, both remain insignificant. The year fixed effects result in slight variations from the main model, but not as systematically as on employment rates (e.g., the coefficient on income growth is smaller for household income, but larger for men's and women's earnings). The years themselves are more significantly related to earnings than to employment: men and households had significantly higher median annual earnings in 2000 than in 1990 (by $12.81 and

$14.83, respectively), and men and women had significantly higher median annual earnings in 2010 than in 2000 (by $28.62 and $13.39, respectively).

Time variance is next tested against industry mix, shown in Table 13.

Table 13. Estimated Relationship Between Net Imports & Industry Mix, with Time Variance

VARIABLES	(1) Share of employment in manufacturing	(2) Share of employment in low-skill services	(3) Share of employment in high-skill services	(4) Share of employment in manufacturing	(5) Share of employment in low-skill services	(6) Share of employment in high-skill services
Net imports as a share of total trade	0.0002	0.002	-0.006			
	(0.004)	(0.004)	(0.005)			
Change in net imports as a share of total trade, 2018 USD				-0.008***	0.001	0.008*
				(0.002)	(0.002)	(0.004)
Share of population 25 and up with a bachelor's degree or higher	-0.221***	-0.083*	0.584***	-0.376***	-0.148***	0.668***
	(0.047)	(0.042)	(0.117)	(0.029)	(0.023)	(0.059)
Share of population born outside the US	0.240***	-0.081	-0.404***	0.088	-0.141**	-0.274
	(0.064)	(0.065)	(0.151)	(0.065)	(0.066)	(0.176)
Total nonfarm output per capita (thousands of 2018 USD)	-1.27e-07	-3.90e-08	1.27e-07	-2.81e-07***	-9.18e-08	2.42e-07**
	(8.10e-08)	(7.13e-08)	(1.02e-07)	(8.19e-08)	(6.66e-08)	(1.08e-07)
Growth in real income	0.034***	0.0004	-0.075***	0.087***	0.020***	-0.131***
	(0.010)	(0.008)	(0.012)	(0.007)	(0.006)	(0.012)
Share of population 16 and up in the Armed Forces	-0.376***	0.0975	0.211**	-0.327***	0.117	0.184**
	(0.121)	(0.0825)	(0.088)	(0.123)	(0.078)	(0.077)
2000	0.021***	0.009**	-0.015*			
	(0.004)	(0.004)	(0.008)			
2010	-0.005*	-9.54e-05	0.010**			
	(0.002)	(0.002)	(0.005)			
Observations	1,027	1,027	1,027	1,027	1,027	1,027
R-squared	0.588	0.279	0.523	0.546	0.265	0.507
Number of CZ00	348	348	348	348	348	348

Reference year 1990; 2018 omitted due to multicollinearity

Fixed effects used; CZ-clustered robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Year fixed effects have a similar association in this model as in the previous two, and do not meaningfully change the results aside from slightly decreasing magnitude and significance. The

year variables show that the share of employment in manufacturing and low-skill services increased between 1990 and 2000 and decreased between 2000 and 2010 (though low-skill services is insignificant), while the reverse was true for high-skill services. Running the model with change in net imports results in a more significant and larger association with net imports relative to the contemporaneous model, switching its relationship with high-skill services to significant. The controls are not meaningfully different.

The results of testing sectoral relationships with gender-differentiated employment rates are shown below, with year fixed effects in Table 14 and change in net imports in Table 15.

Table 14. Estimated Relationship Between Industry Mix & Gender-Differentiated Employment, with Year FE

VARIABLES	(1) Employment rate, male	(2) Employment rate, female	(3) Employment rate, male	(4) Employment rate, female	(5) Employment rate, male	(6) Employment rate, female
Net imports as a share of total trade	0.003	0.001	0.003	0.001	0.001	0.001
	(0.005)	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)
Share of employment in manufacturing	0.409***	0.176***				
	(0.050)	(0.047)				
Share of employment in low-skill services			-0.071	-0.006		
			(0.077)	(0.074)		
Share of employment in high-skill services					-0.251**	-0.019
					(0.098)	(0.063)
Share of population[a] 25 and up with a bachelor's degree or higher	0.141***	0.108**	0.084	0.076*	0.187***	0.083*
	(0.053)	(0.043)	(0.054)	(0.043)	(0.057)	(0.048)
Share of population born outside the US	0.011	-0.108	0.091	-0.065	0.035	-0.070
	(0.096)	(0.097)	(0.099)	(0.099)	(0.094)	(0.098)
Total nonfarm output per capita (thousands of 2018 USD)	-2.09e-07*	-1.73e-09	-2.43e-07**	-1.92e-08	-2.12e-07*	-1.70e-08
	(1.07e-07)	(7.42e-08)	(1.17e-07)	(7.48e-08)	(1.10e-07)	(7.46e-08)
Growth in real income	0.144***	0.0846***	0.158***	0.091***	0.140***	0.089***
	(0.012)	(0.011)	(0.012)	(0.011)	(0.014)	(0.012)
Share of population 16 and up in the Armed Forces	0.597***	0.244**	0.441***	0.181*	0.506***	0.185*
	(0.178)	(0.105)	(0.160)	(0.099)	(0.155)	(0.101)
2000	0.013***	-0.007	0.026***	-0.004	0.017***	-0.004
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)

2010	-0.002	-0.001	-0.002	-0.002	-0.002	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	1,023	1,023	1,023	1,023	1,023	1,023
R-squared	0.696	0.295	0.662	0.275	0.696	0.276
Number of CZ00	348	348	348	348	348	348

[a] *Gender disaggregated in 1, 3, & 5 (male only) and 2, 4, & 6 (female only)*
Reference year 1990; 2018 omitted due to multicollinearity
Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results are robust when year fixed effects are included. The only incidence in which the year variables are significant is for men in 2000, indicating that men's employment is higher in 2000 relative to 1990, but are insignificant for women and in the year 2010.

Table 15. Estimated Relationship Between Industry Mix & Gender-Differentiated Employment, with Change in Net Imports

VARIABLES	(1) Employment rate, male	(2) Employment rate, female	(3) Employment rate, male	(4) Employment rate, female	(5) Employment rate, male	(6) Employment rate, female
Change in net imports as a share of total trade, 2018 USD	-0.002	0.003	-0.005	0.002	-0.004	0.002
	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)
Share of employment in manufacturing	0.482***	0.159***				
	(0.050)	(0.046)				
Share of employment in low-skill services			0.029	-0.009		
			(0.076)	(0.073)		
Share of employment in high-skill services					-0.296***	-0.017
					(0.109)	(0.060)
Share of population[a] 25 and up with a bachelor's degree or higher	0.089**	0.156***	-0.063	0.107***	0.115*	0.116***
	(0.044)	(0.029)	(0.0422)	(0.026)	(0.069)	(0.038)
Share of population born outside the US	-0.139*	-0.073	-0.213**	-0.054	-0.164*	-0.056
	(0.084)	(0.097)	(0.089)	(0.098)	(0.090)	(0.096)
Total nonfarm output per capita (thousands of 2018 USD)	-3.18e-07***	5.36e-08	-5.12e-07***	1.66e-08	-3.63e-07***	2.20e-08
	(9.24e-08)	(6.72e-08)	(9.90e-08)	(6.74e-08)	(1.09e-07)	(6.81e-08)
Growth in real income	0.168***	0.078***	0.211***	0.0914***	0.171***	0.089***
	(0.008)	(0.008)	(0.009)	(0.007)	(0.019)	(0.011)
Share of population 16 and up in the Armed Forces	0.659***	0.214**	0.513***	0.166*	0.565***	0.168*
	(0.170)	(0.100)	(0.127)	(0.097)	(0.133)	(0.098)

Observations	1,023	1,023	1,023	1,023	1,023	1,023
R-squared	0.689	0.292	0.631	0.274	0.684	0.275
Number of CZ00	348	348	348	348	348	348

[a] *Gender disaggregated in 1, 3, & 5 (male only) and 2, 4, & 6 (female only)*

Fixed effects used; CZ-clustered robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

There is no meaningful difference in any case by using the change in net imports as the variable of interest rather than net imports contemporaneously.

Finally, the same models are run using gender-differentiated earnings data. Results are shown in Table 16 and Table 17.

Table 16. Estimated Relationship Between Industry Share & Gender-Differentiated Earnings, with Year FE

VARIABLES	(1) Median earnings for men, 2018 USD	(2) Median earnings for women, 2018 USD	(3) Median earnings for men, 2018 USD	(4) Median earnings for women, 2018 USD	(5) Median earnings for men, 2018 USD	(6) Median earnings for women, 2018 USD
Net imports as a share of total trade	-891.0	687.9**	-868.2	718.9**	-936.1*	696.0**
	(565.8)	(300.7)	(569.8)	(300.4)	(553.2)	(298.9)
Share of employment in manufacturing	14,523***	10,400***				
	(5,424)	(3,390)				
Share of employment in low-skill services			-11,169	-14,087***		
			(9,053)	(5,409)		
Share of employment in high-skill services					-8,253**	1,266
					(3,307)	(1,814)
Share of population[a] 25 and up with a bachelor's degree or higher	24,651***	31,989***	22,132***	29,031***	26,129***	29,638***
	(6,300)	(3,692)	(6,349)	(3,520)	(6,509)	(3,634)
Share of population born outside the US	4,998	3,862	6,885	5,287	5,314	6,838
	(13,362)	(7,993)	(13,657)	(8,107)	(13,048)	(8,131)
Total nonfarm output per capita (thousands of 2018 USD)	-0.011	0.022***	-0.012	0.020***	-0.012	0.020***
	(0.012)	(0.007)	(0.012)	(0.007)	(0.012)	(0.007)
Growth in real income	8,219***	2,483**	8,667***	2,841***	8,100***	2,924***
	(1,507)	(992.3)	(1,483)	(956.6)	(1,514)	(972.5)
Share of population 16 and up in the Armed Forces	-66,811***	-3,520	-71,609***	-5,799	-70,371***	-7,521
	(16,426)	(7,393)	(16,377)	(6,634)	(17,095)	(6,809)
2000	842.1	-568.3	1,416**	-250.5	983.9*	-331.0
	(571.4)	(403.6)	(562.7)	(392.9)	(549.4)	(409.9)

2010	2,864***	1,392***	2,880***	1,331***	2,861***	1,331***
	(375.2)	(276.2)	(379.6)	(276.0)	(374.7)	(275.5)
Observations	1,027	1,027	1,027	1,027	1,027	1,027
R-squared	0.154	0.579	0.149	0.580	0.154	0.574
Number of CZ00	348	348	348	348	348	348

[a] *Gender disaggregated in 1, 3, & 5 (male only) and 2, 4, & 6 (female only)*
Reference year 1990; 2018 omitted due to multicollinearity
Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Adding in year fixed effects decreases the magnitude of the correlation between net imports and women's earnings, but increases that magnitude on men's earnings. While the coefficient on male earnings has not been significant in any other version of the model in which this is a dependent variable, it does flip to significant (and negative) in the model which accounts for the share of high-skill services. The share of manufacturing was previously only significant for men's earnings, but both magnitude and significance increased in this model – without year fixed effects, a one percentage point increase in the share of employment in manufacturing is associated with an annual increase in men's median earnings of $104.91, but with fixed effects, that number jumps to $145.23. Manufacturing employment share was not significant for women's earnings without year fixed effects, but adding those variables means the commensurate increase in women's annual median earnings is $104.00. In general, the year fixed effects intensified the association between earnings and nearly every one of the controls, earnings were higher in 2010 relative to 2000 across the board, and that relationship was stronger for men than for women.

Table 17. Estimated Relationship Between Industry Share & Gender-Differentiated Earnings, with Change in Net Imports

VARIABLES	(1) Median earnings for men, 2018 USD	(2) Median earnings for women, 2018 USD	(3) Median earnings for men, 2018 USD	(4) Median earnings for women, 2018 USD	(5) Median earnings for men, 2018 USD	(6) Median earnings for women, 2018 USD
Change in net imports as a share of	347.9	1,121***	287.3	1,111***	319.9	1,069***

total trade	(400.1)	(210.1)	(394.2)	(209.5)	(394.5)	(207.7)
Share of employment in manufacturing	10,951*	3,420				
	(5,713)	(3,672)				
Share of employment in low-skill services			-10,206	-17,645***		
			(8,966)	(5,485)		
Share of employment in high-skill services					-7,084**	3,314*
					(3,198)	(1,723)
Share of population[a] 25 and up with a bachelor's degree or higher	9,389*	31,774***	4,470	28,591***	10,329*	29,106***
	(5,395)	(2,530)	(5,377)	(2,239)	(5,640)	(2,405)
Share of population born outside the US	-672.8	12,226	-4,947	10,429	-1,694	13,377*
	(11,466)	(7,864)	(11,878)	(7,871)	(11,264)	(7,905)
Total nonfarm output per capita (thousands of 2018 USD)	-0.033***	0.020***	-0.0390***	0.018***	-0.034***	0.019***
	(0.011)	(0.006)	(0.011)	(0.006)	(0.011)	(0.006)
Growth in real income	1,438	-2,027***	2,640***	-1,403**	1,456	-1,317**
	(1,084)	(755.1)	(952.4)	(618.8)	(1,002)	(667.4)
Share of population 16 and up in the Armed Forces	-59,959***	-5,254	-61,910***	-4,145	-62,164***	-6,771
	(16,122)	(6,187)	(16,722)	(6,128)	(16,833)	(5,922)
Observations	1,027	1,027	1,027	1,027	1,027	1,027
R-squared	0.066	0.539	0.063	0.548	0.067	0.540
Number of CZ00	348	348	348	348	348	348

[a] *Gender disaggregated in 1, 3, & 5 (male only) and 2, 4, & 6 (female only)*

Fixed effects used; CZ-clustered robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

There is no meaningful difference in any case by using the change in net imports as the variable of interest rather than net imports contemporaneously.

IV.E. Conclusions

U.S. import trends and trade policy have shaped much of the economy of the past fifty years, particularly with respect to labor and the manufacturing industry. This analysis has examined the local labor market relationship with trade by estimating the relationship between import penetration, defined here as net imports as a share of total trade, and various labor market outcomes, including employment overall and employment in particular sectors. Furthermore, this section has analyzed whether there is a differential relationship between trade and men's and

women's employment, given that trade is assumed to correspond most with manufacturing, whose employment is strongly male-dominated. I hypothesized that net imports are likely to have: (a) a negative association with manufacturing employment overall, but a positive association with other sectors that would become a greater share of employment as manufacturing shrank; (b) a negative association with male employment and wages; and (c) no or a positive association with female employment and wages. Overall, net imports are found to have minimal associations with employment in general, as well as for men and women differentially. In some models, there is a modest significant negative relationship between net imports and manufacturing employment. In all, the only dependent variable with which net imports have a consistent significant relationship was women's median earnings. Instead, even when controlling for differences over time, the greatest associations with the employment variables are those related to labor supply and demand. In particular, educational attainment and growth in real income have the strongest relationship with general and sectoral employment rates, as well as military share for men and the gender-aggregated models.

These results are unexpected, but may reflect that the relationship between trade and labor manifests at the macro (national) level more so than the micro (local) level. States (and CZs), after all, have open borders, so a factory closure in CZ A does not preclude affected workers in CZ A from finding work in CZ B. Likewise, just because a product is no longer produced in CZ A does not mean it is no longer available there. As such, it may be the case that localizing to this degree obscures the forest for the trees, so to speak. While little work has thus far been done on the association of trade with non-manufacturing sectors, my results are mostly consistent with other literature regarding the relationship between trade and manufacturing employment – for example, Autor, Dorn, & Hanson (2013) and Caliendo, Dvorkin, & Parro

(2019) also find that manufacturing employment in local labor markets is negatively impacted by trade exposure to Chinese goods, albeit at a higher magnitude than in my results, and is highly regionalized. Caliendo et al. (2019) additionally find that the effect of trade varies significantly depending on the dominant manufacturing subsector(s) in a particular market, and Autor, Dorn, & Hanson (2019) take that a step further by specifically testing male- and female-intensive manufacturing sectors differently, finding that trade shocks to male-dominated subsectors result in an absolute decline in men's earnings and employment as well as a decline relative to women's. Since my model does not differentiate by subsector (gendered or otherwise), this could explain the small magnitude of my result.

With respect to gender, it appears that local trade exposure is less determinative of employment than are the factors affecting supply and demand for labor. This is consistent with the labor market results in general. With respect to sectoral makeup, both men's and women's employment are positively and significantly associated with the share of employment in manufacturing and goods production more generally, while earnings are most significantly (though negatively) related to the share of employment in low-skill services. Male employment is also significantly and negatively associated with high-skill services. For men, these results concord with the greater literature surrounding male employment trends over the past forty years: because men are more likely to work in goods production, they are negatively affected when those jobs disappear and are less willing to either seek more education to obtain a high-skill service jobs or accept a low-skill service job that they consider to be "beneath" them (e.g., Krause & Sawhill, 2017; Autor, Dorn, & Hanson, 2013).

For women, the story is more interesting. Women's employment increases alongside the share of employment in manufacturing and their earnings increase with trade exposure, which is

not an expected relationship since manufacturing is a male-dominated field. One possible explanation is that there may be positive spillover effects from both manufacturing and import penetration. Brussevich (2018) posits that these gendered effects are related to the relative costs associated with intersectoral job mobility for men and for women. Using a multi-stage estimation strategy that includes a gravity model, idiosyncratic dispersion, and a trade shock simulation and corresponding counterfactual, she finds that an import competition shock to the manufacturing sector has a greater and more negative impact on male employment and earnings because men face higher costs of switching industries relative to women, leaving most of the wage and welfare gains of trade exposure – that is, the structural changes to local economies that result from a trade shock – to women. This is true both in relative and absolute terms: while men see a long-term decline in wages of 0.041 percentage points, women see a long-term wage increase of 0.428 percentage points.[20] Similarly, Besedeš, Lee, & Yang (2021) find that a local labor market's higher exposure to trade liberalization is associated with smaller wage and labor force participation gaps between male and female workers.[21] This effect is primarily due to more women entering the labor force, as well as more men exiting. Notably, they also find an intrahousehold effect, in which women enter the labor force in part to offset their husbands' lost income as they lose their jobs and leave the labor force altogether. They measure this by analyzing household LFP in relation to MSAs' exposure to trade under permanent normal trade relations (PNTR) with China, which follows Pierce & Schott's (2016) definition of PNTR exposure as the difference between high non-NTR tariffs and low NTR tariffs following China's accession to the WTO in 2001. They find no difference over time in high-exposure MSAs in the

[20] "Long-term" is here defined as 15 time periods (t=15) after the trade shock that occurred at t=0.
[21] Instead of commuting zones, the authors use metropolitan statistical area (MSA) as their unit of local economy.

share of households in which both spouses worked, while the share of households in which only the husband worked fell and in which only the wife worked rose.

Based on my results and the existing literature, the gendered relationship to trade and labor can to some extent be understood as a "battle of the sexes" game, in which men "lose" by experiencing lower wages and employment and women "win." My results show that, consistent with Brussevich (2018), women's earnings increase with a greater degree of trade exposure, while men's do not. Similarly, while my study only discussed absolute changes for men and women independently, the decline I find in men's employment and wages associated with both low- and high-skill services concords with Besedeš, Lee, & Yang's (2021) findings that high trade exposure is associated with lower relative employment for men. In the next section, I analyze whether this relationship holds with respect to fertility choice. Brussevich (2018) notes that, to some extent, gender differences in intersectoral labor mobility, particularly into what she refers to as the "residual" sector, can be attributed to fertility decisions. I therefore build on this by exploring the explicit question of whether women's employment, both relative and absolute, affects fertility rates as household dynamics may change alongside increased trade exposure.

V. ANALYSIS: ECONOMIC GENDER EQUALITY AND FERTILITY

V.A. Theoretical Framework

Following the prior analysis of the relationship between trade and gendered labor markets, I next turn to fertility and its relationship with gendered labor markets, specifically through the lens of economic gender equality. Most literature on gender, labor, and fertility examines these relationships in absolute, rather than relative terms; that is, analyses are often based on women's time spent in the labor market and/or the wages they earn, largely taking men's employment and earnings as given and less variable (e.g., Folbre, 1994; Hochschild, 1997 & 2012; Schaller, 2016; Seltzer, 2019; Abboud, 2024). However, examining economic gender equality (measured by the ratio of female to male employment and earnings) allows me to analyze this dynamic in a way that is somewhat independent of broader economic conditions – e.g., a commuting zone (CZ) with low employment rates for both men and women may reflect poor economic conditions overall, but a higher degree of labor market gender equality. Based on the literature and underlying assumptions of the classical fertility model, I hypothesize that CZs with a higher degree of labor market equality will have lower fertility rates due to women substituting market work for household work.

By focusing on economic gender equality, I can clearly assess the applicability of Becker's (1960) classic fertility model, as well as newer frameworks that have arisen given the massive societal changes with respect to gender politics over the last 65 years. Furthermore, Becker's (1973) model of family formation relies on gendered assumptions of comparative advantage – i.e., that men have the comparative advantage in the workplace, while women have the comparative advantage in the home. He argues that higher income, driven by men's higher earning capabilities, results in both more children and more time invested in each child's raising.

Implicit in this assessment is the assumption that women will remain home to be wives and mothers full-time, ensuring that both men and women are maximizing their respective advantage to fully realize the economic gains from marriage. Alternatively, when women possess the capability to work (and, crucially, to earn wages comparable to their husbands), then a substitution effect may arise. That is, if the economic gains from marriage are less relevant, then women may choose to use less of their time doing unpaid labor in the home and more time doing paid work outside the home. That said, since time and money are both crucial inputs to raising children, it is necessary that, to maintain the same quantity and quality of children, men must spend more of their time on unpaid care work to offset their wives' time spent in the market.[22] But if men and women both choose to work full time in the market, we would expect a decline in fertility due to a decrease in the time allotted to childrearing. Labor market equality is therefore used here as a test of the substitution effect argument, which Becker only acknowledged as a future possibility.

An important corollary to Becker is provided by Wilson (1996), who, in his exploration of urban poverty, establishes that just as the gains from marriage fall when women earn more money, the same is true when men earn less. Specifically, Wilson explores the effects to (primarily Black) families and communities when the availability of blue-collar employment (like manufacturing) declines. Men without jobs or the prospect of one are not attractive partners, and women see little to gain by marrying and starting a family with them. In fact, his analysis suggests that male joblessness is an active deterrent for women, who see this as an indication of laziness, a lack of dependability, or other character flaws. Men, on the other hand, feel judged and that women have unrealistic expectations of their ability to provide whether they have a job

[22] Empirically speaking, this shift has not occurred, the implications of which will be discussed further below.

or not, therefore reinforcing the vicious cycle that disincentivizes marriage. Wilson also notes that changes in social norms, like the reduced stigma of having children outside of marriage, have also contributed to the declining gains from marriage: if children are born to unmarried mothers, there is less pressure to marry than in previous generations, and many of the mothers Wilson interviewed stated a preference to remain unmarried due to the unreliability of the fathers. This complicates Becker's model as well, indicating that fertility is less tied to marriage altogether, particularly among low-income communities and those who have experienced negative labor demand shocks. That said, the vast majority of births still occur within married-partner families, and fertility choice is often still a function of a household's available time and money, regardless of the increased possibilities and complexity of household and family relationships over time.

V.A.1 Income effect

The income effect hypothesis arises from traditional neoclassical theories of fertility and family formation, in which it is predicted that higher family income will result in more children. This theory was first put forth by Becker (1960) in one of the foundational texts of the emerging New Home Economics (O'Hara, 1999). Becker, having observed the sharp decline in fertility during the Great Depression as well as the baby boom after World War II, recognized that economic factors may have more to do with fertility than had previously been assumed. In "An Economic Analysis of Fertility" (1960), Becker argues that increased income should, as in the case of other normal consumer goods, result in both higher quantity and higher quality of children – that is, higher-income families are likely to have more children and invest more time and money in their upbringing compared to lower-income families. His empirical analysis largely confirms this, where he noted that "births do conform positively to the business cycle,

even when adjusted for fluctuations in the marriage rate" (Becker, 1960, p. 223). While overall fertility had decreased over the previous century, Becker argues that this is more a function of tastes and knowledge of contraception; at the micro level, individual families' fertility decisions are more closely tied to income. Becker's later work on fertility extends this analysis to also encompass additional socioeconomic conditions, such as the real interest rate, intergenerational growth in per capita consumption, and an economy's openness to trade, generally finding that the "better" the economy, the higher fertility will be (Becker & Barro, 1988).

It stands to reason that income positively correlates to employment, and therefore it is expected that higher employment would thus result in higher fertility. However, crucial to Becker's analysis is the assumption of a gendered division of labor in the household, in which men work in the market and women work in the home. Becker's (1973) framework on household formation asserts that marriage is economically advantageous because men and women have different comparative advantages. Women, according to Becker, have a relative advantage in (unpaid) caring labor, while men have a relative advantage in (paid) market work. This model relies on the expectation that men will be paid more than women; however, as Folbre (1994) points out, this assumption does not come from nowhere. Historically speaking, women have virtually always been expected to provide unpaid labor for their family, an expectation that has been enforced by laws restricting women's choices such that they are dependent on men. This division of household labor may appear "efficient," but when employers pay women less simply because they believe women's priority should be the home, the efficiency of specialization of household labor in this way is artificially inflated (Folbre, 1994). As such, it is often the unfortunate reality that women are dependent on their husbands for income. However, women have increasingly entered the labor force over the past decades and, while the gendered wage gap

persists, it has shrunk considerably: in 1982, women earned 65 cents for every dollar men made; in 2024, the gap fell to 85 cents (Fry & Aragão, 2025). Thus, it is no longer a given that men and women will stick to their proscribed household roles, and because time and money are both crucial inputs to children, it is unlikely that increased *female* employment (particularly if both spouses work full-time outside the home) would result in higher fertility regardless of the higher income that comes from two parents working.

V.A.2 Substitution effect

These new household dynamics have realized the substitution effect, which is the other side of Becker's (1960, 1973, 1981) theory that has gained additional prominence as social norms have changed and the traditional family structure has become less rigid. At the time of his writing, Becker predicted the effect rather than observed: that fertility, and the gains from marriage in general, would fall when women's wages and labor market opportunities improved. Time, Becker argues, is an increasingly important input to the production of children, as the priority has shifted from "quantity" to "quality" – in particular, investing in children's education and skills, which is a time-intensive process for parents (Becker, 1981, 1992). This is especially true for mothers, who have historically held the comparative advantage in household work due to biological factors (namely childbearing and nursing) and discrimination (Becker, 1992; Folbre, 1994). Systemic sexism meant that, for a long time, women were not granted the same labor market opportunities as men; until the Equal Pay Act of 1963, it was legal to pay women less than men for the same job, and Title VII of the Civil Rights Act of 1964 ensured that certain marginalized populations – including women – could not be discriminated against in hiring and firing practices. As a result, Becker observed, women were at a disadvantage for wage work, making it more "efficient" for men to do the market work for the household while women did the

household labor (Becker, 1992). So, as women's opportunities expanded and more women entered the paid workforce, this disadvantage declined, and women's time became more monetarily valuable, increasing the opportunity cost of having children (Becker, 1981). As a result, women substituted paid work in the labor market for unpaid household work and childrearing.

Like the income effect, the substitution effect described here is supported by recent studies and data. In the same paper cited above, in which she finds that an improvement in men's labor market conditions results in higher fertility, Schaller (2016) also finds evidence supporting the opposite: an improvement in women's labor market conditions results in lower fertility. Tavernise et al. (2021) find that women from all socioeconomic strata are more likely than in previous generations to spend their twenties growing their career and investing in their own skills and education, putting off childbearing until their thirties or foregoing it altogether. This is, they posit, for primarily economic reasons: in places where the economy is booming and job growth is strong, fertility is lowest, suggesting that women in these areas have a strong incentive to put off marriage and children and instead focus their time and energy towards career development. The reverse is also true; places where fertility is high tend to be places that are more economically depressed. So, just as increasing economic opportunities for women result in lower fertility, the reverse appears to hold true as well, strongly suggesting that the opportunity cost of women's time is a significant driver of their reproductive choices.

However, it is important to note that a growing body of work has complicated and built on these theories of substitution. For example, while Becker's arguments centralize production both in and out of the home, feminist scholarship has emphasized the non-monetary reasons women have sought work in the paid labor market. Aside from the ability to be independent and

earn wages, the cultural norms that defined household labor and care work as "unproductive" were also a driver of women's desire to join the paid workforce. Unpaid work, despite its crucial importance to individuals, society, and the economy, has long gone unrewarded, and it is likely that many women sought a sense of individual purpose as well as extrinsic compensation to do work that was considered "valuable" in the way their household work was not (Folbre, 1994; Friedan, 1963; Hochschild, 1997). Indeed, Friedan's (1963) identification of "the problem that has no name" in describing the sense of unhappiness and unfulfillment of American housewives that suggested that women sought greater intellectual, social, and economic integration into society than they could achieve through marriage and children is widely credited with kicking off the second-wave feminist movement of the 1960s and 1970s. As such, women's substitution of their time and labor and subsequent decrease in births throughout the late twentieth and twenty-first centuries cannot be solely understood as economically-motivated.

V.B. Hypothesis

Given the existing literature discussed in Section II and the theoretical backing discussed in Section V.A., I hypothesize that increased gender equality in the labor market – measured by the ratio of female to male employment rate and earnings – is associated with decreased fertility rates. This is due to the substitution effect of women's time: when women have access to labor market opportunities similar to men's, then they would no longer be forced into the traditional role of housewife because their earnings potential has increased such that their time for paid labor is more valuable. And if they substitute paid labor for household labor, they have less time to care for children. Put simply, if women have options for their lives outside of staying home and raising children, many are likely to take that option, having fewer children or foregoing motherhood altogether.

V.C. Empirics

To test my hypothesis, I run a series of fixed-effects panel regressions using the following equation.

$$Y_{itd} = \beta_{0it} + \beta_{1itd}X_{1itd} + \beta_{2itd}X_{2itd} + \beta_{3itd}X_{3itd} + a_{it}$$

This model tests the association of economic gender equality with fertility. In this model, Y_{it} is the fertility rate; in some models, it is time-differenced, denoted by the subscript *d.* X_{1itd} represents the first variable of interest: the ratio of female to male employment rates, representing relative female employment; while X_{2it} is the second: the ratio of female to male median earnings, representing relative female wages. X_{3it} is a vector containing additional economic control variables, and a_{it} is the error term.

Generally speaking, fertility models contain variables that help to account for the income and substitution effects as described above. Becker (1960) treats children as a normal consumption good for his analysis, and as such argues that the "taste" for children is determined by such factors as the parents' ages and income, both of which I am able to include in my model.[23] Because parents invest in not only the quantity, but also the quality, of children, income is not the only determinant of fertility; Becker also notes that educational attainment and family size can contribute to fertility choice, both of which are also included. Other (more recent) studies have also accounted for marital status (Aguilera & Korinek, 2020), labor demand (Giuntella, Rotunno, & Stella, 2021; Schaller, 2016), and technological improvement (Greenwood, Seshadri, & Vandenbroucke, 2005). Policy variables, such as those related to

[23] Becker also acknowledges the role of factors that are less easily measured, such as access to contraception and parents' ability to conceive at all. Today, access to assistive reproductive technologies (ART) like intrauterine insemination and in vitro fertilization would similarly be important factors. Unfortunately, accessibility in general is a difficult topic to measure quantitatively and is beyond the scope of this paper; instead, as Becker himself notes, income may be a sufficient variable to capture these effects, since knowledge and availability of contraception (and certainly ART) are often positively related to income (Becker, 1960, p. 218).

contraceptive and abortion legality or healthcare spending, tend to be used in cross-national fertility models, but are uncommon in within-nation studies; however, given the vast differences across states and even cities within the U.S. and how reproductive policy has changed over time, this could be a promising area for further research (e.g., Ouedraogo, Tosun, & Yang, 2018; Jacobson & Royer, 2011).

Based on these prior studies, I construct a base model that tests how education, median age, income growth, foreign-born population, and output correspond to fertility, alongside relative female employment and earnings. These variables are selected based on common theoretical determinants of fertility. However, because many of the independent variables available to me are highly correlated with one another (see Appendix), following the base model, three different additional versions are run, each utilizing different independent variables to differentially test their relationship with fertility in conjunction with either of the gender equality variables. I also exploit the time series nature of the data to test whether a variable's change from period $t - 1$ has an association with fertility in period t, or with the commensurate change in fertility over the same period. In the first set of regressions after the primary model, I exclusively test different combinations of the current and time-differenced gender equality ratios; in the second and third, I add in educational attainment, income, and poverty rates. Finally, I run a series of robustness checks that gender-disaggregate earnings, employment rates, and education; and that add in year fixed effects to the base models.

Table 18. Summary Statistics, Labor & Fertility

VARIABLES	(1) Mean	(2) SD	(3) Min	(4) Max	(5) N
Fertility rate per 1000 women of childbearing age (15-44)	64.21	10.47	31.55	124.8	929
Ratio of female to male employment rate	0.836	0.065	0.585	1.069	929
Employment rate	0.601	0.054	0.384	0.758	929

Employment rate, male	0.658	0.064	0.398	0.900	929
Employment rate, female	0.548	0.054	0.371	0.731	929
Employment growth	0.158	0.193	-0.139	1.889	668
Ratio of female to male earnings, 2018 USD	0.701	0.125	0.361	0.987	929
Real income per capita, 2018 USD	28,990	5,101	13,217	52,549	929
Median earnings for men, 2018 USD	48,772	9,029	19,739	79,428	929
Median earnings for women, 2018 USD	34,702	9,951	11,181	65,739	929
Growth in real per capita income	0.067	0.107	-0.235	0.490	668
Poverty rate	0.102	0.040	0.034	0.405	929
Share of population 25 and up with less than a high school education	0.158	0.070	0.039	0.520	929
Share of men 25 and up with less than a high school education	0.160	0.067	0.030	0.503	929
Share of women 25 and up with less than a high school education	0.156	0.074	0.030	0.534	929
Share of population 25 and up with a high school diploma	0.288	0.055	0.150	0.488	929
Share of men 25 and up with a high school diploma	0.284	0.057	0.152	0.504	929
Share of women 25 and up with a high school diploma	0.292	0.058	0.147	0.491	929
Share of population 25 and up with a bachelor's degree or higher	0.262	0.082	0.086	0.539	929
Share of men 25 and up with a bachelor's degree or higher	0.273	0.081	0.098	0.544	929
Share of women 25 and up with a bachelor's degree or higher	0.252	0.087	0.076	0.536	929

Note that the same data limitations are present as were in the analysis in Section IV: namely, the decadal nature of the Census, which results in a longer span of time between periods than may be strictly desirable. This is particularly salient for a fertility model, in which the window of time in which people are making fertility decisions is relatively narrow. As such, the results of this analysis are best understood as snapshots that may be reflective of a sociocultural shift over time. Furthermore, these variables are also predominately measured as shares or ratios between 0 and 1, so the same caveat regarding interpretation as in Section IV applies.

V.D. Results and Discussion

The results of the primary model are seen in Table 19.

Table 19. Estimated Relationship Between Selected Primary Variables & Fertility

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women
Ratio of female to male employment rate	0.169	
	(6.732)	
Ratio of female to male earnings, 2018 USD		0.500
		(5.617)
Median age in years	-0.568***	-0.570***
	(0.189)	(0.181)
Share of population 25 and up with a bachelor's degree or higher	-70.23***	-70.45***
	(12.95)	(14.31)
Change in log of per capita income, 2018 USD	-4.773***	-4.761***
	(1.650)	(1.577)
Share of population born outside the US	58.02**	57.78**
	(26.49)	(26.24)
Total nonfarm output per capita (thousands of 2018 USD)	7.89e-05***	7.87e-05***
	(2.86e-05)	(2.83e-05)
Observations	668	668
R-squared	0.378	0.378
Number of CZ00	240	240

Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Neither relative female employment nor relative female earnings are statistically or meaningfully significant in relation to the fertility rate, with small magnitudes and exponentially larger standard errors. The rest of the variables are generally as expected. A CZ's median age is negatively and significantly associated with the fertility rate, in which a one-year increase in the average age is associated with roughly 0.6 fewer births per 1000 women of childbearing age, showing that demographically older localities tend to have fewer births. The share of the foreign-born population is also as expected, given that immigrant families tend to be larger than native-

born families, and is significantly and positively associated with fertility. Education and income growth are both significantly and negatively associated with fertility, which could be reflective of women's higher opportunity cost given their investment in their human capital, as well as the tendency of people to partner with individuals with similar education levels.

The lack of substantive significance of these results is notable, but also likely due to high levels of collinearity between several of the variables. Thus, I utilize a stepwise approach to examine sets of variables individually to better understand the direct relationships between the variables of interest to assess sensitivity, as well as exploiting the time-series nature of the data to explore time trends. This is intended to explore whether and where significance may emerge once multicollinear regressors are isolated.

Table 20. Estimated Relationship Between Relative Employment/Earnings & Fertility

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Fertility rate per 1000 women	(4) Fertility rate per 1000 women	(5) Fertility rate per 1000 women	(6) Change in fertility per 1000 women	(7) Change in fertility per 1000 women
Ratio of female to male employment rate	-50.07***		-10.00		0.364		
	(4.491)		(6.773)		(7.517)		
Ratio of female to male earnings, 2018 USD		-24.64***	-21.32***	-26.12***			
		(1.581)	(2.741)	(3.883)			
Change in ratio of female to male employment rate				17.12***		2.926	
				(3.539)		(4.690)	
Change in ratio of female to male earnings					16.91***		-4.994**
					(2.839)		(2.362)
Observations	929	929	929	668	668	668	668
R-squared	0.225	0.309	0.312	0.155	0.153	0.001	0.011
Number of CZ00	258	258	258	240	240	240	240

Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Models 1-3 show evidence to suggest that higher relative female employment rates and earnings (i.e., gender equality in the labor market) are indeed associated with lower fertility: a ten percentage point increase in the female employment rate relative to male is associated with 5.01 fewer births per 1000 women of childbearing age, while a ten percentage point increase in women's relative earnings is associated with 2.46 fewer births. Given a mean fertility rate of 64.21 in my sample, these results are meaningful, but not massive. Relative earnings is quite stable in terms of magnitude and significance across the different iterations (a ten percentage point change in the earnings ratio is associated with a decline of 2.1 to 2.6 births per 1000 woman in each instance), while relative employment has a larger (and more significant) coefficient in the model in which it is the only regressor. Nonetheless, these results closely track with the theory: when women are employed and make money at rates similar to men, their demand for children falls because household labor is no longer their only feasible option.

However, accounting for time in the subsequent models makes it clear that these results only reflect associations in cross-sectional variation in gender equality and fertility differences. In models 4-7, I test whether the change over time in relative employment and/or wages are similarly associated with fertility, either in the current period (models 4 and 5) or the change over the same period (models 6 and 7). In models 4 and 5, the changes in relative employment and earnings are both associated significantly and *positively* with fertility in the current period, while the current-year value of each regressor is fairly consistent with the results of models 1-3. A ten percentage point increase in the relative female employment rate (earnings) between periods $t - 1$ and t is associated with 1.71 (1.69) *more* births per 1000 women in period t. However, this association disappears when the time-differenced regressors are run on the time-differenced regressand: while the change over time in relative female employment is not

significantly associated with the change in the fertility rate over time, a ten percentage point increase in the change of women's relative earnings over two periods is significantly associated with 0.5 fewer births than would be expected when comparing those same two periods. Because the coefficients in models 6 and 7 are much smaller than in the other models, there is some evidence of moderation over time. One explanation could be a cultural shift in attitudes towards work and childrearing, in which prospective parents can observe and learn from their older peers' experiences and better plan ahead for how they will manage work and family when both parents work; alternatively, this change could be informed by institutional changes like increased access to parental leave and childcare as employers and governments adapt over time. This could also help explain the positive relationships shown in models 4 and 5.

The existence of secular fertility decline becomes more evident when adding in year fixed effects, as shown in Table 21.

Table 21. Estimated Relationship Between Relative Employment and Earnings & Fertility, with Year FE

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Fertility rate per 1000 women	(4) Fertility rate per 1000 women	(5) Fertility rate per 1000 women	(6) Change in fertility per 1000 women	(7) Change in fertility per 1000 women
Ratio of female to male employment rate	-3.151		-3.754		-0.392		
	(5.592)		(6.100)		(6.406)		
Ratio of female to male earnings, 2018 USD		2.155	2.709	8.586			
		(6.247)	(6.574)	(6.018)			
Change in ratio of female to male employment rate				-14.90***		-22.17***	
				(4.172)		(6.126)	
Change in ratio of female to male earnings					-4.495		-9.707*
					(3.305)		(5.192)
Year = 2000	-3.835***	-4.447***	-4.381***				
	(0.483)	(1.295)	(1.268)				

Year = 2010	-4.454***	-5.346***	-5.110***	-1.248**	-1.554**	3.252***	1.613*
	(0.731)	(1.744)	(1.672)	(0.484)	(0.633)	(0.486)	(0.883)
Year = 2018	-9.498***	-10.42***	-10.22***	-7.181***	-6.514***	-2.030***	-2.597**
	(0.733)	(1.960)	(1.880)	(0.821)	(0.745)	(0.617)	(1.091)
Observations	929	929	929	668	668	668	668
R-squared	0.462	0.462	0.462	0.436	0.416	0.199	0.173
Number of CZ00	258	258	258	240	240	240	240

Reference year 1990

Fixed effects used; CZ-clustered robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The addition of year fixed effects indicates a significant relationship with time, with negative and significant coefficients on nearly all of the year dummy variables. The significance of the contemporaneous gender equality variables vanishes, though the time-differenced variables have switched to all being negative and mostly significant, indicating that the secular change over time is a contributor to fertility decline, and controlling for the individual time periods likely indicates that additional factors and changes in social structures that cannot necessarily be measured may be present.

Following this stripped-down model, I introduce additional variables one at a time to assess how they relate to fertility in conjunction with the variables of interest. There are two main benefits to this approach. First, it allows me to use variables that are highly correlated but that provide different information relevant to the income and substitution effects hypothesized. For example, the variables for different levels of educational attainment are highly correlated, but each variable holds different implications for socioeconomic status and what that may reflect with respect to fertility. Second, this approach acts as a robustness test for the stripped model as well as the primary model above to check if their associations are stable with the inclusion of different sets of variables.

Table 22 shows the results of the series in which I test income and poverty variables.

Table 22. Estimated Relationships Between Fertility & Income Controls

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Fertility rate per 1000 women	(4) Fertility rate per 1000 women	(5) Fertility rate per 1000 women	(6) Fertility rate per 1000 women
Ratio of female to male employment rate	-36.17***	-46.35***	-11.55			
	(4.494)	(6.563)	(7.782)			
Ratio of female to male earnings, 2018 USD				-20.43***	-36.09***	-16.54***
				(2.271)	(4.114)	(5.026)
Log real income per capita, 2018 USD	-18.57***			-9.287***		
	(2.439)			(3.257)		
Growth in real per capita income		-10.78***	-9.083***		-6.950***	-8.655***
		(1.713)	(1.610)		(1.356)	(1.266)
Poverty rate			84.39***			77.65***
			(12.55)			(13.46)
Observations	929	668	668	929	668	668
R-squared	0.293	0.111	0.289	0.321	0.149	0.308
Number of CZ00	258	240	240	258	240	240

Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

This set of regressions shows consistently that higher income is associated with *lower* fertility both in the current year and the change over time, suggesting that the income effect may not bear out in the data. The high coefficients with poverty rate (a ten percentage point increase in the poverty rate is associated with 8.44 (7.77) additional births per 1000 women when relative employment (earnings) is included in the model, nearly a full standard deviation above the mean) also indicate that lower income is associated with higher fertility, counter to the conventional wisdom on this relationship. When combined with the demonstrated relationship of the labor market gender equality variables, these models are all consistent with my hypothesis that when income is higher and grows over time, fertility falls, as these results suggest the reverse is true as well. Women's economic equality, then, appears to be a stronger predictor of fertility decline.

However, as with the previous set of models (shown in Table 20 and Table 21), secular fertility decline is still a factor that obscures the cross-sectional relationships.

Table 23. Estimated Relationship Between Fertility & Income Controls, with Year FE

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Fertility rate per 1000 women	(4) Fertility rate per 1000 women	(5) Fertility rate per 1000 women	(6) Fertility rate per 1000 women
Ratio of female to male employment rate	-2.231	0.932	2.767			
	(5.527)	(6.492)	(6.498)			
Ratio of female to male earnings, 2018 USD				3.752	8.411	2.963
				(6.052)	(6.151)	(5.373)
Log real income per capita, 2018 USD	11.72***			12.03***		
	(4.201)			(4.060)		
Growth in real per capita income		3.013	7.030**		3.176	6.733**
		(2.503)	(3.003)		(2.570)	(3.043)
Poverty rate			53.58**			51.77**
			(23.02)			(22.74)
Year = 2000	-5.469***			-6.418***		
	(0.814)			(1.265)		
Year = 2010	-5.501***	-0.306	2.193*	-6.747***	-0.664	2.065*
	(0.816)	(0.690)	(1.238)	(1.653)	(0.720)	(1.247)
Year = 2018	-11.67***	-5.583***	-3.087***	-13.02***	-6.167***	-3.278***
	(1.029)	(0.545)	(1.092)	(1.859)	(0.752)	(1.183)
Observations	929	668	668	929	668	668
R-squared	0.473	0.416	0.448	0.473	0.420	0.448
Number of CZ00	258	240	240	258	240	240

Reference year 1990

Fixed effects used; CZ-clustered robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Incorporating the year fixed effects here produces similar results as in Table 20: the year fixed effects show a decline in fertility relative to 1990, though the coefficients in this model are generally smaller and often less significant. The income variables also switch signs here,

indicating a positive relationship between income and fertility irrespective of the change over time, although the significant positive relationship between fertility and poverty persists, albeit at a smaller magnitude.

Education serves as another proxy for the substitution effect: individuals with greater educational attainment have a higher opportunity cost of not working given the time and money invested in their education and are therefore more inclined to work in the market.

Table 24. Estimated Relationship Between Education & Fertility

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Fertility rate per 1000 women	(4) Fertility rate per 1000 women	(5) Fertility rate per 1000 women	(6) Fertility rate per 1000 women
Ratio of female to male employment rate	1.807	-45.19***	-10.34**			
	(6.049)	(5.186)	(4.397)			
Ratio of female to male earnings, 2018 USD				-9.466**	-24.84***	-7.607***
				(3.971)	(2.134)	(2.755)
Share of population 25 and up with less than a high school education	61.85***			41.70***		
	(6.777)			(9.971)		
Share of population 25 and up with a high school diploma		36.17***			-2.414	
		(13.34)			(14.52)	
Share of population 25 and up with a bachelor's degree or higher			-65.18***			-56.76***
			(4.906)			(7.298)
Observations	929	929	929	929	929	929
R-squared	0.342	0.241	0.383	0.355	0.309	0.389
Number of CZ00	258	258	258	258	258	258

Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results are largely as expected: higher education levels are associated with much lower fertility rates (e.g., a ten percentage point increase in the share of the population with a bachelor's degree or higher is associated with 6.52 (5.68) fewer births per 1000 women when included alongside relative female employment (earnings)), while the reverse is true for lower

education levels (a commensurate change in the share of the population with less than a high school education is associated with nearly the same magnitude in the opposite direction). These results hold when education is disaggregated by gender, as well. However, it is notable that the extremes of the education level "eat up" much of the significance and magnitude of the earnings and employment ratios, suggesting a relatively stronger relationship between fertility and education than between fertility and economic gender equality.

Table 25. Estimated Relationship Between Gender-Disaggregated Education & Fertility

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Fertility rate per 1000 women	(4) Fertility rate per 1000 women	(5) Fertility rate per 1000 women	(6) Fertility rate per 1000 women	(7) Fertility rate per 1000 women	(8) Fertility rate per 1000 women
Ratio of female to male employment rate	4.011	-4.644	-6.079	-23.02***				
	(6.109)	(5.892)	(4.438)	(4.494)				
Ratio of female to male earnings, 2018 USD					-9.204**	-11.08***	-5.383*	-13.99***
					(4.134)	(3.570)	(2.811)	(2.389)
Share of population[a] 25 and up with less than a high school education	57.90***	61.91***			38.22***	42.34***		
	(6.238)	(7.138)			(9.412)	(9.988)		
Share of population[a] 25 and up with a bachelor's degree or higher			-54.00***	-71.09***			-48.52***	-55.34***
			(3.948)	(6.449)			(5.851)	(8.648)
Observations	929	929	929	929	929	929	929	929
R-squared	0.342	0.333	0.393	0.346	0.353	0.353	0.396	0.364
Number of CZ00	258	258	258	258	258	258	258	258

[a] *Gender disaggregated, with female only in the odd-numbered models and male only in the even-numbered ones*

Fixed effects used; CZ-clustered robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The negative association of education with fertility holds for men and for women. This can likely be attributed to the sorting effect of education, in which people tend to marry people with similar educational attainment. The magnitude of the relationship, however, is larger for men than for women – in every version of this model, male educational attainment has a higher coefficient than the same level of education for women.

Like the other sets of models, adding year fixed effects suggests the influence of secular fertility decline that education cannot account for.

Table 26. Estimated Relationship Between Education & Fertility, with Year FE

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Fertility rate per 1000 women	(4) Fertility rate per 1000 women	(5) Fertility rate per 1000 women	(6) Fertility rate per 1000 women
Ratio of female to male employment rate	-5.696	-1.238	-3.157			
	(5.574)	(5.857)	(5.564)			
Ratio of female to male earnings, 2018 USD				2.027	-1.963	2.151
				(6.376)	(5.856)	(6.221)
Share of population 25 and up with less than a high school education	-12.16			-9.208		
	(13.47)			(13.15)		
Share of population 25 and up with a high school diploma		-41.27***			-42.31***	
		(14.80)			(14.28)	
Share of population 25 and up with a bachelor's degree or higher			-0.0974			0.0981
			(12.10)			(12.00)
Year = 2000	-4.335***	-4.468***	-3.831***	-4.893***	-4.125***	-4.450***
	(0.840)	(0.535)	(0.717)	(1.180)	(1.256)	(1.399)
Year = 2010	-5.385***	-5.257***	-4.447***	-6.214***	-4.879***	-5.352***
	(1.374)	(0.812)	(1.201)	(1.630)	(1.678)	(1.982)
Year = 2018	-10.76***	-10.92***	-9.487***	-11.52***	-10.51***	-10.43***
	(1.668)	(0.948)	(1.638)	(1.885)	(1.962)	(2.442)
Observations	929	929	929	929	929	929
R-squared	0.463	0.477	0.462	0.463	0.477	0.462
Number of CZ00	258	258	258	258	258	258

Reference year 1990

Fixed effects used; CZ-clustered robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Here, adding the year fixed effects follows the same pattern and removes the significance from each of the regressors, except the population share with a high school diploma, which is more negative and more significant than in Table 24.

V.D.1. Robustness Checks

To check the robustness of these results, I first break down employment rates and earnings by gender in order to examine whether the general results hold for men's and women's absolute employment rates and earnings, not just the relative measures.

Table 27.A. Estimated Relationship Between Fertility & Gender-Disaggregated Employment Rates

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Fertility rate per 1000 women	(4) Fertility rate per 1000 women
Employment rate[a]	-54.59***	53.59***	-8.439	1.833
	(13.06)	(5.045)	(12.26)	(10.62)
Ratio of female to male employment rate			-48.72***	-49.02***
			(4.376)	(8.518)
Observations	929	929	929	929
R-squared	0.045	0.140	0.226	0.225
Number of CZ00	258	258	258	258

[a] *Gender disaggregated, with female only in the odd-numbered models and male only in the even-numbered ones*

Fixed effects used; CZ-clustered robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Models 1 and 2 are consistent with the conventional wisdom and the classic fertility model: female employment is negatively associated with fertility (representative of the substitution effect), while male employment is positively associated with fertility (representative of the income effect). The magnitude of each coefficient is nearly the same, just in opposite directions: a ten percentage point increase in the female employment rate is associated with 5.459 fewer births per 1000 women; for male employment, the same increase is associated with 5.359 *more* births. However, models 3 and 4 make it clear that gender equality in employment rates is a far stronger predictor of fertility than employment rates alone, as adding the ratio into the model

eliminates the significance and drastically reduces the magnitude of the coefficients on the individual employment rates.

Table 27.A. Estimated Relationship Between Fertility & Gender-Disaggregated Employment Rates

VARIABLES	(5) Fertility rate per 1000 women	(6) Fertility rate per 1000 women	(7) Change in fertility per 1000 women	(8) Change in fertility per 1000 women
Change in employment rate[a]	-38.86***	-39.94***	-38.01***	-18.05***
	(6.770)	(3.669)	(8.289)	(4.287)
Observations	668	668	668	668
R-squared	0.069	0.186	0.055	0.032
Number of CZ00	240	240	240	240

[a] *Gender disaggregated, with female only in the odd-numbered models and male only in the even-numbered ones*
Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

However, the change in both male and female employment rates over time are both negatively and significantly associated with fertility in the current year, shown in models 5 and 6. In contrast, the change in the ratio over time (shown in the model in Table 20) is positive and significant, indicating that there may be long-term benefits of gender equality for family formation that do not translate to employment rates in general. These relationships persist when tested against the change in fertility over time, shown in models 7 and 8.

Table 28 displays the results of a similar configuration of models with earnings as the regressors.

Table 28. Estimated Relationship Between Fertility & Gender-Disaggregated Earnings

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Change in fertility per 1000 women	(4) Change in fertility per 1000 women
Change in log of women's real median earnings	5.248***		-1.582**	
	(0.552)		(0.669)	

Change in log of men's real median earnings		9.263*** (0.986)		-2.187* (1.199)
Observations	668	668	668	668
R-squared	0.167	0.158	0.013	0.007
Number of CZ00	240	240	240	240

Fixed effects used, CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Because men's and women's earnings are so closely correlated (correlation coefficient of 0.87, though men's earnings are, on average, roughly $14,000 higher than women's), they are likely to have the same general relationship when tested against fertility in the same time period, so I only test the change over time. The changes in men's and women's earnings from period $t - 1$ to period t are both positively and significantly related to fertility, though for men, a 10% increase in earnings between these two periods is associated with 0.926 additional births per 1000 women, larger than that for women (0.525). This tracks with the results from the base model (Table 20), in which the change in the ratio of women's earnings to men's was also positive and significant. However, also like in the base model, the relationship becomes much smaller and turns negative when the fertility rate is also time-differenced accordingly.

V.E. Conclusions

Changing social and economic structures over the past few decades have upended much of the conventional wisdom around family formation and fertility decisions. As initially conceptualized by Becker (1960), fertility was largely a function of income, given the assumption of a household headed by a male breadwinner and female housewife. With one parent working full-time in the market and the other full-time in the home, couples were limited less by time constraints and more by how many mouths they could comfortably feed on one person's income. This idealized family model was really only achievable in the postwar economy, in which good jobs, union benefits, and tax incentives were plentiful – policies which

encouraged marriage and large families after two decades of economic depression and the war.[24] However, as the twentieth century went on, a rightward shift in economic policy meant that workers' wages were increasingly squeezed in favor of increasing profits for shareholders. At the same time, the civil rights movement and second-wave feminism brooked significant legislative and court victories that moved towards equality of wages and jobs, progress that continues today. Institutions have similarly adapted, as some employers have expanded benefits like parental leave, childcare, and remote work, which makes working while raising children easier. As such, both the need for two-income households and the increased ability for and acceptance of women working outside the home led to higher incomes, but less time for raising children.

This analysis has sought to determine whether recent correlative evidence supports the theory that economic gender equality is a predictor of fertility. Using a fixed-effects panel regression model to test whether increased gender equality in wages and employment rates is statistically associated with decreased fertility as the theory would indicate, I do not find evidence suggesting this to be the case, as neither relative earnings nor employment are significantly associated with fertility. However, the high correlation among certain theoretically important variables (see Appendix) motivates a further stepwise analysis to find whether significance would emerge once multicollinear variables are isolated. Across these secondary analyses, I find that a negative cross-sectional association exists between fertility and relative female employment and wages. Due in part to the strong correlation between the regressors of interest and many other economic variables, using relative, rather than absolute, female

[24] These benefits were, by and large, only practically available to white people. People of color may have been nominally eligible, but they were often unable to access them. Black women have always worked at higher rates than white women because Black men were often paid much less than white men at the same jobs and were typically the first ones laid off, leaving their employment much more precarious (Wilson, 1996). Despite literally having written the book on racial discrimination in employment, Becker did not appear to have made this connection to his "new home economics" and instead treated the white middle-class family as the universal standard.

employment and earnings enables me to control for economic conditions, since a CZ with high female and male employment and/or earnings (indicating a more economically prosperous locale) would not be treated differently from a CZ with a labor market that was similar in terms of gender equality, but in worse shape economically. These results are robust through adding income and education controls, which, along with being consistent with the gender equality hypothesis, are suggestive *against* the traditionalist income effect, as it is shown that both income and income growth are significantly and negatively related to fertility, while poverty rates are significantly and positively associated. Testing absolute, rather than relative, employment rates also suggests support for my hypothesis, as female employment is negatively associated and male employment is positively associated.

However, the story changes when elements of time are introduced, both in terms of time-differenced variables that test the change from period $t - 1$ to period t, either against a commensurate change in fertility or fertility in period t, and in the addition of year fixed effects. In general, testing a time-differenced regressor against a static regressand results in that regressor switching signs but remaining significant, while differencing both the regressor and regressand reverts to the original sign. Alongside the year fixed effects, which are almost universally negative and significant, these results are consistent with the theory that fertility is declining secularly over time relative to 1990 (the reference year), possibly for reasons that cannot easily be modeled, such as cultural and institutional adaptations in response to women's increased labor force participation. However, controlling for year illuminates that time is a significant predictor and indicates that, without the time effect confounding the relationships, then the association of labor market equality with fertility is negligible, which is further indicative of broader institutional and cultural change over time.

Taking time into account shows that economic factors cannot be cleanly separated from the broader trend of secular fertility decline, but when taken exclusively at a cross-sectional level, my analysis here largely reflects the broader literature, which generally finds that an increase in women's labor force participation is associated with lower fertility. For instance, Schaller (2016) uses a series of indices to capture exogenous changes in labor demand for men and women. She notes, as I do, that a simple analysis of male and female labor market metrics would reflect the endogenous conditions affecting labor supply, not just demand. While I account for this by leaning into the relativity aspect and testing the ratio of women's to men's employment rates, she attempts to remove relativity and instead uses a shift-share model to test fertility against gender-specific predicted employment growth. She finds that improvements in men's labor market conditions are strongly associated with increased fertility, while for women, improvements are associated (though less strongly) with decreased fertility.

This endogeneity problem is fairly common in the literature and is addressed in various ways, particularly through indices. Mills (2010) uses a series of random coefficient logistic regressions to empirically compare five different gender equality indices to determine which are the strongest predictors of fertility, noting that a significant limitation of the literature is an overemphasis on women's education and labor market participation which neglects the role of men and household decision-making in fertility choices. Through this analysis of fertility in relation to holistic gender equality, she finds conflicting results, with some indices suggesting that higher gender equality is associated with higher fertility, while others are insignificant or show the opposite. She attributes this to differences in how each index is comprised. For example, a high score on the Gender-related Development Index (GDI), which primarily measures human development and well-being, has a strong positive association with fertility, but

that is likely attributed to the underlying economic development information than gender equality itself. This may help explain my result that controlling for time shows that increased equality is positively associated with fertility if increased economic stability is assumed. In contrast, the European Union Gender Equality Index (EU-GEI) is based on Fraser's (1997) universal caregiver model, which, unlike the rest of the indices, accounts for not only the "typical" measures of equality in employment, wages, occupations, and politics, but also the gender gap in time spent on care work and on leisure. The EU-GEI is the only one that shows a negative relationship between gender equality and fertility, indicating that household dynamics, regardless of paid work, are a key factor in fertility choice. In the following analysis, I explore more explicitly the relationship between fertility and economic structure, particularly with respect to trade and its association with labor dynamics over time, to see if this provides any additional insight into the economic association with fertility decline.

VI. ANALYSIS: TRADE EXPOSURE AND FERTILITY

VI.A. Theoretical framework

After establishing the relationships between gendered labor markets and trade and between gendered labor markets and fertility, this final analytical section explores the relationship between trade and fertility. In Section IV, I find that, while trade exposure is not significantly related to men's and women's employment, it is positively and significantly associated with women's earnings. I also find that men's employment is positively associated with a higher manufacturing share of employment, and negatively associated with a lower share of high-skill service employment. In Section V, I find that economic gender equality – measured by the ratio of women's employment rate and median earnings to men's – is negatively and significantly associated with fertility, suggesting that, when women enter the paid labor market and earn wages at rates similar to men, their opportunity cost of having children is higher and women are inclined to spend more time in the workforce.

This third analysis completes this circle and examines fertility in relation to trade penetration. If women realize more of the gains from trade relative to men (e.g., Besedeš, Lee, & Yang (2021); Brussevich (2018)), and the gains from marriage are falling (as discussed in Section V.A.2), then it is expected that increased trade exposure, like a higher relative employment rate, would correspond with lower fertility. While this contradicts Becker's (1960) model, which (as discussed in Section V.A.1) specifically cites a country's openness to trade as a potential determinant of *higher* fertility, his theory relies on an outdated assumption of household comparative advantage where fertility was largely tied to (men's) income. Openness to trade was assumed to be a feature of a prosperous economy, thereby more trade would increase income and therefore fertility. On the other hand, since it is men who make up the majority of the

manufacturing workforce, it is their income that is more likely to be affected by lower employment rates in areas in which manufacturing was or is the primary industry. As discussed in Section II.B. above, about two-thirds of manufacturing jobs are and historically have been held by men.

As argued by Wilson (1996), Autor, Dorn, & Hanson (2019), and Giuntella, Rotunno, & Stella (2021), a decline in manufacturing jobs primarily impacts the economic security of low-skill men. Autor, Dorn, & Hanson (2019) in particular stress that, as a result, the marriage-market value of these men drops. Men who are economically insecure, without stable employment or the prospect of it, may not be considered desirable partners by women, who may choose to forego starting a family with a man who can offer less economic support. Similarly, Schaller (2016) finds that when men's labor market conditions improve, an increase in fertility is observed, just as an improvement in women's labor market conditions result in lower fertility. Autor, Dorn, & Hanson (2019) also find that negative trade shocks result in decreased fertility overall, but have a differential sectoral and gendered impact: shocks to female-dominated sectors result in increased fertility, and the opposite is true for male-dominated sectors. Furthermore, a greater share of these births are to unwed mothers, suggesting that in this environment, men are not considered desirable as partners and not "marriage material." Their work concords with Becker's (1973) model of household specialization, in which the higher earning spouse (usually male) specializes in market work, providing money to support the household financially while the lower earning spouse (usually female) specializes in household work. If a shock causes the higher earning (potential) spouse to no longer earn enough to support the household, then the gains from marriage fall, deterring family formation. Alternatively, if the shock is to the lower earning spouse, this reduces their incentive to work even further and encourages them to

exclusively specialize in household work, thus making marriage and family formation a more attractive option.

Overall, the relationship between trade and fertility is a complex one due to the fact that the income and substitution effects work in opposite directions. Giuntella, Rotunno, & Stella (2022) note that, as a result, the effect of trade on fertility is "ultimately an empirical question" that depends on workers' gender, sectoral sensitivity to trade-induced labor demand, social norms and context around family formation, skill and education, and other factors (p. 2139). They theorize that because differences in men's and women's relative labor market opportunities have different implications for fertility choices (i.e., improvements in men's labor market conditions will positively impact fertility, while the opposite is true for women's labor market conditions), then trade-induced labor demand shocks, which are more likely to impact male-intensive sectors, are likely to be negatively associated with fertility. However, the authors also highlight the importance of educational level, hypothesizing that trade exposure differentially impacts not only different sectors, but also different skill levels of workers. Specifically, they theorize that low-skill workers will be more impacted by trade shocks because they may be less able to find a new job given their relatively lower human capital. Thus, because of the multiple axes along which workers and families may be affected by trade shocks, there is not a straightforward theoretical argument for how trade will impact fertility, and a high level of disaggregation of data is necessary to tease out these relationships.

Further complicating matters is the degree to which social, cultural, and institutional context affect the relationship between trade and fertility. For instance, Giuntella, Rotunno, & Stella (2021) study this relationship in Germany, while Keller & Utar (2022) focus on Denmark. Despite the fact that these countries are both in Western Europe and share some cultural

similarities, they find opposing results: trade exposure is associated with lower fertility in the former, and higher fertility in the latter. Giuntella et al. (2021) attribute this largely to policy differences, noting that Denmark has a more robust social safety net with more family-friendly policies, particularly regarding parental leave and childcare subsidies. This changes the incentive structure, primarily for women, who may be less concerned about the income loss associated with leaving the labor force to have children. That earnings loss is substantial, according to Keller & Utar (2022), but the authors suggest that Danish women may take advantage of a work displacement caused by import competition to have children rather than find a new job immediately. They also corroborate Giuntella et al.'s theory, noting that social insurance and transfers help to alleviate the negative consequences of lost income from a labor demand shock and shape Danish women's choices differently from women for whom those options are less or not available, such as those in Germany and the U.S.

VI.B. Hypotheses

Based on the literature discussed in Section II, the theoretical framework established in Section VI.A., and the theory and results from Sections IV and V, I hypothesize that trade exposure has a negative relationship with fertility. This is based on two key results from previous sections. First, while most of the trade-labor relationships in Section IV were null, the one consistent significant finding on women's earnings, combined with the Section V result that women's relative wages are negatively associated with fertility, points to an indirect inverse relationship between trade and fertility. Second, while Becker posits that increased trade exposure indicates more economic prosperity and therefore would suggest higher fertility via the income effect, my results in Section V indicate that economic prosperity – e.g., higher per capita income and education and lower poverty rates – is negatively associated with fertility. Thus, the

earlier analysis indicates that higher trade is associated with greater economic opportunity for women, which, in turn, is associated with lower fertility.

VI.C. Empirics

To test my hypotheses, I perform a series of fixed-effects panel regression models.

$$Y_{itd} = \beta_{0it} + \beta_{1it}X_{1it} + \beta_{2it}X_{2it} + \beta_{3it}X_{3it} + a_{it}$$

This model is similar in structure to the one in Section V, with Y_{itd} again representing fertility, which, in some regressions, is time-differenced. X_{1it} is a vector containing the economic variables of interest (net imports as a share of total trade and relative employment rate (i.e., the ratio of female to male employment)), X_{2it} is a vector containing other economic control variables, and X_{3it} is a vector containing demographic controls, D_{it} is a vector containing the dummy variables for year, and a_{it} is the error term.

This model builds on the one I used in Section V and includes most of the same variables in a similar structure, just with the addition of the net imports variable of interest from Section IV (net imports as a share of total trade) as an additional independent variable. I also incorporate versions with additional economic controls, including productivity, output, and industry mix.

Table 29. Summary Statistics, Trade & Fertility

VARIABLES	(1) Mean	(2) SD	(3) Min	(4) Max	(5) N
Fertility rate per 1000 women	64.21	10.47	31.55	124.8	929
Net imports as a share of total trade	0.109	0.268	-0.726	0.913	929
Ratio of female to male employment rate	0.836	0.065	0.585	1.069	929
Employment rate	0.601	0.054	0.384	0.758	929
Employment rate, male	0.658	0.064	0.398	0.900	929
Employment rate, female	0.548	0.054	0.371	0.731	929
Employment growth	0.158	0.193	-0.139	1.889	668
Ratio of female to male earnings, 2018 USD	0.701	0.125	0.361	0.987	929
Real income per capita, 2018 USD	28,990	5,101	13,217	52,549	929
Median earnings for men, 2018 USD	48,772	9,029	19,739	79,428	929
Median earnings for women, 2018 USD	34,702	9,951	11,181	65,739	929
Growth in real per capita income	0.067	0.107	-0.235	0.490	668

Poverty rate	0.102	0.040	0.034	0.405	929
Share of employment in manufacturing	0.126	0.064	0.018	0.441	929
Share of employment in low-skill services	0.219	0.047	0.109	0.369	929
Share of employment in high-skill services	0.572	0.091	0.254	0.786	929
Nonfarm labor productivity (real value)	62.64	8.957	50.44	72.38	929
Total nonfarm output per capita (thousands of 2018 USD)	42,692	36,169	590.4	152,583	929
Share of population 25 and up with less than a high school education	0.158	0.070	0.039	0.520	929
Share of men 25 and up with less than a high school education	0.160	0.067	0.030	0.503	929
Share of women 25 and up with less than a high school education	0.156	0.074	0.030	0.534	929
Share of population 25 and up with a high school diploma	0.288	0.055	0.150	0.488	929
Share of men 25 and up with a high school diploma	0.284	0.057	0.152	0.504	929
Share of women 25 and up with a high school diploma	0.292	0.058	0.147	0.491	929
Share of population 25 and up with a bachelor's degree or higher	0.262	0.082	0.086	0.539	929
Share of men 25 and up with a bachelor's degree or higher	0.273	0.081	0.098	0.544	929
Share of women 25 and up with a bachelor's degree or higher	0.252	0.087	0.076	0.536	929
Number of CZ00	240	240	240	240	240

VI.D. Results and discussion

Like in Section V, a primary base model is constructed with the theoretically relevant variables; however, due to the high correlation among many variables of interest, I utilize a stepwise approach to identify associations between smaller groups of variables (see correlation tables in the Appendix). The results from my base model are shown in Table 30.

Table 30. Estimated Relationships Among Selected Primary Variables & Fertility

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women
Net imports as a share of total trade	-1.820	-1.806
	(1.181)	(1.178)

Ratio of female to male employment rate	1.082	
	(6.793)	
Ratio of female to male earnings, 2018 USD		0.128
		(5.750)
Median age in years	-0.550***	-0.546***
	(0.188)	(0.181)
Share of population 25 and up with a bachelor's degree or higher	-67.47***	-67.22***
	(12.91)	(14.13)
Change in log of per capita income, 2018 USD	-3.701**	-3.873**
	(1.838)	(1.745)
Share of population born outside the US	61.67**	61.49**
	(26.31)	(26.14)
Total nonfarm output per capita (thousands of 2018 USD)	7.59e-05***	7.63e-05***
	(2.89e-05)	(2.87e-05)
Observations	668	668
R-squared	0.382	0.382
Number of CZ00	240	240

Fixed effects used, CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

These results are consistent with the primary model used in Section V, with the same signs and similar magnitudes on each of the regressors. Net imports, however, are negative and insignificant. While this primary model demonstrates consistency with the addition of this key variable of interest, the same concerns regarding collinearity exist. Thus, the following variations present a similar method to the stepwise regressions shown in Section V, to explore whether isolating the multicollinear regressors provides additional insight into the key theoretical relationships among the variables of interest.

The first variation is a stripped-down model showing only the relationships among fertility, net imports, and relative employment and earnings. These results are shown in Table 31.

Table 31. Estimated Relationships Among Fertility, Trade, & Gender Equality

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Fertility rate per 1000 women	(4) Fertility rate per 1000 women	(5) Fertility rate per 1000 women	(6) Fertility rate per 1000 women	(7) Change in fertility per 1000 women	(8) Change in fertility per 1000 women
Net imports as a share of total trade	-10.92***	-8.043***	-5.577***	-5.489***	-5.774***	-5.712***	-2.918**	-4.286***
	(0.895)	(0.958)	(1.432)	(1.388)	(1.267)	(1.247)	(1.421)	(1.496)
Ratio of female to male employment rate		-24.04***		-8.212		-1.749		
		(4.360)		(6.192)		(7.432)		
Ratio of female to male earnings, 2018 USD			-15.40***	-12.82***	-22.32***			
			(2.826)	(4.006)	(4.102)			
Change in ratio of female to male employment rate					11.33***		-0.535	
					(3.703)		(5.224)	
Change in ratio of female to male earnings						12.79***		-7.740***
						(2.825)		(2.667)
Observations	929	929	929	929	668	668	668	668
R-squared	0.290	0.321	0.341	0.343	0.210	0.207	0.013	0.037
Number of CZ00	258	258	258	258	240	240	240	240

Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

These basic iterations of the model show a negative relationship between fertility and trade, consistent over time and regardless of which economic gender equality variables are also controlled for, suggesting specification errors in the primary model, most likely multicollinearity. Net imports is consistently negative and significant, where a ten percentage point increase in net imports as a share of total trade is associated with a maximum of 1.092 fewer births per 1000 women, which, as is the case with the gender equality variables here and in Section V, is meaningful but still modest. The rest of the variables are consistent with the results in Section V, with relative employment and relative earnings each having negative and mostly significant associations. However, while these variables switch direction depending on the time variance, net imports is always negative, whether regressed on fertility in the current year or the change in fertility over time, suggesting that the trade exposure does not moderate over time in the way the

economic equality variables do, possibly because this relationship is less direct – i.e., affected workers are more likely to observe changes in employment and earnings than in import penetration.

That said, like in Section V, adding year fixed effects to the models suggests that secular fertility decline is occurring over time, making it difficult to tease out even the relatively strong cross-sectional relationship between net imports and fertility.

Table 32. Estimated Relationships Among Fertility, Trade, & Gender Equality, with Year FE

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Fertility rate per 1000 women	(4) Fertility rate per 1000 women	(5) Fertility rate per 1000 women	(6) Fertility rate per 1000 women	(7) Change in fertility per 1000 women	(8) Change in fertility per 1000 women
Net imports as a share of total trade	1.223	1.238	1.302	1.338	1.913*	1.170	2.680**	1.975
	(1.366)	(1.357)	(1.297)	(1.279)	(1.092)	(1.091)	(1.343)	(1.353)
Ratio of female to male employment rate		-3.292		-4.057		-0.451		
		(5.523)		(6.017)		(6.316)		
Ratio of female to male earnings, 2018 USD			2.774	3.390	9.852*			
			(6.058)	(6.383)	(5.932)			
Change in ratio of female to male employment rate					-15.61***		-23.11***	
					(4.076)		(6.073)	
Change in ratio of female to male earnings						-4.298		-9.377*
						(3.221)		(5.043)
Year = 2000	-4.458***	-4.302***	-5.077***	-5.023***				
	(0.707)	(0.797)	(1.228)	(1.220)				
Year = 2010	-5.248***	-4.918***	-6.013***	-5.775***	-1.303***	-1.515**	3.266***	1.674*
	(0.659)	(0.937)	(1.610)	(1.579)	(0.476)	(0.623)	(0.485)	(0.868)
Year = 2018	-10.54***	-10.23***	-11.38***	-11.19***	-7.728***	-6.726***	-2.660***	-2.960***
	(0.941)	(1.133)	(1.831)	(1.801)	(0.861)	(0.778)	(0.735)	(1.113)
Observations	929	929	929	929	668	668	668	668
R-squared	0.463	0.463	0.463	0.463	0.440	0.418	0.206	0.177
Number of CZ00	258	258	258	258	240	240	240	240

Reference year 1990

Fixed effects used, CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Controlling for year indicates that these results are not stable over time and fertility in each year has declined relative to 1990, with the exception of 2010 when tested against the change in fertility over time. Net imports has also switched signs, but is now insignificant in all models except 5 and 7.

Testing for differences in economic structure, measured using variables for output, productivity, and income growth, shows instability across the variables of interest. Table 33 shows these results.

Table 33. Estimated Relationships Among Fertility, Trade, & Economic Structure

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Change in fertility per 1000 women	(4) Change in fertility per 1000 women	(5) Fertility rate per 1000 women	(6) Fertility rate per 1000 women	(7) Change in fertility per 1000 women	(8) Change in fertility per 1000 women
Net imports as a share of total trade	-0.867		2.524*		-0.828		2.629**	
	(1.224)		(1.317)		(1.222)		(1.292)	
Change in net imports as a share of total trade		-1.116		-0.050		-1.090		0.461
		(0.982)		(1.114)		(0.986)		(1.154)
Ratio of female to male employment rate	0.230	-0.096	16.69*	20.13**				
	(7.497)	(7.498)	(8.849)	(8.733)				
Ratio of female to male earnings, 2018 USD					2.069	1.877	14.26***	16.81***
					(6.377)	(6.415)	(5.159)	(5.498)
Nonfarm labor productivity, 2018 USD	-0.377***	-0.399***			-0.387***	-0.407***		
	(0.0395)	(0.0393)			(0.0515)	(0.0498)		
Change in nonfarm labor productivity, 2018 USD			0.746***	0.683***			0.790***	0.735***
			(0.090)	(0.080)			(0.095)	(0.091)
Total nonfarm output per capita (thousands of 2018 USD)	8.36e-05***	8.32e-05***			8.29e-05***	8.24e-05***		
	(2.99e-05)	(3.01e-05)			(2.96e-05)	(2.97e-05)		
Growth in real per capita income	-13.66***	-13.05***	16.07***	15.76***	-13.74***	-13.10***	16.07***	15.01***
	(2.043)	(2.153)	(3.571)	(3.482)	(1.860)	(1.944)	(3.438)	(3.328)
Observations	668	668	668	668	668	668	668	668
R-squared	0.349	0.351	0.217	0.210	0.350	0.351	0.223	0.215
Number of CZ00	240	240	240	240	240	240	240	240

Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In this model, the variables of interest are less stable. Net imports (and the change in net imports over time) are largely insignificant, though in models 3 and 7, net imports is positively and significantly associated with the change in fertility over time, suggesting that, when controlling for output and productivity, the aforementioned time moderation is present, albeit small (for instance, in model 3, a ten percentage point increase in net imports as a share of trade is associated with an increase of 0.25 additional births per 1000 women between two periods than would have occurred otherwise). Relative earnings and employment are only significant in relation to the change in fertility, but are consistent with the Section V results. The economic structure variables, however, are all highly significant, though the magnitude is negligible for all but income growth. Labor productivity, measured as output (in constant 2018 USD) per worker, is negative and has roughly the same value across the board, indicating that an increase of $1 in output produced per worker is associated with about 0.4 fewer births per 1000 women. However, this turns positive when examining the association between the change in productivity and the change in fertility, in which a $1 increase in output per worker over 10 years is associated with about 0.7 additional births per 1000 women over that same time period. Total output is also positive and highly significant in the current year, but the magnitude is not meaningful: a $1,000 increase in total output per capita is associated with an increase of 0.08 births per 1000 women. Finally, growth in per capita income is significant in all models, but is negatively associated with current fertility rate and positively associated with the change in fertility, also suggesting a cultural and/or institutional adjustment over time.

Table 34. Estimated Relationships Among Fertility, Trade, & Economic Conditions, with Year FE

VARIABLES	(1) Fertility rate per 1000	(2) Fertility rate per 1000	(3) Change in fertility per 1000 women	(4) Change in fertility per 1000 women	(5) Fertility rate per 1000	(6) Fertility rate per 1000	(7) Change in fertility per 1000	(8) Change in fertility per 1000

	women	women			women	women	women	women
Net imports as a share of total trade	2.679*** (0.961)		1.550 (1.345)		2.894*** (0.996)		1.833 (1.351)	
Change in net imports as a share of total trade, 2018 USD		1.565** (0.737)		0.892 (1.130)		1.737** (0.769)		1.047 (1.136)
Ratio of female to male employment rate	-3.333 (6.634)	-2.561 (6.682)	8.205 (10.36)	8.577 (10.35)				
Ratio of female to male earnings, 2018 USD					8.478 (5.887)	8.001 (5.946)	8.539 (6.692)	8.162 (6.768)
Nonfarm labor productivity, 2018 USD	-0.424*** (0.035)	-0.372*** (0.035)			-0.474*** (0.049)	-0.414*** (0.045)		
Change in nonfarm labor productivity, 2018 USD			0.234 (0.296)	0.0491 (0.281)			0.374 (0.334)	0.137 (0.304)
Total nonfarm output per capita (thousands of 2018 USD)	0.0002*** (3.06e-05)	0.0002*** (3.09e-05)			0.0002*** (3.01e-05)	0.0002*** (3.03e-05)		
Growth in real per capita income	3.693 (2.373)	3.521 (2.382)	18.47*** (3.699)	18.40*** (3.686)	4.191* (2.445)	3.901 (2.445)	17.92*** (3.585)	17.78*** (3.559)
Year = 2010	5.516*** (0.533)	5.380*** (0.539)	4.823* (2.719)	6.384** (2.828)	5.629*** (0.557)	5.491*** (0.563)	3.751 (2.929)	5.750** (2.876)
Observations	668	668	668	668	668	668	668	668
R-squared	0.474	0.470	0.225	0.224	0.477	0.473	0.226	0.225
Number of CZ00	240	240	240	240	240	240	240	240

Reference year 1990; 2000, 2018 omitted due to multicollinearity
Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

When controlling for year in the economic conditions model, only output and productivity are consistent with the earlier version of this model. Net imports (either current or time-differenced) has a positive association across the board, though is only significant half the time.

Analyzing income more specifically shows results consistent with the cross-sectional models tested above and presented in Table 31.

Table 35. Estimated Relationships Among Fertility, Trade, & Income

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Fertility rate per 1000 women	(4) Fertility rate per 1000 women	(5) Fertility rate per 1000 women	(6) Fertility rate per 1000 women

Net imports as a share of total trade	-6.243*** (1.313)	-6.275*** (1.439)	-3.346*** (1.259)	-4.998*** (1.512)	-5.860*** (1.387)	-2.990** (1.195)
Ratio of female to male employment rate	-23.46*** (4.209)	-33.93*** (6.933)	-8.387 (7.996)			
Ratio of female to male earnings, 2018 USD				-14.54*** (2.909)	-28.53*** (4.729)	-14.59*** (5.249)
Log real income per capita, 2018 USD	-8.561** (3.511)			-4.025 (3.404)		
Growth in real income		-6.567*** (2.042)	-7.003*** (1.870)		-4.141** (1.630)	-7.054*** (1.463)
Poverty rate			76.00*** (13.24)			70.05*** (14.06)
Observations	929	668	668	929	668	668
R-squared	0.331	0.175	0.305	0.343	0.205	0.321
Number of CZ00	258	240	240	258	240	240

Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

These results are consistent with both those shown in Table 31 (the stripped model) and from Section V. Net imports are negatively and significantly associated with fertility across the board, as are relative earnings and employment. A ten percentage point increase in the share of net imports is associated with a decrease of anywhere from 0.299 to 0.628 births per 1000 women, which is aligned with previous analyses but is also not a particularly substantive relationship. Per capita income is negatively associated, but only significant in model 1. Income growth is negative and significant with similar magnitudes to net imports, consistent with the Table 32 results. Finally, poverty rate is again significant and has a relatively high magnitude – a ten-percentage point increase in the poverty rate is associated with a maximum of 7.6 additional births per 1000 women.

Similar patterns are found when testing educational attainment, modeling the individual associations of three highly correlated variables: the shares of the population with less than a

high school education, a high school education only, and a bachelor's degree or higher.

Table 36. Estimated Relationships Among Fertility, Trade, & Education

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Fertility rate per 1000 women	(4) Fertility rate per 1000 women	(5) Fertility rate per 1000 women	(6) Fertility rate per 1000 women
Net imports as a share of total trade	-4.473***	-7.820***	-3.453***	-3.712***	-5.665***	-3.020**
	(1.080)	(1.155)	(1.111)	(1.195)	(1.485)	(1.340)
Ratio of female to male employment rate	1.538	-23.69***	-6.394			
	(5.953)	(4.347)	(4.090)			
Ratio of female to male earnings, 2018 USD				-6.243	-15.98***	-4.514
				(4.295)	(2.800)	(3.229)
Share of population 25 and up with less than a high school education	44.26***			33.65***		
	(8.072)			(9.223)		
Share of population 25 and up with a high school diploma		7.911			-8.602	
		(14.67)			(14.67)	
Share of population 25 and up with a bachelor's degree or higher			-53.31***			-50.39***
			(6.590)			(7.121)
Observations	929	929	929	929	929	929
R-squared	0.362	0.322	0.396	0.367	0.342	0.397
Number of CZ00	258	258	258	258	258	258

Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As expected, education level and fertility have an inverse relationship. Similar to the models tested in Section V, a ten-percentage point increase in the share of the population with a bachelor's degree is associated with a decrease of at least 5.039 births per 1000 women, while the relationship is equal and almost opposite for the share with less than a high school education, where a ten percentage point increase is associated with an increase of at least 3.365 births per 1000 women. Higher relative employment and earnings are both only significant when a high school education is included in the model. Since the share with a high school diploma is unstable

and insignificant, this may reflect that education is more strongly related to fertility at either end of the educational spectrum relative to economic gender equality.

Table 37. Estimated Relationships Among Fertility, Trade, & Gender-Disaggregated Education

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Fertility rate per 1000 women	(4) Fertility rate per 1000 women	(5) Fertility rate per 1000 women	(6) Fertility rate per 1000 women	(7) Fertility rate per 1000 women	(8) Fertility rate per 1000 women
Net imports as a share of total trade	-4.424***	-4.891***	-3.105***	-4.845***	-3.757***	-3.843***	-2.844**	-3.825***
	(1.106)	(1.041)	(1.116)	(1.061)	(1.201)	(1.209)	(1.330)	(1.368)
Ratio of female to male employment rate	2.876	-2.661	-3.175	-14.24***				
	(6.061)	(5.692)	(4.152)	(4.156)				
Ratio of female to male earnings, 2018 USD					-6.061	-7.355*	-2.648	-9.203***
					(4.419)	(4.017)	(3.250)	(3.101)
Share of population[a] 25 and up with less than a high school education	41.36***	43.04***			30.59***	34.10***		
	(7.604)	(8.148)			(8.766)	(9.119)		
Share of population[a] 25 and up with a bachelor's degree or higher			-45.23***	-52.93***			-43.54***	-47.27***
			(5.404)	(7.798)			(5.732)	(8.335)
Observations	929	929	929	929	929	929	929	929
R-squared	0.361	0.359	0.403	0.373	0.366	0.366	0.403	0.378
Number of CZ00	258	258	258	258	258	258	258	258

[a] *Gender disaggregated, with female only in the odd-numbered models and male only in the even-numbered ones*
Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Like in Section V, gender disaggregating education levels produces results that are consistent with the results that aggregate gender. Controlling for trade does not meaningfully change the results, either.

Economic structure is analyzed in more depth through a selection of variables that measure industry mix. These results are presented in Table 38.

Table 38. Estimated Relationships Among Fertility, Trade, & Industry Mix

VARIABLES	(1) Fertility rate per 1000	(2) Fertility rate per 1000	(3) Fertility rate per 1000	(4) Fertility rate per 1000 women	(5) Fertility rate per 1000	(6) Fertility rate per 1000

	women	women	women		women	women
Net imports as a share of total trade	-4.859*** (1.319)	-5.498*** (1.251)	-3.613*** (1.223)	-4.864*** (1.284)	-5.480*** (1.212)	-3.699*** (1.188)
Ratio of female to male employment rate	-20.57*** (4.789)	4.177 (6.819)	0.627 (5.208)			
Ratio of female to male earnings, 2018 USD				-19.02*** (4.100)	-10.21* (5.961)	-4.029 (5.771)
Change in share of employment in manufacturing	-51.82*** (7.322)			-41.16*** (7.377)		
Change in share of employment in low-skill services		-36.70*** (6.268)			-26.78*** (6.764)	
Change in share of employment in high-skill services			30.90*** (3.967)			28.49*** (5.279)
Observations	668	668	668	668	668	668
R-squared	0.227	0.225	0.267	0.236	0.231	0.268
Number of CZ00	240	240	240	240	240	240

Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Because of significant correlation in the current values of industry employment shares with the economic gender equality variables, I only test the change over time for each share, which reflects broader changes in economic structure. Here, a change in the shares of manufacturing and in low-skill services are associated with declines in fertility, while a change in the share of high-skill service employment is associated with increased fertility. The largest association is with manufacturing: a ten-percentage point decline in manufacturing employment between periods $t - 1$ and t is associated with at least 4.116 fewer births per 1000 women in period t. A commensurate change in high-skill service employment is associated with at least 2.849 more births per 1000 women. These results suggest that a local economy's workforce becoming more white-collar over time may result in increased fertility.

Table 39. Estimated Relationships Among Fertility, Trade, & Industry Mix, with Year FE

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Fertility rate per 1000 women	(4) Fertility rate per 1000 women	(5) Fertility rate per 1000 women	(6) Fertility rate per 1000 women
Net imports as a share of total trade	1.350	1.256	1.163	1.625	1.530	1.446
	(1.064)	(1.096)	(1.118)	(1.072)	(1.107)	(1.113)
Ratio of female to male employment rate	1.379	-0.860	1.962			
	(6.813)	(6.473)	(7.350)			
Ratio of female to male earnings, 2018 USD				9.105	9.066	9.286
				(6.131)	(6.090)	(5.984)
Change in share of employment in manufacturing	19.25**			19.03**		
	(8.247)			(7.757)		
Change in share of employment in low-skill services		-4.716			-4.919	
		(12.65)			(12.70)	
Change in share of employment in high-skill services			-13.66			-13.52*
			(8.716)			(7.902)
Year = 2010	-0.915*	-0.466	-1.945*	-1.317***	-0.970	-2.315***
	(0.502)	(1.072)	(1.005)	(0.491)	(1.058)	(0.780)
Year = 2018	-6.651***	-5.536***	-7.709***	-7.327***	-6.303***	-8.362***
	(0.734)	(1.224)	(1.399)	(0.882)	(1.313)	(1.257)
Observations	668	668	668	668	668	668
R-squared	0.422	0.416	0.421	0.426	0.421	0.425
Number of CZ00	240	240	240	240	240	240

Reference year 1990; 2000 omitted due to multicollinearity

Fixed effects used; CZ-clustered robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Controlling for year switches the direction of the association between manufacturing and high-skill services employment shares. This further suggests societal adjustment over time – all else equal, a ten percentage point increase in the share of manufacturing over time is associated with 1.9 additional births per 1000 women in the present year, as fertility appears to be secularly declining relative to 1990.

At first glance, the cross-sectional relationships between fertility and industry mix seem

counterintuitive given the previous results which found that, for instance, income growth is associated with lower fertility in the current year; however, this relies on an assumption that jobs in the high-skill service sector are better paying than those in manufacturing or low-skill services, which is not necessarily true – as shown in Figure 8, average weekly earnings in the goods production and high-skill service sectors are nearly the same. High-skill service industries are defined as those in which workers, by and large, require a college degree, but this encompasses fields such as education, which is traditionally low-paying. Furthermore, additional analysis indicates that a positive change in the employment share of manufacturing is associated with increased income and increased wage equality, while the opposite is true for the share of high-skill service employment:

Table 40. Estimated Relationships Between Earnings & Industry

VARIABLES	(1) Log real income per capita	(2) Ratio of female to male earnings	(3) Log real income per capita	(4) Ratio of female to male earnings	(5) Log real income per capita	(6) Ratio of female to male earnings
Change in share of employment in manufacturing	1.082***	0.721***				
	(0.097)	(0.091)				
Change in share of employment in low-skill services			0.002	0.749***		
			(0.065)	(0.039)		
Change in share of employment in high-skill services					-0.258***	-0.522***
					(0.039)	(0.029)
Observations	668	668	668	668	668	668
R-squared	0.180	0.136	0.000	0.447	0.063	0.438
Number of CZ00	240	240	240	240	240	240

Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Here, a ten-percentage point increase in the share of manufacturing between period $t - 1$ and period t is associated with an approximately 10.82% increase in real per capita income and an increase in the earnings ratio of about 0.072, or roughly 7.2 percentage points (e.g., from 0.70 to

0.77). For high-skill services, these changes are -2.58% and -0.052, or about -5.2 percentage points, respectively. Similar trends emerge when relative employment is used as the dependent variable:

Table 41. Estimated Relationship Between Relative Employment & Industry Mix

VARIABLES	(1) Ratio of female to male employment rate	(2) Ratio of female to male employment rate	(3) Ratio of female to male employment rate
Change in share of employment in manufacturing	0.155**		
	(0.068)		
Change in share of employment in low-skill services		0.539***	
		(0.031)	
Change in share of employment in high-skill services			-0.293***
			(0.025)
Observations	668	668	668
Number of CZ00	240	240	240

Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results shown in Table 41 are therefore consistent with other cross-sectional results, which show that income and fertility are inversely related. As such, the relationship between industry mix and fertility may instead reflect the broader changes in economic structure, which may include factors like increased precarity and polarization in the labor market that cannot be as easily measured.

VI.D.1. Robustness Checks

To check the robustness of these results, employment rates and earnings are disaggregated by gender in order to examine whether the general results hold for men's and women's absolute employment rates and earnings, not just the relative measures.

Table 42. Estimated Relationships Among Fertility, Trade, & Gender-Disaggregated Employment Rates

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Fertility rate per 1000 women	(4) Fertility rate per 1000 women	(5) Fertility rate per 1000 women	(6) Fertility rate per 1000 women	(7) Change in fertility per 1000 women	(8) Change in fertility per 1000 women
Net imports as a share of total trade	-10.61***	-9.439***	-8.041***	-8.060***	-7.056***	-4.546***	-1.536	-1.064
	(0.862)	(1.053)	(0.941)	(0.950)	(1.398)	(1.376)	(1.349)	(1.410)
Employment rate[a]	-12.79	22.47***	-0.152	4.282				
	(11.40)	(5.996)	(11.46)	(9.963)				
Ratio of female to male employment rate			-24.02***	-21.53***				
			(4.394)	(7.572)				
Change in employment rate[a]					-27.85***	-31.65***	-35.61***	-16.10***
					(7.320)	(4.349)	(8.826)	(5.006)
Observations	929	929	929	929	668	668	668	668
R-squared	0.292	0.309	0.321	0.322	0.158	0.217	0.059	0.033
Number of CZ00	258	258	258	258	240	240	240	240

[a] *Gender disaggregated, with female only the odd-numbered models and male only in the even-numbered ones*
Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

For all except model 1, these results are consistent with the ones reported in Section V, indicating that controlling for trade exposure, which is negative and significant for all but models 7 and 8, does not change the relationships between gender-disaggregated employment and fertility. The one exception is the female employment rate, which was significant without the trade variable, but insignificant with.

Using gender-disaggregated earnings as regressors produces the following results.

Table 43. Estimated Relationships Among Fertility, Trade, & Gender-Disaggregated Earnings

VARIABLES	(1) Fertility rate per 1000 women	(2) Fertility rate per 1000 women	(3) Fertility rate per 1000 women	(4) Fertility rate per 1000 women	(5) Change in fertility per 1000 women	(6) Change in fertility per 1000 women
Net imports as a share of total trade	-6.553***	-8.753***	-5.818***	-6.278***	-4.080***	-3.593**
	(1.338)	(1.148)	(1.217)	(1.223)	(1.478)	(1.432)

Log of real earnings for women, 2018 USD	-4.576*** (0.901)					
Log of real earnings for men, 2018 USD		-5.455*** (1.569)				
Change in log of women's real median earnings			4.280*** (0.545)		-2.261*** (0.747)	
Change in log of men's real median earnings				7.742*** (0.981)		-3.057** (1.312)
Observations	929	929	668	668	668	668
R-squared	0.321	0.301	0.226	0.228	0.037	0.027
Number of CZ00	258	258	240	240	240	240

Fixed effects used; CZ-clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

These results are consistent with all previous results. Net imports are negative and significant across the board, income is negative and significant for both men and women, and the moderation that occurs when regressing the change in income against the change in fertility is present as well.

VI.E. Conclusions

Decreasing fertility and a growing trade deficit have been two key characteristics of the U.S.'s social and economic climate of the past half century. This analysis has sought to explore what, if any, relationship these phenomena have had with one another. Generally speaking, net imports as a share of total trade have a negative and significant relationship with fertility in a particular year. Along with the results in Sections IV and V, this provides correlational evidence to suggest an economic explanation for fertility, of which trade exposure plays a small but significant part. Introducing trade into the fertility model analyzed in Section V showed that trade had a more stable association with fertility than the gender equality measures (relative female employment and earnings), which may indicate that broader economic conditions and

structure may be the greater driving force behind fertility decisions. This is consistent with Mills (2010), whose analysis of fertility and gender equality found that the index with the strongest predictive power for fertility, the GDI, likely does so because it measures economic structure and conditions more so than explicit gender equality, of which some of the other indices she studies do a better job.

Trade exposure is one of many economic factors that can help explain fertility decline, though in a less direct way than others. Autor, Dorn, & Hanson (2019) argue that this mechanism is through trade's impact on manufacturing employment, which reduces job opportunities for men and therefore makes men less attractive as partners. They find that trade shocks are associated with a decline in men's employment and, subsequently, fertility; they are also associated with increased mortality for men and an increase in the share of mothers who are unmarried. Similarly, Giuntella, Rotunno, & Stella (2021) find that individuals working in sectors with greater import competition and who faced worse labor market outcomes were less likely to have children. This is particularly true for less-educated men. While these two papers differ from mine in that they perform two-stage least squares analyses and I directly test the correlational relationship between trade and fertility, the wider trend of a negative relationship is nonetheless consistent.

Theoretically speaking, my null results can be explained by Becker (1973) in much the same way Autor, Dorn, and Hanson (2019) can. Becker's framework posits that fertility is a function of the gains from marriage. In his model, the higher-earning spouse (assumed to be the husband) pursues his comparative advantage in paid market work, while the lower-earning spouse (assumed to be the wife) pursues her comparative advantage in home production. This framework is predicated on the assumption that a man can be the sole breadwinner and earns a

"family wage" to support his wife and children, and because the wife doesn't need to work, she can stay home to take care of the family, having plenty of children since she has the time to care for them. In this way, fertility is expected to be high because the childbearing spouse has a low opportunity cost of staying home to care for children. However, over time, these gains to marriage have fallen as wages declined, a single income could no longer support a family, women could enter the workforce, and the previously stable blue-collar jobs that built the middle class disappeared. As such, women's time has become more valuable, and the opportunity cost of staying home with children is much higher. Fertility decline, then, appears to be reflective of (a) decreasing job opportunities and wages for men, particularly in the manufacturing sector; and (b) increasing job opportunities and wages for women. On the other hand, when women's job opportunities and wages decrease, the opportunity cost of having and raising children decreases and fertility rises. So, as demonstrated theoretically by Becker's (1973) model and empirically by Autor, Dorn, and Hanson (2019), shocks to men's and women's respective economic opportunities have opposite impacts on fertility. It therefore follows that an aggregate, non-gender-specific trade shock would have a "canceling out" effect, as demonstrated in my null results.

However, the Becker story is not the only possible explanation, particularly when considering feminist theories of gendered labor markets and household formation. Key to Becker's analysis is that production in the market and in the home are paramount and that to maximize production, one parent (father) should specialize in market work and the other parent (mother) should specialize in household work. If both parents are working in the market, then not only is production inefficient, but household production is minimal to nonexistent. As Folbre (1994) points out, household production – or, put differently, the work of social reproduction – is

nonetheless essential, but its undervaluation and drudgery make it undesirable to perform. When (affluent white) households followed the Becker model en masse in the 1950s, mothers were largely miserable, a phenomenon that inspired Betty Friedan's classic *The Feminine Mystique* (1963), which argued that these women deserved the opportunity to pursue independence and personal growth in the form of wage labor. The book was a sensation and contributed to the second-wave feminist movement of the mid-twentieth century, but largely ignored that even as these women were suffering in the home, poor women and women of color were already working for wages – and many of them ultimately went to work for these affluent women when they went to work in the market, taking care of wealthy homes and children, while their own had no one to care for them. Never was the father considered as a candidate to take on his share of the household labor instead. Even as the decades wore on, as women began to work more and men worked less, women have continued to work a greater share of household labor regardless of how much they work relative to their husbands (Bertrand, Kamenica, & Pan, 2015). Fundamentally, this is a case of the household bargain breaking down in response to patriarchal resistance to taking on "women's work." Trade shocks and manufacturing decline disproportionately affect men, who may react to their loss of bargaining power in the workplace by resisting that loss in the home and refusing to take on more of the household labor, leaving their wives to what Hochschild (1989) termed "the second shift": the housework and child care that must be done even after she got home from her paid job. Women, therefore, simply had no time for more children, and with the new availability of contraception, they could easily make that desire a reality. This theory, too, reflects the story of my results, indicating that there are multiple competing explanations for fertility decline as a function of economic conditions.

My results largely concord with the broader literature, but should be interpreted as a series of snapshots in time due to the evidence of secular fertility decline, demonstrated by the changes in sign and significance of many key variables when the year fixed effects (with significant and negative coefficients in all cases) are introduced. As such, there appears to be a cross-sectional relationship between trade and fertility decline, but there is not evidence suggesting that this relationship is stable over time and it cannot be separated from secular fertility decline. This limitation is reflected elsewhere in the literature (e.g., Piriu, 2022) and indicates that broader factors, likely some that are not easily measured, are significant contributors to decreased fertility. For instance, given the differing results other authors have found across different countries, it is likely that social and cultural context are underlying factors related to fertility. In Germany, researchers point to Germany's "lowest low" fertility status as a base effect, as well as the unique context of German reunification and the subsequent cultural and economic upheaval through the 1990s and 2000s (Giuntella, Rotunno, & Stella, 2021; Piriu, 2022), while a strong social safety net and pro-family policies shape the fertility choices of Danish women differently from those of women in countries without those benefits (Keller & Utar, 2022). In the U.S., Kearney, Levine, & Pardue (2022) decompose trends in fertility rates among different demographic subgroups (sorted by race, ethnicity, age, and education) and find that within-group variation is the key driver of aggregate fertility decline, showing that 75.1% of the decline in the birth rate between 2007 and 2019 is attributed to eight demographic groups making up 34% of the population. All except two of these groups were young women (ages 15-24), suggesting that fertility decline is likely a function of shifting priorities for women, who increasingly delay or defer childbirth in a broader reflection of changing social norms. Of particular note is that births to teenagers have fallen significantly, from a high of 61.8 births per

1000 girls aged 15-19 in 1991 to 41.5 in 2007 to 15.3 in 2020. Given that teen births are generally unplanned, they are not likely to be affected by economic conditions, but instead increased access to sex education, contraception, and abortion care. Overall fertility decline cannot be ascribed completely to plummeting rates of teen pregnancy (responsible for 36.7% of the decline), but it represents a significant underlying trend that may help explain the secular fertility decline observed in my and other analyses.

VII. CONCLUSIONS & POLICY IMPLICATIONS

The U.S. birth rate's "below replacement" status has resulted in much public concern from journalists, politicians, and other institutions over the last several years, prompting social scientists to research possible causes. While previous work has examined the impact of socioeconomic conditions, particularly wages and labor market opportunities, the role of international trade, despite its close ties to these conditions, has largely been left out of the conversation. In this study, I have attempted to remedy this gap in the literature by pursuing an explanation for whether and how fertility models could account for how trade may be associated. I hypothesized that, due to the social and economic changes that have occurred over the past sixty-five years since Becker (1960) first laid out the classic fertility model (updated by later theorists like Wilson (1996)), fertility choice is most likely to be driven by economic change in gendered labor markets, and I performed a series of OLS panel regressions to test this. I took a three-prong approach, where I first explored the relationship between trade and gendered labor markets, then gendered labor markets and fertility, and finally trade and fertility. I found that there is no clear relationship between trade and labor (and certainly not between trade and economic gender equality). I also found that, at the cross-sectional level, fertility is negatively associated with gender equality in the labor market, and that trade is negatively associated with fertility, but controlling for time caused these relationships to either lose significance or reverse altogether. As such, these results do not establish a causal relationship between trade exposure and fertility decline. Instead, they suggest that trade exposure and gendered labor market conditions are associated with fertility differences across local labor markets, while broader secular changes in culture, society, and institutions likely explain the change over time. Thus, it is likely that additional complicating factors exist that more directly affect the relationship

between fertility, employment, and trade exposure; in particular, gender politics both inside and outside the home, as well as shifting cultural norms surrounding family formation.

As discussed in Section V.A., the Beckerian fertility model is one that is inherently based on gender, in which the income effect is more likely to affect fertility choices through men's economic conditions and the substitution effect is more likely to affect fertility through women's. This analysis was intended to identify whether a clear conclusion of whether men's or women's economic circumstances – is more salient in family formation decisions. I found correlative evidence suggesting that women's economic circumstances were more determinative than men's, though these results were not consistent across time. This instability could be due to a number of complicating factors as well as the inadequacy of Becker's model in analyzing modern household decision-making. When Becker created this model in 1960, women did not have the right to equal pay for equal work (established by the Equal Pay Act of 1963), work outside the home once married or have a workplace free from discrimination (Title VII of the Civil Rights Act of 1964), birth control (Griswold v. Connecticut (1965) for married couples and Eisenstadt v. Baird (1972) for single women), abortion (Roe v. Wade (1973)[25]), equal access to higher education (Title IX of the Education Amendments of 1972), or obtain a credit card or home loan in their name (Equal Credit Opportunity Act of 1974). Social norms, as well, have changed drastically, such that it is no longer socially taboo for women to get divorced, be single mothers, or remain unmarried. As a result, it no longer makes sense for fertility to be treated as a joint household decision based on comparative advantage, a factor that may explain the inconsistent results described throughout this paper.

[25] Later overturned by Dobbs v. Whole Women's Health (2022).

The overall relationship between economics, gender politics, and fertility is a rich area for research and policy going forward. Women's advancement in the labor market has been a remarkable societal accomplishment in the last few decades, but as women have graduated college and entered the workforce in ever-increasing numbers, the opposite has happened to men. As such, the typical gains from marriage have all but disappeared – in fact, studies have consistently showed that women spend more time on unpaid care work than men do, even when they spend more time in the paid labor market or make more money (e.g., Gender Economic Policy Institute, 2024; Bertrand, Kamenica, & Pan, 2015). A growing share of women are even consciously choosing single motherhood in their 30s or later, due to their increased financial capability to have children on their own, advances in reproductive medicine such as egg freezing and IVF, and the lack of available male partners willing or able to do their fair share in running a household (Gogol & Lee, 2025; Goldin, 2025). This trend turns Becker's model even further on its head. These women are not substituting work for marriage and family, but are instead utilizing their own employment and income-earning capacity to start a family by themselves.

That said, even women who consciously choose single motherhood typically acknowledge the difficulty of doing so and express desire for partners to take on a share of the responsibilities; they just have little tolerance for men who won't be an equal partner. Like in Wilson's (1996) interviews from 30 years before, internet forums like Reddit are full of women explaining their choice to be single as a function of not wanting to be with men they perceive as immature and not feeling the social pressure to get married anyway and "fix" them. Dating, they say, is simply not worth the emotional effort they put in without getting anything in return – in contrast to their mothers and grandmothers, who they watched stay in miserable marriages with

men who barely lifted a finger to help with housework.[26] This anecdotal evidence is also reflected in Claudia Goldin's (2025) research, which shows empirically that while fertility decline can be primarily attributed to women's increased agency, a major additional factor is men's willingness to signal (and follow through on) being committed fathers who take on an equal share of household labor: "The more that men can credibly signal they will be dependable 'dads' and not disappointing 'duds,' the higher will be the birthrate in the face of greater female agency" (p. 2). Much ink has been spilled by proponents of traditional families bemoaning this trend, suggesting everything from financial incentives for marriage and children to constraining women's ability to work at all. However, the global evidence suggests that attempting to coerce women into having more babies is a losing battle, while providing strong social supports, like the Nordic social democracies do, does, in fact, incentivizes higher fertility. Paid family leave, universal healthcare, and low-cost childcare would therefore likely be far more successful in encouraging marriage and family formation in the U.S. than banning abortion; though, as Goldin (2025) notes, these policies are necessary but not sufficient conditions for increased fertility, and a broader cultural shift around household labor and gendered expectations is needed as well.

When Millennials and Gen Z-ers are asked if they want children, economic and social structures in the U.S. are continually cited as reasons for why, whether they want children or not, it just does not seem like a feasible option. The cost of living is sky-high and the country has been in an affordability crisis since at least the pandemic. Jobs are increasingly precarious, with a growing share of the population engaged in freelance or gig work, which crucially do not offer health insurance or other benefits. The federal minimum wage has been $7.25 per hour since 2009, while the consumer price index has risen 146.2% since then. The Beckerian ideal of a

[26] For example, the subreddit r/AskWomenOver30 is full of posts about this topic, with hundreds of comments explaining this as their reasoning.

single-income family seems like a fantasy, almost entirely due to economic conditions that make one's own survival difficult, let alone being responsible for anyone else. As such, policymakers who want to increase fertility should focus first on improving material conditions for young adults. For example, Couillard (2025) has found that rising housing costs (and insufficient housing supply) has had a negative effect on fertility: increased housing costs have resulted in 11% fewer children since 1990 and are attributed to 51% of the fertility decline between the 2000s and 2010s. Dow (2025) similarly finds that a 10% increase in the cost of childcare is associated with a 5.7% decrease in the fertility rate. Increasing the accessibility of housing and childcare could therefore have a measurable effect on increasing fertility. However, this does not solve every problem. Economic stability in the form of good jobs with high wages and benefits is also crucial, particularly for the men who have been falling behind. In the paid labor market, there needs to be additional jobs training for displaced workers, particularly those with less education. The need for health and childcare workers to meet the demand for market-provided care provides a natural opportunity to develop incentives for men to take up caring professions, which could also help destigmatize care work for men in general such that they may be more willing to take up the mantle of caring work in their households as well. American deindustrialization, combined with increased economic gender equality, has resulted in a society in which gender norms have been increasingly inverted, with women taking more of the service jobs that have replaced the manufacturing jobs typically held by men. True equality, however, cannot be achieved without men becoming equal partners in the home. Providing additional training, support, and incentives to improve Americans' material conditions may allow this process to happen, making family formation an attractive option once again.

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APPENDIX: CORRELATION TABLES

All correlation matrices have been constructed by pooling the data across all years. As such, shared time trends may inflate some correlations, motivating my stepwise analytical approach.

A. Full correlation matrix

	Fertility rate	Ratio of female to male emp. rate	Ratio of female to male earnings	Emp. rate	Emp. rate, female	Emp. rate, male	Emp. growth	Median earnings, women	Median earnings, men	Real income per capita	Log real income per capita	Growth in real per capita income	Poverty rate	Share of pop. with a bach. degree	Share of pop. with high school diploma	Share of pop. with less than high school	Share of women with a bach. degree	Share of women with high school diploma	Share of women with less than high school	Share of men with a bach. degree	Share of men with high school diploma	Share of men with less than high school
Fertility rate	1																					
Ratio of female to male emp. rate	-0.54	1																				
Ratio of female to male earnings	-0.26	0.57	1																			
Emp. rate	0	-0.04	-0.11	1																		
Emp. rate, female	-0.24	0.38	0.13	0.91	1																	
Emp. rate, male	0.2	-0.4	-0.33	0.93	0.69	1																
Emp. growth	0.13	-0.23	0.08	0.15	0.06	0.22	1															
Median earnings, women	-0.33	0.57	0.82	0.08	0.31	-0.15	-0.03	1														
Median earnings, men	-0.27	0.4	0.44	0.21	0.37	0.04	-0.07	0.87	1													
Real income per capita	-0.32	0.25	0.31	0.45	0.53	0.32	0.06	0.67	0.77	1												
Log real income per capita	-0.36	0.28	0.31	0.46	0.55	0.32	0.05	0.66	0.76	0.99	1											
Growth in real per capita income	-0.03	-0.31	-0.22	0.33	0.21	0.41	0.19	-0.03	0.1	0.3	0.3	1										
Poverty rate	0.25	-0.37	-0.36	-0.32	-0.45	-0.15	-0.04	-0.53	-0.53	-0.58	-0.61	0.09	1									
Share of pop. with a bach. degree	-0.49	0.43	0.5	0.4	0.55	0.19	0.12	0.65	0.56	0.69	0.69	0.03	-0.4	1								
Share of pop. with high school diploma	-0.02	-0.03	-0.32	-0.28	-0.27	-0.24	-0.27	-0.37	-0.27	-0.39	-0.36	-0.07	-0.02	-0.66	1							
Share of pop. with less than high school	0.51	-0.65	-0.56	-0.24	-0.48	0.03	0.05	-0.64	-0.54	-0.51	-0.55	0.09	0.67	-0.69	0.17	1						
Share of women with a bach. degree	-0.51	0.51	0.59	0.33	0.52	0.11	0.1	0.71	0.58	0.67	0.66	0.01	-0.43	0.98	-0.62	-0.73	1					
Share of women with high school diploma	0.03	-0.16	-0.47	-0.21	-0.26	-0.12	-0.25	-0.48	-0.32	-0.38	-0.34	-0.04	0.06	-0.68	0.96	0.27	-0.68	1				
Share of women with less than high school	0.52	-0.69	-0.59	-0.21	-0.47	0.07	0.05	-0.67	-0.55	-0.5	-0.54	0.12	0.67	-0.68	0.16	0.99	-0.73	0.26	1			
Share of men with a bach. degree	-0.44	0.32	0.36	0.45	0.56	0.29	0.13	0.55	0.51	0.69	0.69	0.06	-0.33	0.97	-0.67	-0.61	0.91	-0.64	-0.59	1		
Share of men with high school diploma	-0.08	0.12	-0.13	-0.33	-0.26	-0.34	-0.28	-0.21	-0.19	-0.37	-0.34	-0.1	-0.1	-0.57	0.95	0.04	-0.49	0.84	0.03	-0.64	1	
Share of men with less than high school	0.49	-0.6	-0.52	-0.28	-0.49	-0.03	0.05	-0.61	-0.51	-0.5	-0.54	0.06	0.65	-0.69	0.17	0.99	-0.72	0.27	0.96	-0.63	0.05	1

For Sections V and VI, high degrees of correlation are noted especially on the gender-disaggregated variables (e.g., male and female employment rates); income, earnings, and log income; educational attainment; as well as interactions like income and education. In some cases, there are high correlations between specific variables of interest that cannot be avoided (such as the -0.54 coefficient between fertility rate and the relative female employment rate), so the breadth of models testing those specific variables alongside multiple others is intended to serve as a robustness check accounting for the acknowledged inherent presence of multicollinearity.

B. Primary model specification for Section V analysis

	Fertility rate per 1000 women	Ratio of female to male employment rate	Median age in years	Share of population 25 and up with a bachelor's degree or higher	Change in log of per capita income, 2018 USD	Share of population born outside the US	Total nonfarm output per capita (thousands of 2018 USD)
Fertility rate per 1000 women	1						
Ratio of female to male employment rate	-0.54	1					
Median age in years	-0.36	0.38	1				
Share of population 25 and up with a bachelor's degree or higher	-0.49	0.43	0.08	1			
Change in log of per capita income, 2018 USD	-0.04	-0.3	-0.07	0.04	1		
Share of population born outside the US	0.17	-0.06	0.01	0.29	-0.08	1	
Total nonfarm output per capita (thousands of 2018 USD)	-0.1	0.22	-0.01	-0.19	0.04	-0.38	1

C. Primary model specification for Section VI analysis

	Fertility rate per 1000 women	Net imports as a share of total trade	Ratio of female to male employment rate	Median age in years	Share of population 25 and up with a bachelor's degree or higher	Change in log of per capita income, 2018 USD	Share of population born outside the US	Total nonfarm output per capita (thousands of 2018 USD)
Fertility rate per 1000 women	1							
Net imports as a share of total trade	-0.27	1						
Ratio of female to male employment rate	-0.54	0.46	1					
Median age in years	-0.36	0.37	0.38	1				
Share of population 25 and up with a bachelor's degree or higher	-0.49	0.42	0.43	0.08	1			
Change in log of per capita income, 2018 USD	-0.04	0.16	-0.3	-0.07	0.04	1		
Share of population born outside the US	0.17	0.23	-0.06	0.01	0.29	-0.08	1	
Total nonfarm output per capita (thousands of 2018 USD)	-0.1	0.05	0.22	-0.01	-0.19	0.04	-0.38	1