

“It Takes Two to Tango”: Joint Location Choices and Local Shocks*

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Abstract

I examine how couples’ decision-making shapes the aggregate and distributional impacts of local trade shocks. Using the PSID, I document two novel facts about the China Trade Shock: (i) a couple moves only when the husband is exposed to the shock; and (ii) the wife’s labor force participation rises when her husband is exposed and falls when she is exposed herself. I then build a quantitative spatial model in which couples choose jointly where to live and whether the wife works. In the model, the shock raises real wages and draws more people into work. I compare this baseline economy with an economy populated only by single individuals, calibrated to the same short-run aggregate moments. In my model, the wife’s labor supply responds to the rise in relative wages between men and women, so aggregate employment gains are 15.4% smaller in the long run. At the same time, 14.9% more people move to a different state because husbands are the main earners and unexposed wives move with their spouse. As the China Trade Shock hits male-intensive manufacturing, joint decision-making redistributes gains from the wife to the husband and, through wages, from married to single women.

Keywords: *Spatial equilibrium, Local labor markets, Household labor supply*

JEL Codes: *F16, R13, J12*

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I. Introduction

Couples represent more than half of US households ([Anderson et al., 2024](#)), and their responses to a local trade shock may differ from those of single individuals for two reasons. First, a couple moves to a new labor market only if the move improves the spouses’ joint welfare, whereas a single individual moves only if it improves his or her own. Second, when one spouse loses a job or experiences a decline in earnings, the other spouse, usually the wife, may increase her labor supply to offset the household’s lost income, a response known as the *added-worker effect* ([Lundberg, 1985](#); [Attanasio et al., 2005](#)). Although couples are prevalent in the data, researchers have not yet studied them in general-equilibrium spatial models.

In this paper, I examine how couples shape the aggregate and distributional impacts of local trade shocks. I combine new reduced-form evidence on couples’ responses to a local shock in the US with a dynamic spatial and trade model in which each couple decides jointly where to live and whether the wife works. My main findings are that, relative to an economy populated only by singles, female employment responds less to a local shock and more people relocate. Couples also redistribute welfare gains, both between spouses and across singles, through general equilibrium effects. These results come from how couples optimize jointly. On the one hand, a couple decides whether the wife works based on the change in her wage relative to her husband’s. When a shock moves both spouses’ wages, her participation responds less than it would if only her own wage mattered. On the other hand, because husbands are typically the main earners, an unexposed wife moves for her husband’s job opportunities.

In the first part of the paper, I leverage the China Trade Shock as a natural experiment for a local trade shock in the US. After China joined the WTO in 2001, US manufacturing faced increased import competition, with commuting zones differentially exposed ([Autor et al., 2013, 2021](#)). To examine couples’ responses to the shock, I measure exposure at the individual level: an individual is exposed if they were employed in 1999 in an industry that faced rising competition from Chinese imports between 2000 and 2012. To do so, I use geocoded data from the 1991–2013 waves of the Panel Study of Income Dynamics (PSID), which track each household’s composition, labor-market outcomes, and migration across commuting zones over time. Unlike work that compares commuting zones with different exposure, I compare outcomes for exposed and unexposed individuals or couples in the same commuting zone before and after 2001. Because I observe each household, I can also distinguish couples where the husband is exposed from those where the wife is.

After corroborating prior evidence on the effects of the China Trade Shock on employment

and migration, I document two novel insights into how couples responded to the shock. Consistent with the literature ([Autor et al., 2014](#); [Greenland et al., 2019](#); [Autor et al., 2021](#)), exposed individuals in the PSID were 6.3 p.p. less likely to be employed and 4.7 p.p. more likely to leave their commuting zone. These employment losses induce different responses for couples depending on which spouse is exposed. First, couples who are less mobile than singles before the shock move only when the husband is exposed. On the one hand, couples' out-migration rises by 5 p.p. when the husband is exposed. On the other hand, the estimate is small, negative, and not statistically significant when the wife is exposed. Second, a wife's labor force participation (LFP) rises by 4.2 p.p. when her husband is exposed and falls by 11 p.p. when she is exposed herself, with no offsetting response in the husband's labor supply.

To quantify the aggregate implications of joint decision-making for the economy, I develop a new dynamic spatial and trade model where households consist of a single man, a single woman, or a couple. The model builds on the multi-region and multi-sector dynamic model of [Caliendo et al. \(2019\)](#). Each period, a household chooses where to live and which sector each member works in, subject to migration frictions and idiosyncratic preferences. Following [Rodríguez-Clare et al. \(2026\)](#), I assume household members prefer switching sectors rather than moving locations. I then add four features to this framework. First, a couple jointly maximizes the weighted sum of the spouses' utilities, with weights determined by their bargaining power. The couple chooses a location and a sector for each spouse, and they move only if the move benefits the couple as a whole. Second, after choosing where to live and which sectors to work in, the couple additionally decides whether the wife works in the market or at home. Third, male and female labor are imperfect substitutes, and sectors use them in different proportions, so the same shock can affect the two spouses differently.

Fourth, I introduce a non-rival household public good (e.g., housing or cleaning services) to capture marriage economies of scale. The couple splits their pooled income between private consumption for each spouse and the non-rival public good. When the wife stays at home, her home production increases the quantity of public goods available for consumption. Given that marriage exhibits economies of scale, total consumption can exceed total income. To estimate aggregate effects for spouses and singles, I follow [Chiappori and Meghir \(2015\)](#) and measure each person's welfare as the income a single person would need to reach the same level of utility.

To bring the model to the data, I calibrate four new parameters in the couple's problem, along with the dispersion of preferences across locations. The first two parameters are the wife's bargaining weight, which determines her share of the couple's private consumption, and the share of the budget spent on the household public good, which determines the size of the economies of scale from marriage. I set both to the corresponding expenditure

shares in the Consumer Expenditure Survey. The third and fourth parameters govern the Pareto distribution of a wife’s home productivity. The third is the shape, which governs how strongly the wife’s LFP responds to changes in relative wages. I calibrate it to match my empirical finding that the wives increase their LFP when husbands are exposed to the shock. The fourth is the lower bound of the distribution, which I calibrate internally so that the model matches married women’s participation in the 2000 US Census. Finally, I calibrate the dispersion of preferences across locations via indirect inference. I set it such that the model reproduces the population response to import competition between 2000 and 2007 estimated by [Autor et al. \(2013\)](#) (as in [Rodríguez-Clare et al., 2026](#)). Given these parameters, I solve for the effects of the China Trade Shock using standard dynamic hat-algebra methods ([Caliendo et al., 2019](#)).

I first use my calibrated model to quantify the long run employment, migration, and welfare effects of the China Trade Shock both in the aggregate and for each type of household. I find that the shock raises the employment rate by 0.11 p.p. Cheaper Chinese goods raise real wages, so working becomes more attractive than non-employment. Expanding service sectors absorb workers leaving manufacturing and draw in people out of the labor force, more than offsetting the 0.29 p.p. drop in manufacturing employment.

Couples adjust to the shock using the same mechanisms as in my reduced-form evidence. Married women’s participation rises by 0.10 p.p., as the shock primarily hits male-intensive manufacturing. The couple also adjusts by moving if the husband is exposed. In fact, couples where only the husband is exposed are five times more likely to move than couples where only the wife is exposed. As the husband is the main earner, his job opportunities drive the couple’s migration decisions.

As real wages rise and more people work, the average individual gains the equivalent of a 0.18% income increase. Every household gains, but how much depends on its type. Single women gain the most, 34% more than the average individual. They work in sectors that expand in response to the shock and, unlike a wife, a single woman is not tied to a husband’s job. Single men gain the least, and couples fall in between, much closer to single men, because the household’s income largely depends on the husband’s wage.

To understand how joint decision-making changes the absorption of the shock, I compare my baseline economy with an economy populated only by singles. I call this counterfactual economy the all-singles economy. I build it from the same data, split each couple into two singles, and recalibrate the dispersion of preferences across locations so this economy reproduces the same moment as my baseline economy. I find three key differences regarding employment, migration, and distribution of welfare gains between the two economies.

First, relative to the all-singles economy, aggregate employment gains are 15.4% smaller,

driven by married women. In my baseline economy, a couple decides whether the wife works based on her wage relative to her husband's, and because the shock raises both of their wages, her participation rises less than half as much as it would if she decided alone.

Second, couples change the number of migrants and the share of unexposed workers moving. In my baseline economy, 14.9% more people move to a different state than in the all-singles economy. This is not driven by a higher migration response of exposed workers; in fact, it is actually 14.5% smaller. The result comes from unexposed wives following their exposed husbands, while couples with an unexposed husband do not move. When only the wife is exposed, her migration response is only about a quarter of what it would be if she were single; in contrast, when only the husband is exposed, he migrates about as much as he would alone.

Third, couples redistribute the shock's welfare gains, both between spouses and, through wages, to singles. Because the China Trade Shock hits mostly men's jobs, being in a couple shifts gains from the wife to the husband. Relative to the all-singles economy, married women gain 12% less and married men 3% more. A wife gains less than she would alone because her decision to work depends on her husband's wage and her location is tied to his job, so she cannot fully take advantage of the expanding sectors. Couples also change the gains of singles. Single women gain 20% more and single men 5% less than in the all-singles economy. Because married women's employment responds less to the shock, female wages rise more than male wages in my baseline economy.

Ultimately, these results show that understanding the incidence of local trade shocks requires treating the household, and not only the worker, as the unit that decides where to live and work.

Related literature. This paper contributes to three strands of the literature. First, it contributes to the dynamic spatial general-equilibrium literature on trade and migration responses to local shocks ([Redding and Rossi-Hansberg, 2017](#); [Desmet et al., 2018](#); [Monte et al., 2018](#); [Allen and Donaldson, 2020, 2022](#); [Donald et al., 2025](#); [Desmet and Parro, 2025](#); [Pellegrina and Sotelo, 2025](#)). It is particularly closely related to [Caliendo et al. \(2019\)](#), which emphasizes the interaction between migration, productivity, and the spatial distribution of economic activity under the China Trade Shock, and to [Rodríguez-Clare et al. \(2026\)](#), who extend [Caliendo et al. \(2019\)](#) to separate mobility across sectors within a location from mobility across locations. My contribution is to bring the household into this class of models, in which each worker usually decides alone. In my model, spouses choose together where to live and whether the wife works. As a result, women's employment responds less, and more people relocate, than in a model in which each worker decides alone, and gains shift from

wives to husbands and from single men to single women.

Second, the paper contributes to the literature that studies how dual-earner households respond to shocks, highlighting the roles of risk sharing within couples ([Attanasio et al., 2005](#); [Pilossoph and Wee, 2021](#); [Calvo et al., 2024](#)) and co-location frictions ([Guler et al., 2012](#); [Flabbi and Mabli, 2018](#); [Foerster and Ulbricht, 2023](#); [Jayachandran et al., 2024](#); [Yan, 2025](#)).¹ This literature studies how couples respond to idiosyncratic shocks, such as one spouse’s job loss, by reallocating labor within the household or by searching for jobs jointly across locations. A local shock is different because it hits many households in the same place at once. Couples adjust both by moving, though less than singles, and by reallocating labor within the household, and their responses change local wages and, with them, every other household’s options. My contribution is to study these two margins in general equilibrium, where they interact with wages and with other households’ decisions, including those of singles.

Third, the paper contributes to the literature on the China Trade Shock and its effects on US local labor markets ([Autor et al., 2013, 2014, 2016, 2019, 2021, 2025](#); [Acemoglu et al., 2016](#); [Pierce and Schott, 2016](#); [Greenland et al., 2019](#); [Caliendo et al., 2019](#); [Faber et al., 2022](#); [Borusyak et al., 2026](#)). This literature has documented substantial heterogeneity in the local effects of rising competition from Chinese imports.² My contribution to this literature is twofold. First, using the PSID, I provide new empirical results on the effects of the shock in the US by measuring individual-level exposure and comparing individuals within the same commuting zone. Although my analysis uses a different dataset, sample definition, and empirical design, these results are consistent with previous evidence that increased import competition from China harmed more exposed workers and places, with persistent employment effects on manufacturing workers. Second, to the best of my knowledge, this is the first paper to provide empirical evidence on within-household responses to the shock in the US.

The rest of the paper proceeds as follows. Section II presents the empirical analysis, details the approach, and reports the main findings. Section III presents the theoretical

¹There is an extensive literature on family migration and household adjustment. Starting with [Mincer \(1978\)](#), this literature has emphasized that migration is often a joint decision and that such decisions can have unequal consequences within the household. Subsequent work has documented the role of “trailing wives” and the labor market costs of family migration for women ([Costa and Kahn, 2000](#); [Cooke et al., 2009](#); [Benson, 2014](#); [Blau and Kahn, 2017](#); [Fadlon et al., 2020](#); [Braun et al., 2021](#); [Le Barbanchon et al., 2021](#); [Venator, 2026, 2024](#)). Although beyond the scope of this paper, the outcomes of the “trailing wives” under a trade shock remain an open research question.

²In particular, [Autor et al. \(2013\)](#) and subsequent papers document a significant decrease in manufacturing employment in US commuting zones with larger manufacturing shares, with long-lasting consequences that include increases in political polarization ([Autor et al., 2020](#)), child and adult poverty, and even mortality among young men ([Autor et al., 2019](#)), among several other topics.

model. Section IV brings the model to the data, and Section V presents the results of the quantitative exercise. Finally, Section VI concludes.

II. Empirical Analysis

This section presents the empirical analysis of how couples respond to the China Trade Shock and shows that their response depends on which spouse is exposed. I begin by describing the data, defining exposure at the individual and couple levels, and outlining the empirical design. I then document three empirical facts: exposed workers become less likely to be employed and more likely to leave their commuting zone; couples move only when the husband is exposed; and wives' labor force participation rises when their husbands are exposed and falls when the wives themselves are exposed. Together, these findings motivate the theoretical framework that I develop in the next section.

II.1 Empirical Design

Data. The primary data source for the empirical analysis is the Panel Study of Income Dynamics (PSID), which follows individuals and their households over time. Because the PSID follows both spouses within the same household over time and across locations, it lets me distinguish how exposure varies within households and track individuals across time and space. Most studies of the local labor market effects of trade shocks, such as the China Trade Shock, cannot do this, because they use commuting zones as the unit of observation and rely on repeated cross-sections.

Relative to the data used in most of these studies, the PSID has three additional advantages that make it particularly well suited to this analysis. First, the restricted geocoded version records household addresses at the census-tract level in every survey wave. This information allows me to follow individuals across local labor markets, compare individuals within the same market, and study migration between markets. To ensure comparability with previous work, I define local labor markets as US commuting zones (CZs).

Second, the PSID allows me to construct marital status from household composition and each person's relationship to the household head in each period. I therefore do not have to rely exclusively on current legal marital status, which may understate the number of couples by excluding cohabitation or overstate it by including individuals who are separated but not divorced. I classify individuals into three marital-status categories:³

³I exclude remarried individuals from the sample. I classify an individual who separated after a cohabitation as "divorced", even if their legal marital status is single. I also exclude widowed individuals, because I cannot tell whether a spouse's death is related to the shock or to something that affected the household

1. “Married”: Individuals in their first union who are legally married or cohabiting with a different-sex partner;
2. “Divorced”: Individuals who are legally divorced or separated, or whose cohabiting union ended;
3. “Single”: Individuals whom I never observe as “married” to another individual.

I then pool single and divorced individuals into an unmarried category because neither group makes joint household decisions with a partner.⁴

Third, the PSID records detailed labor market outcomes for the same individuals over two decades, even after they move.⁵ In the PSID, I observe employment, unemployment, and labor force participation and, for employed individuals, average weekly hours, hourly wages, annual labor income, and several additional outcomes. I also observe total household income for couples.⁶

I use all PSID waves conducted in odd-numbered years between 1991 and 2013.⁷ I restrict the sample to individuals aged 20–55 who lived in the mainland US and were present in the 1999 wave. The final sample contains 4,731 individuals and 38,634 observations across 12 waves.

Individuals exposed to the China Trade Shock. The China Trade Shock refers to the increase in competition from Chinese manufactured goods in the US after China joined the WTO in 2001 and continuing through 2012 (Autor et al., 2013, 2021). I identify exposed individuals in two steps. In the first step, I measure the exposure of each US manufacturing industry following Acemoglu et al. (2016), who construct this industry-level measure, and Autor et al. (2021), who use it for 2000–2012. I define the change in Chinese import competition faced by US manufacturing industry j between 2000 and 2012 as:

$$\Delta IC_j = 100 \times \frac{\Delta M_j^{\text{China, US}}}{Y_{j,2000} + M_{j,2000} - X_{j,2000}},$$

before it.

⁴Assuming that divorced individuals do not make joint decisions follows previous literature studying life after divorce (Weiss and Willis, 1993; Del Boca and Flinn, 1995; Flinn, 2000; Reynoso, 2024; Didier and Lopez Villalba, 2026).

⁵Most studies of these shocks rely on the American Community Survey (ACS) or the Current Population Survey (CPS). Both measure similar outcomes, but the ACS is a repeated cross-section, and the CPS follows addresses for at most 16 months, so it loses individuals who move.

⁶I convert all monetary variables to 2017 dollars using the Personal Consumption Expenditures Price Index (PCE) from the US Bureau of Economic Analysis.

⁷Because the PSID was conducted annually until 1997 and biennially afterward, I consider only odd years to construct a biennial sample before and after 1997, which avoids double-counting migration.

where $\Delta M_j^{\text{China,US}}$ is the change in US imports from China in industry j between 2000 and 2012, and $Y_{j,2000} + M_{j,2000} - X_{j,2000}$ is the industry's domestic absorption in 2000: its gross output plus imports minus exports. Normalizing by initial absorption measures the rise in Chinese imports relative to the size of the US market for the industry's goods, so ΔIC_j is the change in China's import penetration, in percentage points. A positive value of ΔIC_j therefore indicates that US manufacturing industry j experienced increased competition from Chinese imports between 2000 and 2012.

To isolate the foreign supply-driven component of US imports from China, I follow these papers and measure the industry-level change in Chinese exports to eight other high-income countries. The rise in these exports reflects China's own productivity gains and falling trade costs, which raise Chinese exports everywhere, rather than changes in US demand.⁸ I also normalize by absorption in 1997 rather than 2000, to avoid any endogeneity on the demand side. The resulting measure of import competition is

$$\widehat{\Delta IC_j} = 100 \times \frac{\Delta M_j^{\text{China,Other Countries}}}{Y_{j,1997} + M_{j,1997} - X_{j,1997}}.$$

A positive value of this measure indicates that industry j experienced increased competition from Chinese imports in other high-income countries. I therefore classify the corresponding US industry j as exposed to the China Trade Shock.

In the second step, I identify the industry in which each individual i was employed in 1999 and define the indicator Exposed_i as follows:

$$\text{Exposed}_i = \begin{cases} 1 & \text{if } i \text{ worked in 1999 in industry } j \text{ with } \widehat{\Delta IC_j} > 0 \\ 0 & \text{otherwise.} \end{cases} \quad (1)$$

For the analysis of within-household mechanisms, I further restrict the sample to couples. I divide couples into three groups: those in which neither spouse worked in an exposed industry in 1999, those in which the husband worked in an exposed industry, and those in which the wife worked in an exposed industry. I define couple h as exposed through the husband if

$$\text{Exposed Husband}_h = \begin{cases} 1 & \text{if he worked in 1999 in industry } j \text{ with } \widehat{\Delta IC_j} > 0 \\ 0 & \text{otherwise} \end{cases} \quad (2)$$

⁸Autor et al. (2013) and their follow-up papers consider Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain, and Switzerland. They select these countries based on the availability of data for the full sample period.

and as exposed through the wife if

$$\text{Exposed Wife}_h = \begin{cases} 1 & \text{if she worked in 1999 in industry } j \text{ with } \widehat{\Delta IC_j} > 0 \\ 0 & \text{otherwise.} \end{cases} \quad (3)$$

Summary statistics. Table 1 describes the sample before the China Trade Shock, pooling the 1991–1999 waves. It makes three points that help interpret the empirical facts I describe in the next subsection. First, because I restrict the sample to prime-age individuals whose industry I observe in 1999, it consists of workers with a strong attachment to the labor market. Second, even within this sample, couples differ from singles, and husbands differ from wives, in ways that shape how each group can adjust: couples migrate less, and wives are less attached to the labor market than husbands. Third, married and unmarried individuals live in similarly exposed commuting zones, so differences in how they respond to the shock do not reflect where they live.

The sample consists of prime-age individuals, approximately 60% of whom are married, 24% single, and the remainder divorced. The average individual is 37 years old; two-fifths of the sample are women, one-third are college graduates, and 86% are white. Unmarried individuals are slightly younger and less likely to be college graduates or white than married individuals. Half of the sample have children under 18, including nearly one-quarter of unmarried individuals. The youngest child in the household is, on average, 4 years old and tends to be younger among unmarried individuals, consistent with the younger average age of unmarried individuals.

Because the sample consists of prime-age individuals for whom I can identify their industry in 1999, employment and labor force participation rates are high, at 91% and 95%, but husbands and wives differ in their attachment to the labor market. Among non-employed individuals, unemployment is the most common status for unmarried individuals and husbands, whereas non-participation in the labor force is most common among wives. This pattern is consistent with unmarried individuals relying more heavily on reemployment after job loss, whereas married individuals can adjust labor supply within the household.

The average employed individual works 40 hours per week, earns \$19 per hour in 2017 USD, and receives approximately \$42,000 in annual labor income. Husbands work the most hours, earn the highest hourly wages, and consequently receive the highest annual labor income; wives have the lowest values for all three outcomes. Married and unmarried individuals work similar hours on average, but married individuals earn approximately 20% higher hourly wages and therefore receive more labor income per capita. Although selection into marriage likely explains part of this gap, this pattern is also consistent with couples using

Table 1: Summary Statistics Before the China Trade Shock

	(1)	(2)	(3)	(4)
	All	Unmarried	Couples	
			Husbands	Wives
Panel A: Distribution by “Marital Status”				
Share of Single Individuals	0.24			
Share of Married Individuals	0.59			
Share of Divorced Individuals	0.16			
Panel B: Demographic Characteristics				
Age ⁺	36.86	34.69	38.92	37.19
Share of Female Individuals	0.42	0.55		
Share of College Graduates	0.33	0.29	0.37	0.32
Share of White Individuals	0.86	0.75	0.93	0.93
Share of Individuals with Kids	0.50	0.23		0.69
Age of Youngest Kid ⁺	3.67	1.75		4.98
Share in Highly Exposed CZs ⁺⁺	0.11	0.12		0.11
Migration Rate	0.08	0.11		0.06
Panel C: Labor Market Outcomes				
Share of Exposed Individuals	0.15	0.14	0.19	0.10
Share in Routine Occupations	0.23	0.22	0.23	0.26
Share in Offshorable Occupations	0.12	0.14	0.08	0.16
Share Employed	0.91	0.89	0.97	0.85
Share Unemployed	0.03	0.06	0.02	0.02
Share Out of the Labor Force	0.05	0.05	0.01	0.13
Weekly Hours ⁺	40.80	39.89	45.34	33.60
Hourly Wage ⁺	19.54	16.98	23.70	16.45
Labor Income ⁺	42671.70	35953.36	57073.74	27617.31
Number of Observations	16,645	4,343	6,151	6,151

Notes. Marital status is constructed from household composition and each person’s relationship to the household head. Married individuals are in their first union, either legally married or cohabiting; divorced individuals are legally divorced or separated, or their cohabiting union ended; and single individuals are never observed in a union. The unmarried category pools single and divorced individuals. Monetary values are expressed in 2017 USD using the PCE price index. ⁺: Indicates the sample mean. ⁺⁺: Highly exposed CZs are those in the top 20% of exposure according to [Autor et al. \(2021\)](#).

intra-household labor supply adjustments to allocate resources more effectively.

Exposure to the shock also differs across groups. In 1999, 15% of the sample worked in an industry exposed to competition from Chinese imports: 14% of unmarried individuals, 19% of husbands, and 10% of wives. At the household level, 20% of couples had at least one exposed spouse.

Married and unmarried individuals live in similarly exposed CZs but differ sharply in how often they migrate. Using the commuting-zone measure of [Autor et al. \(2021\)](#), one in ten individuals lives in a CZ in the top two deciles of exposure to Chinese import competition, and this share does not vary meaningfully by marital status, suggesting little spatial sorting along this dimension. Where they differ is in mobility: the average migration rate is 8%, but unmarried individuals migrate at nearly twice the rate of married individuals.

Two other forces could confound the effects of the shock, and they matter even more in my setting because men and women sort into different occupations. As noted by [Autor et al. \(2013, 2021\)](#), the period of the China Trade Shock also featured increasing automation and broader globalization. Following [Autor and Dorn \(2013\)](#), I calculate routine-task intensity and offshorability indices for the occupations represented in the sample. Slightly less than one-quarter of observations correspond to individuals employed in routine-task-intensive occupations, while approximately one in ten workers is employed in an offshorable occupation. Offshorability varies substantially by gender, reflecting the occupational sorting of men and women. Because both forces also affected manufacturing workers, omitting them could lead to attributing their effects to the China Trade Shock. Because offshorability differs by gender, omitting it could also bias the comparison between husbands' and wives' responses, which is central to this paper. I therefore control for both occupational characteristics in the empirical analysis.

Difference-in-differences design. To estimate the overall effect of exposure to the China Trade Shock, I estimate the following event-study specification for individual i in commuting zone c and year t :

$$\begin{aligned} \text{Outcome}_{i,c,t} = & \alpha \cdot \mathbb{1}[\text{Exposed}_i = 1] + \sum_{\tau \neq 1999} \beta_{\tau} \cdot \mathbb{1}[\text{Exposed}_i = 1] \cdot \mathbb{1}[t = \tau] \\ & + X'\delta + \gamma_t + \gamma_c + \varepsilon_{i,c,t}. \end{aligned} \tag{4}$$

The control vector includes age and indicators for being female, holding a college degree, having children younger than 18, working in manufacturing in 1999, working in a routine occupation, and working in an offshorable occupation. The specification also includes commuting-zone and year fixed effects. I weight all regressions by PSID sampling weights and two-way

cluster standard errors at the individual and industry levels.

Because the specification includes commuting-zone and year fixed effects, the coefficients of interest, β_τ , measure the difference in outcomes between exposed and non-exposed individuals in year τ , relative to the corresponding difference in 1999. Thus, the comparison is between individuals in the same local labor market and year who worked in different industries in 1999. I fix exposure at the 1999 industry level, before China joined the WTO, so that exposure does not reflect workers' later moves across industries. The identifying assumption is that, absent the shock, the outcomes of exposed and non-exposed individuals would have evolved in parallel, and the coefficients before 1999 test this assumption.

To summarize the average effect during the shock, I also estimate a difference-in-differences version of equation (4) that replaces the year-specific interactions with a single interaction with an indicator for $t \geq 2001$, the first post-shock wave in the biennial sample:

$$\begin{aligned} \text{Outcome}_{i,c,t} = & \beta_1 \cdot \mathbb{1}[\text{Exposed}_i = 1] + \beta_2 \cdot \mathbb{1}[\text{Exposed}_i = 1] \cdot \mathbb{1}[t \geq 2001] \\ & + X'\delta + \gamma_c + \gamma_t + \varepsilon_{i,c,t}. \end{aligned} \quad (5)$$

To examine joint household decision-making, I estimate the following specifications for spouse $s \in \{\text{husband}, \text{wife}\}$ in couple h , commuting zone c , and year t . First, I focus on whether the husband is exposed:

$$\begin{aligned} \text{Outcome}_{s,h,c,t} = & \beta_1 \cdot \mathbb{1}[\text{Exposed Husband}_h = 1] \\ & + \beta_2 \cdot \mathbb{1}[\text{Exposed Husband}_h = 1] \cdot \mathbb{1}[t \geq 2001] \\ & + X'\delta + \gamma_c + \gamma_t + \varepsilon_{s,h,c,t}, \end{aligned} \quad (6)$$

and then on whether the wife is exposed:

$$\begin{aligned} \text{Outcome}_{s,h,c,t} = & \beta_1 \cdot \mathbb{1}[\text{Exposed Wife}_h = 1] + \beta_2 \cdot \mathbb{1}[\text{Exposed Wife}_h = 1] \cdot \mathbb{1}[t \geq 2001] \\ & + X'\delta + \gamma_c + \gamma_t + \varepsilon_{s,h,c,t}. \end{aligned} \quad (7)$$

In these specifications, the coefficient of interest is β_2 , which captures the post-2001 difference in outcomes between couples with an exposed spouse and those without, relative to the corresponding pre-2001 difference.⁹ I estimate both specifications on the same sample of couples, so the comparison group in equation (6) includes couples in which only the wife is exposed, and vice versa. Both equations include the controls used in equation (4). For controls measured at the individual level, I include separate values for each spouse, such as the husband's and wife's ages.¹⁰

⁹For this analysis, I drop 4% of couple-year observations across the full 1991–2013 panel in which both spouses were working in exposed industries in 1999, because I cannot measure whether one spouse's job was more important to the couple than the other's.

¹⁰I two-way cluster standard errors by the industry of the exposed spouse (the husband in equation (6))

II.2 Empirical Facts

I now establish three main facts, proceeding from individual-level effects to within-household adjustment. The first fact documents the labor market effects of the shock and examines whether exposed individuals respond by leaving their commuting zone; it confirms, at the individual level, what previous work finds across commuting zones. The second and third facts are new. The second fact shows that couples migrate in response to the shock only when the husband is the exposed spouse. The third fact examines wives' labor supply responses, a margin of adjustment that couples can use alongside or instead of migration. Across all three analyses, I identify the effects by comparing individuals whose exposure differs by their 1999 industry, holding commuting zone and year fixed. The comparison is therefore between exposed and non-exposed individuals within the same local labor market, rather than between local labor markets with different levels of exposure.

Fact 1: Exposure to the China Trade Shock worsened labor market outcomes and increased out-migration.

Exposed individuals became less likely to work and earned less during the China Trade Shock, and they became more likely to leave their commuting zone. Figure 1 shows the year-by-year estimates of equation (4) for employment, unemployment, labor force participation, weekly hours worked, hourly wages, and annual labor income. Table A.2 reports the corresponding difference-in-differences estimates from equation (5), which average the effect over 2001–2013 relative to the pre-shock difference.

Panel A of Figure 1 shows that, between 2001 and 2007, exposed individuals became less likely to be employed than non-exposed individuals, relative to the difference between them in 1999. After 2009, the point estimates remain close to their 2007 level, but the confidence intervals widen, and the estimates are no longer statistically significant. On average over the full duration of the shock, 2001–2013, exposure was associated with a 6.3 p.p. decline in the probability of employment (Table A.2). Most of the decline in employment reflects individuals leaving the labor force (Panel C) rather than entering unemployment (Panel B). In fact, on average over 2001–2013, exposed individuals were 3.9 p.p. less likely to participate in the labor force.

Weekly hours worked follow a similar pattern (Panel D): exposed individuals worked 5% fewer hours per week during the shock than non-exposed individuals. Hourly wages exhibit a different pattern (Panel E). Although the estimate is positive in 2001, the hourly wages

and the wife in equation (7)) and by the unit at which the outcome is measured: the household for household outcomes, such as out-migration and household income, and the individual for each spouse's outcomes, such as employment and labor force participation.

of exposed individuals declined through the final year of the sample. On average, exposed individuals earned 10% lower hourly wages during the shock than non-exposed individuals. Combined with the reduction in hours worked, this decline resulted in \$5,600 lower annual labor income among exposed individuals, 11% of the pre-shock mean (Panel F).¹¹

Using the continuous import-competition measure of Autor et al. (2021) instead of the binary exposure measure, my employment estimates are similar in magnitude to theirs: the average decadalized growth in Chinese import competition implies a 0.5 p.p. average decline in the probability of employment between 2001 and 2013 (Table A.3), compared with 0.55 p.p. in their estimates.¹² These findings are consistent with previous evidence on the adverse effects of the China Trade Shock in the US (Autor et al., 2013, 2014, 2016, 2021; Acemoglu et al., 2016; Pierce and Schott, 2016).

Given the deterioration in labor market outcomes among individuals employed in industries exposed to Chinese import competition, particularly the decline in employment during the first years of the shock, I next examine whether exposed individuals moved to other CZs in search of better opportunities. For each individual i , I define out-migration in year t as follows:

$$\text{Out-Migration}_{i,t} = \begin{cases} 1 & \text{if } CZ_{i,t-2} \neq CZ_{i,t} \\ 0 & \text{if } CZ_{i,t-2} = CZ_{i,t}. \end{cases} \quad (8)$$

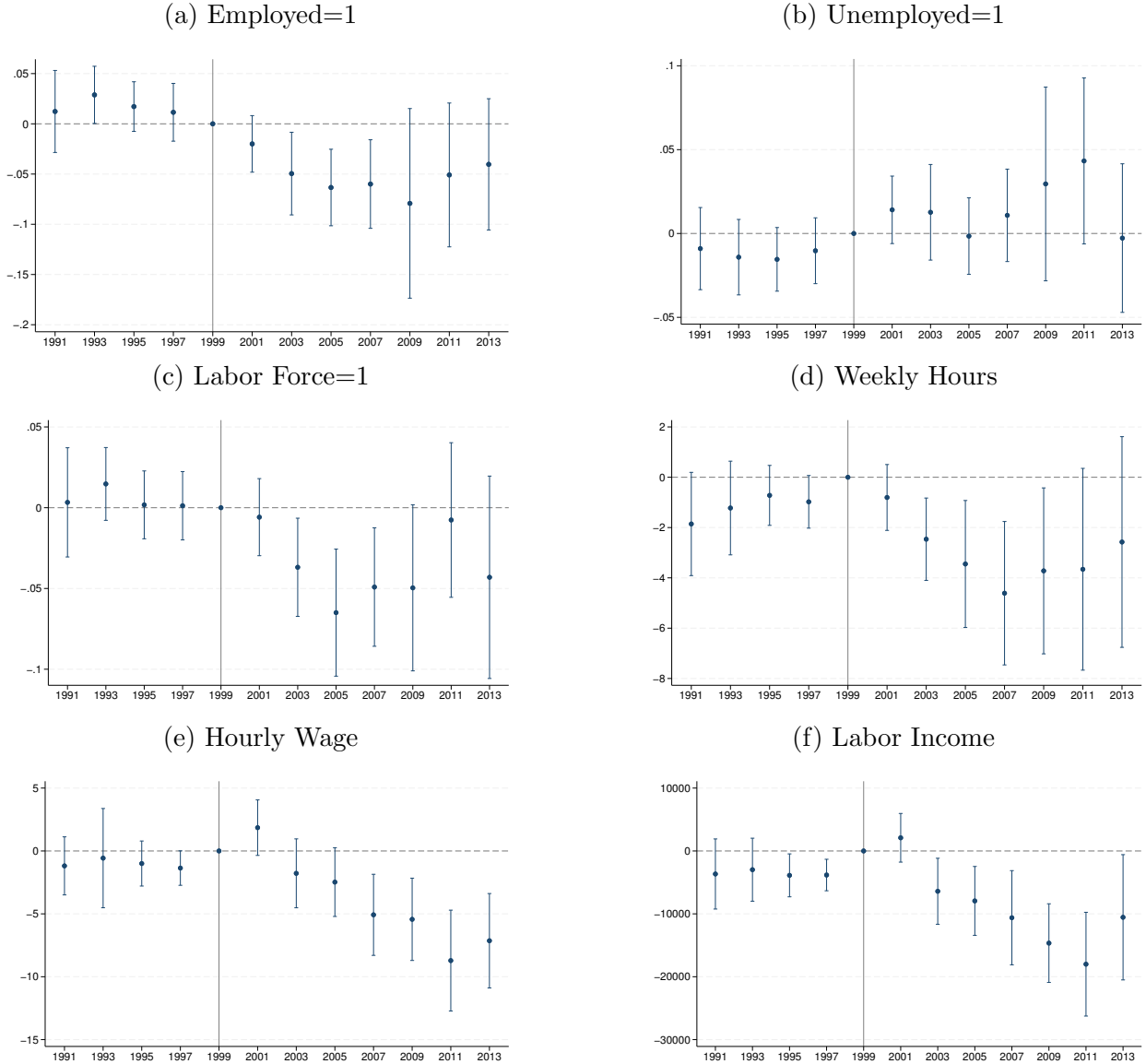
During the shock, exposed individuals became increasingly likely to leave their CZ. Figure 2 presents estimates of equation (4) with out-migration as the outcome: the estimated difference increased by approximately 2 p.p. every two years after 2009, reaching 6 p.p. in 2013. Thus, most of the response emerges with a lag of seven to ten years, consistent with Greenland et al. (2019)’s evidence on the effects of the China Trade Shock on internal migration in the US. On average, exposed individuals were 4.7 p.p. more likely to out-migrate than non-exposed individuals within the same commuting zone, as reported in Table A.4.

The out-migration response is consistent with the evidence in Autor et al. (2021) of a statistically significant decline in the population aged 25 to 39 and a statistically insignificant

¹¹A back-of-the-envelope calculation puts this loss in perspective. Accumulated over 2001–2013, an 11% annual loss amounts to roughly 1.3 to 1.4 years of pre-shock earnings, similar to the 1.4 years that Davis and von Wachter (2011) estimate for men displaced in mass layoffs when unemployment is low. Their estimate is a present value over 20 years for displaced workers, whereas not all exposed individuals in my sample lose their jobs.

¹²To compare the two, I convert their cumulative estimate for the employment-to-population ratio between 2001 and 2019 into an evenly distributed effect and retain only odd-numbered years, as in the PSID sample. One potential concern is that, given the small PSID sample, the particular set of CZs in my sample may drive the estimates. To address this concern, Appendix A.1 replicates their findings using the same CZs included in my sample, ruling out this alternative explanation.

Figure 1: Exposure to the China Trade Shock and Labor Market Outcomes

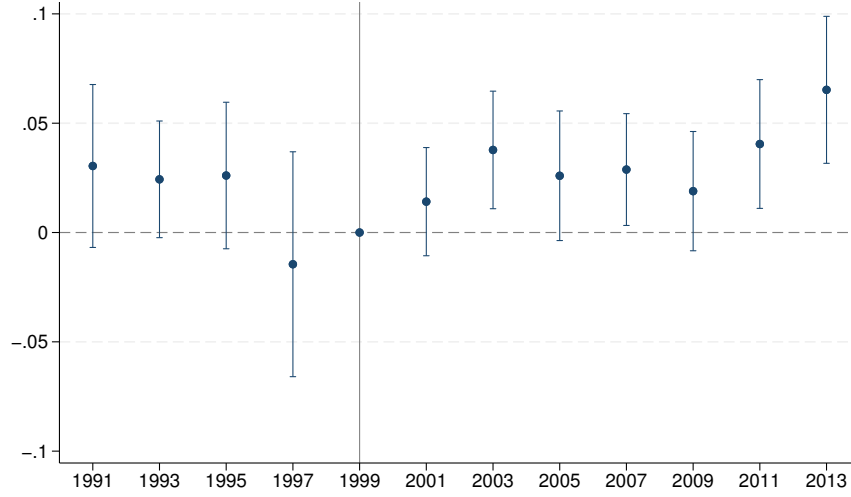


Notes. Each panel reports estimates from equation (4), using the variable named in the panel title as the outcome. Monetary outcomes are expressed in 2017 USD using the PCE price index and include zero values. Robust standard errors are two-way clustered at the industry and individual levels. The bars indicate 95% confidence intervals.

decline in the overall population of more exposed commuting zones.¹³

¹³The two estimates, however, measure different objects. [Borusyak et al. \(2026\)](#) show that commuting-zone migration regressions understate how responsive migration is to local shocks for two reasons: they omit the shocks hitting workers' alternative destinations, and, with industry-level shocks, shift-share measures misstate how exposed each location is. My design avoids the second problem, because I measure exposure through each worker's own 1999 industry. The first implies that my estimate captures the out-migration response to the China Trade Shock as it occurred, which is likely smaller than the response to a shock confined to the worker's local industry.

Figure 2: Exposure to the China Trade Shock and Out-Migration Responses



Notes. Out-migration is defined as equation (8). Robust standard errors are two-way clustered at the industry and individual levels. The bars indicate 95% confidence intervals.

Fact 2: Couples out-migrate only when the husband is exposed.

Couples leave their commuting zone when the husband is exposed to the shock, but not when the wife is. To examine how couples' migration responses differ from those of individuals, I estimate equations (6) and (7) using out-migration as the outcome at the household level.¹⁴ Column 1 of Table 2 shows that couples in which the husband was exposed to the shock were 5 p.p. more likely to leave their commuting zone than couples in which the husband was not exposed.¹⁵ By contrast, exposure of the wife produces no statistically significant migration response, and the point estimate in Column 2 is negative. This asymmetry is consistent with evidence that husbands' employment plays a larger role in family migration decisions (Mincer, 1978; Costa and Kahn, 2000; Cooke et al., 2009; Benson, 2014; Blau and Kahn, 2017; Fadlon et al., 2020; Braun et al., 2021; Le Barbanchon et al., 2021).

I can rule out two alternative explanations for this asymmetry: changes in family composition and differences in how parents or women respond to exposure. First, the asymmetry could be driven by changes in family composition. If, for example, couples divorce when

¹⁴The PSID records only the census tract of the household in which the interview takes place, which it always treats as the family's primary household. As a result, if only one spouse migrates, the PSID does not record the couple as migrating. Instead, it records the couple as "married, spouse absent," and the respondent reports for both spouses. According to PSID staff, this case is very unlikely. My estimates are therefore a lower bound on couples' migration responses, as they only account for couples who migrate together.

¹⁵The negative coefficient in the first row of Table 2 reflects the relatively favorable employment conditions in those manufacturing industries before the shock, which made couples less likely to migrate if the husband was employed there.

the wife is exposed but not when the husband is exposed, this would bias my findings. In Appendix A.2, I study the effect of the trade shock on the probabilities of marriage, divorce, and fertility and find no effect on any of them. Second, the asymmetry could reflect who the exposed spouse is rather than how couples decide. If parents, or women in general, respond less to their own exposure regardless of marital status, couples with an exposed wife would move less for that reason alone. In Appendix A.3, I expand equation (4) to include triple interactions of exposure with having children and with being a woman. In both cases, I cannot reject that parents or women responded in the same way as non-parents or men.

Table 2: Exposure to the China Trade Shock and Couples' Out-Migration Responses

	(1)	(2)
	Out-Migration=1	
Exposed Husband=1	-0.121***	
	(0.043)	
(Exposed Husband=1)x(Post=1)	0.050**	
	(0.022)	
Exposed Wife=1		0.064
		(0.074)
(Exposed Wife=1)x(Post=1)		-0.010
		(0.028)
Observations	13,695	13,695
R^2	0.10	0.09
Baseline Mean	0.05	0.05

Notes. Out-migration is measured at the household level and defined as equation (8). Robust standard errors are two-way clustered by household and the husband's industry in Column 1, and by household and the wife's industry in Column 2. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

Fact 3: Wives' labor force participation falls when they are exposed and rises when their husbands are exposed.

Couples have an additional margin of adjustment besides migration: one spouse's labor supply can respond to the other's exposure, as in the so-called "added-worker effect" (Lundberg, 1985), which refers to a spouse who specializes in home production entering

the labor market when the other spouse loses their job, to offset the household's income loss. I therefore study labor market responses to the shock, distinguishing between direct exposure, through a spouse's own 1999 industry, and indirect exposure, through the other spouse's. When wives are directly exposed to the shock, they are 9.9 p.p. less likely to be employed and 11 p.p. less likely to be in the labor force than non-exposed wives (Panel A of Table 3). However, when wives are indirectly exposed because their husbands worked in an exposed industry, their labor force participation rises by 4.2 p.p. relative to that of wives of non-exposed husbands (Panel B of Table 3). This provides suggestive evidence of the added-worker effect among wives indirectly exposed to the China Trade Shock through their husbands.

Husbands, by contrast, show no added-worker effect, although their wages respond to their wives' exposure. When husbands are indirectly exposed to the shock, they have the same probability of employment as non-exposed husbands but earn a lower hourly wage (Table A.5). One interpretation is that indirectly exposed husbands have a lower reservation wage. When the wife's earnings fall, the household values the husband's job more, so he may accept a lower wage rather than risk a longer spell without work. The evidence here does not distinguish this interpretation from other channels, such as wage cuts within the same job.

Table 3: Wife's Exposure to the China Trade Shock and Labor Market Outcomes

	Wife Employed=1	Wife Labor Force=1
Exposed Wife=1	0.041 (0.099)	0.016 (0.110)
(Exposed Wife=1)x(Post=1)	-0.099** (0.045)	-0.110** (0.048)
Exposed Husband=1	0.027 (0.077)	0.027 (0.068)
(Exposed Husband=1)x(Post=1)	0.041*** (0.013)	0.042*** (0.013)
Observations	14,083	14,083
Baseline Mean	0.77	0.78

Notes. Robust standard errors are two-way clustered at the wife's industry and individual levels in Panel A and at the husband's industry and individual levels in Panel B. * for $p < .10$, ** for $p < 0.05$, *** for $p < 0.01$.

The absence of an added-worker effect among husbands contrasts with the findings of [Parey et al. \(2025\)](#) for England and Wales. They show that when English husbands are indirectly exposed to the trade shock, older husbands increase their labor force participation and move into self-employment. They find a positive, though not statistically significant, response among indirectly exposed wives. The difference in the results for husbands could be driven by the fact that 93% of husbands in their sample are in the labor force, compared with 99% in my sample (Table 1). As a result, husbands in my sample face a ceiling effect that limits the scope for an added-worker effect.

The household income of exposed couples remained close to that of non-exposed couples during the shock, regardless of which spouse was exposed. To see whether these asymmetric responses help couples absorb the shock, I estimate equations (6) and (7) using a measure of household income from the PSID. When husbands are exposed, the coefficient is statistically insignificant, suggesting that the combination of out-migration and the wife’s labor force participation helps stabilize household income during the shock (Table A.6).

When the wife is exposed, household income is stable because the expected loss is small, not because the couple offsets it by migrating or working more. These couples do not respond by migrating, the wife’s employment falls, and the husband’s employment does not change (Tables 3 and A.5). Before the shock, wives earned about a third of the couple’s labor income (Table 1). Losing it entirely would lower household labor income by a third, but exposure lowers wives’ employment by 9.9 p.p., so the expected loss is about 3% of household labor income. The point estimate in Column 2 of Table A.6 is negative, consistent with this smaller loss, but imprecisely estimated. The smaller loss also helps explain why these couples do not move: the income at stake is lower than it would be when the husband, the household’s main earner, is exposed to the shock. Household income is also an incomplete measure of welfare. When an exposed wife leaves the labor force, the couple gains home production and leisure, so household income overstates its loss. When a couple moves, it pays the costs of moving, so household income understates its loss. I quantify the welfare effects of both margins with the model developed in the next section.

Together, the three facts suggest that couples adjust to the shock both by moving and by adjusting labor supply within the household, and that the use of each margin depends on which spouse is exposed. This evidence is well identified because it compares exposed and non-exposed individuals within the same commuting zone. For the same reason, it cannot capture the general equilibrium effects of couples’ adjustment. Changes in local wages and prices reach exposed and non-exposed individuals in the same commuting zone alike, and migration and trade spread the shock across commuting zones, so the comparison differences out both. The evidence therefore cannot show what each margin does for the economy

as a whole and who bears the shock, including singles who were never exposed but whose wages depend on how many wives enter the labor market. In the next section, I develop a quantitative spatial and trade model in which couples’ joint decisions generate these facts, which allows me to measure what these decisions imply in general equilibrium.

III. A Model of Trade and Migration with Couples

This section develops a dynamic spatial and trade model in which couples jointly decide where to live, which sector each spouse works in, and whether the wife works in the market. The model extends the framework of [Caliendo et al. \(2019\)](#) (henceforth CDP). I use it to rationalize the three empirical facts documented in Section II and to quantify how couples change the way the economy adjusts to the China Trade Shock and who bears it.

The economy consists of L locations, indexed by i as origins and j as destinations, populated by three household types, indexed by h : single men ($h = s_m$), single women ($h = s_f$), and couples ($h = c$). The economy has a fixed total population of mass N , comprising $N/2$ men and $N/2$ women. Time is discrete and indexed by $t \in \{0, 1, 2, \dots\}$. At $t = 0$, a fraction $\bar{s}_i$ of individuals in location i are single, while the remaining fraction, $1 - \bar{s}_i$, belong to different-sex couples.¹⁶ How this population is distributed across locations and sectors changes over time as households move.

All households are forward-looking and respond to local conditions by choosing their place of residence and sector of employment. Couples make these choices jointly, as a unit that weights each spouse’s utility by their bargaining weight, and choose a location and a sector for each spouse. After making these choices, a couple draws a home-production productivity shock β and, given this draw and the spouses’ relative wage, decides whether the wife works in the market.

The model’s central feature is the interaction between migration and married women’s labor force participation. When spouses work in different sectors, a sectoral productivity shock affects them differently, and the couple can respond by moving, by changing whether the wife works, or both.

To simplify the exposition, I present a stripped-down version of the model’s production side. In this version, firms produce with labor alone, goods are differentiated by origin (an Armington formulation), and trade is balanced. In the model I solve, firms also use structures and intermediate inputs, sectors trade as in [Eaton and Kortum \(2002\)](#), and trade need not

¹⁶The model holds household composition fixed: marriage, divorce, fertility, and population growth are excluded, so couples remain together throughout the transition. In my sample, the China Trade Shock has no statistically significant effect on marriage, divorce, or fertility (Appendix A.2).

be balanced (Appendix C). Both trade formulations yield trade shares and price indices of the same form, and the household side of the model, where couples enter, is identical in the two versions.

III.1 Technology

There are K productive sectors, indexed by $k, n \in \{1, \dots, K\}$. Let $A_{i,k,t} > 0$ denote Hicks-neutral productivity in sector k of region i . Let $\psi_{k,m}, \psi_{k,f} > 0$ denote sector-specific gender-intensity parameters, which govern how male- or female-intensive the production of each good is. These parameters are common across locations and satisfy $\psi_{k,m} + \psi_{k,f} = 1$.

A representative intermediate-good firm in sector k of origin i combines male labor, $M_{i,k,t}$, and female labor, $F_{i,k,t}$, into an effective labor aggregate using a CES production function with elasticity of substitution $\sigma > 1$:

$$\mathcal{L}_{i,k,t} = \left(\psi_{k,m} M_{i,k,t}^{(\sigma-1)/\sigma} + \psi_{k,f} F_{i,k,t}^{(\sigma-1)/\sigma} \right)^{\sigma/(\sigma-1)}. \quad (9)$$

Output is then given by $Y_{i,k,t} = A_{i,k,t} \mathcal{L}_{i,k,t}$.

Under perfect competition and constant returns to scale, each good is sold at its unit cost. Shipping it from region i to region j entails iceberg trade costs $\tau_{ij,k} \geq 1$, with $\tau_{jj,k} = 1$. The delivered price paid in region j is therefore $p_{ij,k,t} = p_{i,k,t} \tau_{ij,k}$, where $p_{i,k,t} = \bar{w}_{i,k,t} / A_{i,k,t}$ is the producer price and $\bar{w}_{i,k,t}$ is the CES wage index corresponding to equation (9). The CES wage index is the unit cost of effective labor given the wages paid to men and women in sector k of location i , $w_{i,k,t}^M$ and $w_{i,k,t}^F$:

$$\bar{w}_{i,k,t} = \left(\psi_{k,m}^\sigma (w_{i,k,t}^M)^{1-\sigma} + \psi_{k,f}^\sigma (w_{i,k,t}^F)^{1-\sigma} \right)^{\frac{1}{1-\sigma}}. \quad (10)$$

The first-order conditions of the firm's cost-minimization problem yield optimal demands for male and female labor as functions of the effective labor aggregate and relative wages:

$$M_{i,k,t} = \psi_{k,m}^\sigma \left(\frac{w_{i,k,t}^M}{\bar{w}_{i,k,t}} \right)^{-\sigma} \mathcal{L}_{i,k,t}, \quad (11)$$

$$F_{i,k,t} = \psi_{k,f}^\sigma \left(\frac{w_{i,k,t}^F}{\bar{w}_{i,k,t}} \right)^{-\sigma} \mathcal{L}_{i,k,t}. \quad (12)$$

The labor demand functions in equations (11) and (12) yield the equilibrium gender-specific wages within each region-sector pair:

$$w_{i,k,t}^M = \bar{w}_{i,k,t} \psi_{k,m} \left(\frac{\mathcal{L}_{i,k,t}}{M_{i,k,t}} \right)^{1/\sigma}, \quad w_{i,k,t}^F = \bar{w}_{i,k,t} \psi_{k,f} \left(\frac{\mathcal{L}_{i,k,t}}{F_{i,k,t}} \right)^{1/\sigma}. \quad (13)$$

In each destination region j and sector n , a representative sectoral final-good firm combines sector- n goods from all origins into a sector- n composite, $Q_{j,n,t}$, using a CES aggregator with elasticity of substitution $1 + \eta_n$, where $\eta_n > 0$ is the sectoral trade elasticity.¹⁷ The sectoral price index and the share of region j 's expenditure on sector- n goods spent on goods from region i are

$$P_{j,n,t} = \left(\sum_{i=1}^L p_{ij,n,t}^{-\eta_n} \right)^{-1/\eta_n}, \quad \pi_{ij,n,t} = \left(\frac{p_{ij,n,t}}{P_{j,n,t}} \right)^{-\eta_n}. \quad (14)$$

A representative regional final-good firm then combines the sectoral composites into the regional consumption good, $Q_{j,t}$, using a Cobb-Douglas aggregator with expenditure shares $\iota_k > 0$ and $\sum_{k=1}^K \iota_k = 1$.¹⁸ The regional price index and the expenditure on sector n are therefore

$$P_{j,t} = \prod_{k=1}^K P_{j,k,t}^{\iota_k}, \quad P_{j,n,t} Q_{j,n,t} = \iota_n P_{j,t} Q_{j,t}. \quad (15)$$

Each location j also has a non-employment sector, indexed by $k = 0$, available to single men, single women, and married men. The non-employment sector produces no output. An individual who chooses sector 0 in region j instead obtains a constant real income $y_j > 0$ from home production.

III.2 Preferences

Location and sector choices. Each household type $h \in \{s_m, s_f, c\}$ is forward-looking and discounts the future with discount factor $\delta \in (0, 1)$. At the start of every period, a household begins in a particular location-sector position and must decide whether to switch sectors, locations, or both. The sector component of the position differs by household type. For single individuals, it is one sector in $\{0, 1, \dots, K\}$. For couples, it is the pair formed by the husband's and wife's sectors, where the husband's current and destination sectors satisfy $k_m, n_m \in \{0, 1, \dots, K\}$ and the wife's current and destination potential sectors satisfy $k_f, n_f \in \{1, \dots, K\}$. A couple cannot choose sector 0 for the wife. Instead, it always chooses a productive sector for her and then decides whether she works in that sector or engages in home production, as I explain below.

For convenience, I collapse a household's location-sector position into a single index. For a single, the index is a location-sector pair, (i, k_m) for a single man and (i, k_f) for a single

¹⁷Goods are traded only within a sector.

¹⁸The aggregator is $Q_{j,t} = \prod_{k=1}^K (Q_{j,k,t}/\iota_k)^{\iota_k}$, where dividing each composite by its share ι_k normalizes the aggregator so that the regional price index takes the simple form in equation (15).

woman. For a couple, it bundles a location with a sector for each spouse, (i, k_m, k_f) . For every household type, I denote the origin index by $\mathbf{o}$, the destination index by $\mathbf{d}$, and a generic index used in sums by $\mathbf{z}$, written for couples as $\mathbf{o} \equiv (i, k_m, k_f)$, $\mathbf{d} \equiv (j, n_m, n_f)$, and $\mathbf{z} \equiv (\ell, q_m, q_f)$. I write out an index's components only where an expression refers to a particular location or sector.

To decide its destination $\mathbf{d}$ for the next period, each household of type h in $\mathbf{o}$ draws two idiosyncratic preference shocks: a *location* shock $\varepsilon_{\mathbf{o}j,t}^{h,L}$ for each destination location j , and a *sector* shock $\varepsilon_{\mathbf{o}\mathbf{d},t}^{h,S}$ for each destination index within that location. Couples draw each of these shocks jointly, rather than one per spouse. The two shocks enter additively, so the total preference shock attached to destination $\mathbf{d}$, located in j , is

$$\varepsilon_{\mathbf{o}\mathbf{d},t}^h = \varepsilon_{\mathbf{o}j,t}^{h,L} + \varepsilon_{\mathbf{o}\mathbf{d},t}^{h,S}. \quad (16)$$

Following [Rodríguez-Clare et al. \(2026\)](#), I assume that the preference shocks are i.i.d. over time and households. Let $\mathcal{S}_h$ denote the set of feasible destinations for household type h , and $\mathcal{S}_h(j)$ denote the set of feasible sectors available to h , conditional on choosing location j . The vector of preference shocks, $\varepsilon_{\mathbf{o},t}^h \equiv (\varepsilon_{\mathbf{o}\mathbf{d},t}^h)_{\mathbf{d} \in \mathcal{S}_h}$, has a nested Gumbel joint distribution,

$$F(\varepsilon_{\mathbf{o},t}^h) = \exp \left(- \sum_{j=1}^L \left(\sum_{\mathbf{d} \in \mathcal{S}_h(j)} \exp(-\varepsilon_{\mathbf{o}\mathbf{d},t}^h / \nu) \right)^{\nu/\theta} \right), \quad (17)$$

with $0 < \nu \leq \theta$.¹⁹ The parameter ν governs the dispersion of preferences across sectors within a location, so $1/\nu$ determines substitution across sectors. Similarly, θ governs preference dispersion across locations, so $1/\theta$ determines substitution across locations.²⁰ The restriction $\nu \leq \theta$ implies that households substitute at least as much across sectors within a location as they do across locations.

A household moving from origin $\mathbf{o}$ to destination $\mathbf{d}$ incurs a mobility cost $\mu_{\mathbf{o}\mathbf{d}} \geq 0$, with $\mu_{\mathbf{o}\mathbf{o}} = 0$. The lifetime utility of a household of type h in $\mathbf{o}$ at time t is

$$v_{\mathbf{o},t}^h = \log(W_{\mathbf{o},t}^h) + \max_{\mathbf{d} \in \mathcal{S}_h} \left\{ \delta \mathbb{E}(v_{\mathbf{d},t+1}^h) - \mu_{\mathbf{o}\mathbf{d}} + \varepsilon_{\mathbf{o}\mathbf{d},t}^h \right\},$$

¹⁹[Rodríguez-Clare et al. \(2026\)](#) extend [Caliendo et al. \(2019\)](#) by allowing the dispersion of preferences that governs mobility across sectors within a region to differ from the one that governs mobility across regions. Distinguishing the two margins matters here because spouses must live in the same location but can work in different sectors. When $\nu = \theta$, equation (17) reduces to the product of independent Gumbel distributions with scale θ , which recovers CDP's specification.

²⁰Strictly speaking, ν and θ are not elasticities but measures of how dispersed preferences are. The more dispersed preferences are, the less households' choices respond to differences in the value of their options. The inverses, $1/\nu$ and $1/\theta$, give roughly the percentage increase in the share of households choosing an option when its value rises by one unit of log utility, so they are semi-elasticities ([Appendix B.1](#)).

where $W_{\mathbf{o},t}^h$ denotes the period- t indirect utility of household type h in $\mathbf{o}$. For single men and single women, the indirect utility corresponds to $W_{\mathbf{o},t}^{s_m} = w_{i,k,t}^M/P_{i,t}$ and $W_{\mathbf{o},t}^{s_f} = w_{i,k,t}^F/P_{i,t}$.²¹ For couples, $W_{\mathbf{o},t}^c$ also depends on the wife's market-work decision, as I describe below.

Let $V_{\mathbf{o},t}^h \equiv \mathbb{E}(v_{\mathbf{o},t}^h)$. Then, using the properties of the nested Gumbel distribution (Appendix B.1), I write the value function as

$$V_{\mathbf{o},t}^h = \log(W_{\mathbf{o},t}^h) + \theta \log \left(\sum_{\ell=1}^L \left(\sum_{\mathbf{z} \in \mathcal{S}_h(\ell)} \exp [\delta V_{\mathbf{z},t+1}^h - \mu_{\mathbf{o}\mathbf{z}}]^{1/\nu} \right)^{\nu/\theta} \right). \quad (18)$$

I decompose the choice probability into a location choice and a conditional sector choice. Intuitively, a household first compares locations based on the value each location offers, then chooses a sector within the chosen location. The value of the sectors that location j offers is summarized by

$$\Omega_{\mathbf{o}j,t}^h \equiv \sum_{\mathbf{z} \in \mathcal{S}_h(j)} \exp [\delta V_{\mathbf{z},t+1}^h - \mu_{\mathbf{o}\mathbf{z}}]^{1/\nu}.$$

The share of type- h households in origin $\mathbf{o}$ that choose location j is

$$\lambda_{\mathbf{o}j,t}^h = \frac{(\Omega_{\mathbf{o}j,t}^h)^{\nu/\theta}}{\sum_{\ell=1}^L (\Omega_{\mathbf{o}\ell,t}^h)^{\nu/\theta}}. \quad (19)$$

Conditional on choosing location j , the share of type- h households in origin $\mathbf{o}$ that choose destination $\mathbf{d} \in \mathcal{S}_h(j)$ is

$$\lambda_{\mathbf{o}\mathbf{d}|j,t}^h = \frac{\exp [\delta V_{\mathbf{d},t+1}^h - \mu_{\mathbf{o}\mathbf{d}}]^{1/\nu}}{\Omega_{\mathbf{o}j,t}^h}. \quad (20)$$

The unconditional share of type- h households in origin $\mathbf{o}$ that choose destination $\mathbf{d} \in \mathcal{S}_h(j)$ is therefore

$$\lambda_{\mathbf{o}\mathbf{d},t}^h = \lambda_{\mathbf{o}\mathbf{d}|j,t}^h \lambda_{\mathbf{o}j,t}^h. \quad (21)$$

These choice probabilities show that a negative sectoral productivity shock pushes households out of the region-sector pairs it hits, as happens to exposed workers during the China Trade Shock (Fact 1). A fall in $A_{i,k,t}$ lowers the wages paid in sector k of region i and, in turn, the value of every destination $\mathbf{d}$ that includes sector k in region i . Because staying is now worth less, more households in these origins leave by moving to another sector, including non-employment, to another location, or both.

When men and women work in different sectors, the same shock changes their wages

²¹This is the same as CDP's indirect utility, but allowing for gender-specific wages.

differently. Within a region-sector pair and for a given level of employment, a change in $A_{i,k,t}$ moves men's and women's wages in the same proportion, through the wage index $\bar{w}_{i,k,t}$ in equation (13). Across sectors, however, if men and women are distributed differently, the shock changes their average wages differently. As a result, two spouses who work in different sectors experience different wage changes, and a couple's response, described next, depends on which spouse's sector the shock hits.

Couples' consumption and wives' participation choices. After choosing its destination, a couple jointly decides how to spend household income and whether the wife works in the market or stays at home, based on the spouses' wages and a home-production productivity draw.

Each couple draws an independently and identically distributed home-production productivity shock $\beta \sim \text{Pareto}(\chi, \kappa)$, with support $\beta \geq \chi > 0$ and shape parameter $\kappa > 0$.²² The couple then jointly chooses each spouse's private consumption, $c_{d,f,t}$ and $c_{d,m,t}$, expenditure on the household public good, $b_{d,t}$, and whether the wife stays at home, $\mathcal{H}_{d,t} \in \{0, 1\}$, with $\mathcal{H}_{d,t} = 1$ if she stays at home and $\mathcal{H}_{d,t} = 0$ if she works in the market.²³ When the wife stays at home, the productivity shock increases the effective level of the household public good, $B_{d,t} = \beta^{\mathcal{H}_{d,t}} b_{d,t}$. The wife's home production therefore acts as a multiplier on the public good the household buys.

The public good $B_{d,t}$ captures the economies of scale that couples obtain from living together. A good is public within the household when it is *non-rival*: one spouse's consumption does not reduce what is available to the other, so both spouses consume the full quantity the household buys, like housing or heating (Browning et al., 2014). Two singles who live apart must each pay for their own housing, whereas a couple pays for it once and both spouses enjoy it.²⁴ Because both spouses value the public good, pooling income always makes a couple potentially better off than the two spouses living apart. The couple can replicate each spouse's private consumption as a single, buy the larger of the two amounts of the public good the spouses would have bought alone, and still have income left over. As a result, a given standard of living costs less per person in a couple than for an individual.

²²The home-production productivity shock captures the non-monetary value generated when the wife engages in home production (Becker, 1965).

²³The model abstracts from the intensive margin of the wife's labor supply: the wife either participates in market work or does not. This restriction appears empirically innocuous because, alongside the participation responses documented in Fact 3, wives' hours exhibit no statistically significant response to either spouse's exposure.

²⁴Singles have the same preferences over private consumption and the household good as spouses, $\gamma \log B + (1 - \gamma) \log c$, but do not share B with a spouse. Their indirect utility is therefore $\log(w/P)$ up to the constant $\gamma \log \gamma + (1 - \gamma) \log(1 - \gamma)$, which cancels from all welfare changes. This formulation assumes that welfare is comparable across marital statuses; the money-metric index below makes this comparison explicit.

Conditional on choosing destination $\mathbf{d}$, the couple solves

$$\begin{aligned}
& \max_{c_{\mathbf{d},f,t}, c_{\mathbf{d},m,t}, b_{\mathbf{d},t}, \mathcal{H}_{\mathbf{d},t} \in \{0,1\}} (B_{\mathbf{d},t}^\gamma c_{\mathbf{d},f,t}^{1-\gamma})^\alpha (B_{\mathbf{d},t}^\gamma c_{\mathbf{d},m,t}^{1-\gamma})^{1-\alpha} \\
& \text{s.t.} \quad P_{j,t} (c_{\mathbf{d},f,t} + c_{\mathbf{d},m,t} + b_{\mathbf{d},t}) = \underbrace{w_{j,n_m,t}^M + w_{j,n_f,t}^F (1 - \mathcal{H}_{\mathbf{d},t})}_{I(\mathcal{H})}, \\
& B_{\mathbf{d},t} = \beta^{\mathcal{H}_{\mathbf{d},t}} b_{\mathbf{d},t},
\end{aligned} \tag{22}$$

where $\alpha \in (0,1)$ is the wife's bargaining weight and $\gamma \in (0,1)$ is the expenditure share on the public good.²⁵ The parameter γ governs the size of the economies of scale from marriage: the larger the share of income spent on the public good, the larger the gain from sharing it. Home production adds to this gain, because when the wife stays at home, her home productivity β raises the effective quantity of the public good, $B_{\mathbf{d},t}$, that both spouses enjoy.²⁶ The couple buys both private consumption and the market input of the public good, $b_{\mathbf{d},t}$, as the regional consumption good at price $P_{j,t}$, so both enter goods-market clearing in the equilibrium below.

Following Chiappori and Mazzocco (2017), I solve the couple's problem sequentially and obtain the optimal allocations for private and public consumption, conditional on $\mathbf{d}$ and $\mathcal{H}_{\mathbf{d},t}$,

$$\begin{aligned}
c_{\mathbf{d},f,t}^*(\mathcal{H}) &= \alpha(1-\gamma) \frac{I(\mathcal{H})}{P_{j,t}}, \\
c_{\mathbf{d},m,t}^*(\mathcal{H}) &= (1-\alpha)(1-\gamma) \frac{I(\mathcal{H})}{P_{j,t}}, \\
b_{\mathbf{d},t}^*(\mathcal{H}) &= \gamma \frac{I(\mathcal{H})}{P_{j,t}} \implies B_{\mathbf{d},t}^*(\mathcal{H}) = \beta^{\mathcal{H}} \gamma \frac{I(\mathcal{H})}{P_{j,t}}
\end{aligned} \tag{23}$$

The couple has the wife work in the market when the gain in household income from her earnings outweighs the gain in the household public good from her home production. To find the decision rule for $\mathcal{H}_{\mathbf{d},t}$, define the relative wage r faced by a couple in $\mathbf{d}$ as

$$r_{\mathbf{d},t} \equiv \frac{w_{j,n_f,t}^F}{w_{j,n_m,t}^M}.$$

The couple's indirect utility conditional on choosing $\mathbf{d}$ and drawing β in period t is

$$\mathcal{U}_{\mathbf{d},t}(\beta) = \mathcal{A} \frac{w_{j,n_m,t}^M}{P_{j,t}} \begin{cases} (1 + r_{\mathbf{d},t}) & \text{if } \mathcal{H}_{\mathbf{d},t} = 0 \text{ (wife works in the market)} \\ \beta^\gamma & \text{if } \mathcal{H}_{\mathbf{d},t} = 1 \text{ (wife works at home)}, \end{cases}$$

²⁵The model holds α fixed, thereby ruling out negotiation of intra-household bargaining power.

²⁶Section IV.1 and Appendix E.1 describe the calibration process for α , the public-good expenditure share γ , and the scale and shape of the home-production shock, χ and κ , respectively.

where $\mathcal{A} \equiv \alpha^{\alpha(1-\gamma)}(1-\alpha)^{(1-\alpha)(1-\gamma)}\gamma^\gamma(1-\gamma)^{1-\gamma}$ collects constants. Hence, she works if and only if

$$\begin{aligned} \mathcal{U}_{d,t}(\mathcal{H}_{d,t} = 1) &< \mathcal{U}_{d,t}(\mathcal{H}_{d,t} = 0) \\ \iff \beta &< (1 + r_{d,t})^{1/\gamma}, \end{aligned} \quad (24)$$

which implies that the value of β such that the couple is indifferent between the wife working at home and at the market is $\beta_{d,t}^* = (1 + r_{d,t})^{1/\gamma}$. Working raises household income by the factor $1 + r_{d,t}$, whereas staying at home raises the effective public good by the factor β , which enters utility with weight γ . The wife therefore stays at home only when her home productivity is high relative to the income gain from her working. Thus, the probability that the wife works in the market conditional on destination $\mathbf{d}$, denoted by $\rho_{d,t}$, is²⁷

$$\rho_{d,t} \equiv \Pr(\mathcal{H}_{d,t} = 0) = 1 - \left(\frac{\chi}{\beta_{d,t}^*} \right)^\kappa = 1 - \chi^\kappa (1 + r_{d,t})^{-\kappa/\gamma}. \quad (25)$$

This probability's response to the relative wage explains why wives' participation falls when they are directly exposed and rises when their husbands are exposed (Fact 3).

Proposition 1. *The probability that the wife works in the market rises with the relative wage:*

$$\frac{\partial \rho}{\partial r} = \frac{\kappa}{\gamma} \cdot \frac{1 - \rho}{1 + r} > 0. \quad (26)$$

The relative wage, rather than each wage separately, determines whether the wife works, because the husband's wage raises the value of both options in the same proportion. When she works, her earnings add to his, so the gain in household income is her wage relative to his. When she stays at home, her home production scales up the public good, which the couple buys in proportion to household income and hence to his wage. A higher wage for the wife relative to her husband's therefore raises the opportunity cost of staying home. The threshold β^* rises, and some draws that used to justify staying home no longer do, so more couples have the wife work. A decline in the husband's sectoral wage raises $r_{d,t}$ and leads more couples to have the wife enter market work, whereas a decline in the wife's own sectoral wage lowers $r_{d,t}$ and has the opposite effect, as in the data.

Because the couple chooses its destination before drawing β , it values each destination by

²⁷To avoid corner solutions in the couple's problem, I require $0 < \rho_{d,t} < 1$. The upper bound, $\rho_{d,t} < 1$, holds for any $\chi > 0$, whereas the lower bound, $\rho_{d,t} > 0$, requires χ to lie below the market-work threshold, i.e., $\chi < (1 + r_{d,t})^{1/\gamma}$. Moreover, because the home-production productivity shock enters the couple's problem as $B_{d,t} = \beta^{\mathcal{H}_{d,t}} b_{d,t}$, the model requires $\chi \geq 1$, ensuring that staying at home never reduces the effective level of the public good. For this condition to hold for every destination and period, the relevant restriction is $1 \leq \chi < \min_{d,t} (1 + r_{d,t})^{1/\gamma}$.

integrating over β . Given the wife's labor-supply rule in equation (24), the ex ante expected utility from choosing $\mathbf{d}$ at time t is²⁸

$$\begin{aligned} W_{\mathbf{d},t}^c &\equiv \mathbb{E}[\mathcal{U}_{\mathbf{d},t}(\beta)] = \mathcal{A} \frac{w_{j,n_m,t}^M}{P_{j,t}} \left[(1 + r_{\mathbf{d},t}) F_{\beta}(\beta_{\mathbf{d},t}^*) + \int_{\beta_{\mathbf{d},t}^*}^{\infty} \beta^{\gamma} f_{\beta}(\beta) d\beta \right] \\ &= \mathcal{A} \frac{w_{j,n_m,t}^M}{P_{j,t}} \cdot \underbrace{\chi^{\gamma} (1 - \rho_{\mathbf{d},t})^{-\gamma/\kappa} \frac{\kappa/\gamma - \rho_{\mathbf{d},t}}{\kappa/\gamma - 1}}_{\Phi_{\mathbf{d},t}}. \end{aligned}$$

where F_{β} and f_{β} denote the cumulative distribution and density functions of β . The first term is the payoff when the wife works, weighted by the probability that β falls below the threshold, $F_{\beta}(\beta_{\mathbf{d},t}^*) = \rho_{\mathbf{d},t}$. The second term is the payoff when she stays at home, averaged over the draws above the threshold.

Conditional on choosing $\mathbf{d}$, the couple's payoff therefore combines the husband's sector-specific wage with the expected gain from the wife's labor-supply decision, summarized by $\Phi_{\mathbf{d},t}$. Because the couple picks the better of the two options once β is drawn, $\Phi_{\mathbf{d},t}$ has a simple interpretation:

$$\Phi_{\mathbf{d},t} = \mathbb{E}[\max\{1 + r_{\mathbf{d},t}, \beta^{\gamma}\}].$$

$\Phi_{\mathbf{d},t}$ measures the couple's payoff in units of the husband's wage. When the wife works, household income is her wage plus his, which is $1 + r_{\mathbf{d},t}$ times his wage. When she stays at home, her home production scales up the public good by β^{γ} . $\Phi_{\mathbf{d},t}$ is then the value of the wife's participation option, the expected value of the better of these two options, and it rises when her wage increases more than her husband's.

Even holding wages and prices fixed, the two spouses' wages enter the couple's location choice asymmetrically, which helps explain why couples out-migrate only when the husband is exposed (Fact 2). The husband's wage scales the couple's entire payoff, whereas the wife's wage matters only when she works, and even then it is only part of household income.

Proposition 2. *Let $e_{\mathbf{d},t}^F$ and $e_{\mathbf{d},t}^M$ denote the elasticities of the couple's payoff, $W_{\mathbf{d},t}^c$, with respect to the wife's and the husband's wages. Then*

$$e_{\mathbf{d},t}^F = \frac{\rho_{\mathbf{d},t} r_{\mathbf{d},t}}{\Phi_{\mathbf{d},t}} \leq \frac{\rho_{\mathbf{d},t} r_{\mathbf{d},t}}{1 + r_{\mathbf{d},t}}, \quad e_{\mathbf{d},t}^M = 1 - e_{\mathbf{d},t}^F.$$

A sufficient condition for $e_{\mathbf{d},t}^F < e_{\mathbf{d},t}^M$ is $r_{\mathbf{d},t} < 1$. That is, if the wife earns less than her husband, a decline in his wage lowers the couple's payoff in a location by a larger percentage than the same percentage decline in hers.

²⁸For $W_{\mathbf{d},t}^c$ to be finite, I require $\kappa > \gamma$.

Collecting the three household types, the indirect utility relevant for household h 's dynamic problem in equation (18) is

$$W_{o,t}^h = \begin{cases} \frac{w_{i,k,t}^M}{P_{i,t}} & \text{if } h = s_m \\ \frac{w_{i,k,t}^F}{P_{i,t}} & \text{if } h = s_f \\ \frac{\mathcal{A} \cdot \Phi_{o,t} \cdot w_{i,k_m,t}^M}{P_{i,t}} & \text{if } h = c. \end{cases} \quad (27)$$

Here, $P_{i,t}$ denotes the regional aggregate consumption price index defined in equation (15).

III.3 Equilibrium

The economic geography at time t , denoted by Γ_t , consists of the time-varying exogenous sectoral productivities and the time-invariant shares of single individuals born in each region, migration costs, iceberg trade costs, and home production in the non-employment sector: $\Gamma_t = \{A_{i,k,t}, \bar{s}_i, \mu_{od}, \tau_{ij,k}, y_j\}_{i,j=1, k=1}^{L,K}$. I collect the remaining time-invariant parameters in the vector $\bar{\Gamma} = \{N, L, K, \delta, \chi, \kappa, \alpha, \gamma, \sigma, \nu, \theta, \{\psi_{k,m}, \psi_{k,f}, \eta_k, \iota_k\}_{k=1}^K\}$.

Let $N_{d,t}^{sm}$ and $N_{d,t}^{sf}$ denote, respectively, the masses of single men and single women living in location j and working in sector $n \in \{0, \dots, K\}$ at time t . Let $N_{d,t}^c$ denote the mass of couples living in location j in which the husband is in sector $n_m \in \{0, \dots, K\}$ and the wife's sector is $n_f \in \{1, \dots, K\}$. Labor markets clear when the male and female labor that firms demand in each productive sector $n = 1, \dots, K$, given by equations (11) and (12), equals the labor that households supply:

$$M_{j,n,t} = N_{j,n,t}^{sm} + \sum_{n_f=1}^K N_{j,n,n_f,t}^c, \quad F_{j,n,t} = N_{j,n,t}^{sf} + \sum_{n_m=0}^K \rho_{j,n_m,n,t} N_{j,n_m,n,t}^c. \quad (28)$$

Male labor supply in sector n sums over the wife's sector, whereas female labor supply in sector n sums over the husband's sector and weights each sector pair by the wife's probability of participation. Thus, male labor supply responds to wages only through location and sector choices, which include non-employment, whereas female labor supply also responds through married women's participation.

Let $N_t = \left\{ \{N_{d,t}^{sm}\}, \{N_{d,t}^{sf}\}, \{N_{d,t}^c\} \right\}$ denote the complete distribution of household masses across locations and sectors at time t . Because the problems of intermediate-good firms, final-good firms, and married women's labor supply are static, I define the *temporary equilibrium* as follows.

Definition 1. Given $(N_t, \Gamma_t, \bar{\Gamma})$, a **temporary equilibrium** is a vector of productive-sector wages $\{\bar{w}_{j,n,t}, w_{j,n,t}^M, w_{j,n,t}^F\}$ such that, for every productive region-sector pair jn and period t :

- (i) The wage index satisfies (10);

(ii) Male and female labor markets clear, (28), with labor demands given by (11)–(12) and participation probabilities by (25);

(iii) Goods markets clear under balanced trade, $p_{i,k,t}Y_{i,k,t} = \sum_{j=1}^L \pi_{ij,k,t} \iota_k P_{j,t} Q_{j,t}$, where each region spends its labor income, $P_{j,t} Q_{j,t} = \sum_{n=1}^K (w_{j,n,t}^M M_{j,n,t} + w_{j,n,t}^F F_{j,n,t})$.

Given these wages, prices and trade shares follow from equations (14) and (15).

Given the path of exogenous fundamentals and an initial distribution of households across locations and sectors, denoted by $N_0 = \{\{N_{o,0}^{sm}\}, \{N_{o,0}^{sf}\}, \{N_{o,0}^c\}\}$, I define the model's *sequential competitive equilibrium*. Using the two-stage choice probabilities in equations (19) and (20), the population of each household type evolves according to

$$N_{d,t+1}^h = \sum_{o \in S_h} \lambda_{od|j,t}^h \lambda_{oj,t}^h N_{o,t}^h, \quad d \in S_h(j), \quad \forall h. \quad (29)$$

Definition 2. Given $(N_0, \Gamma_t, \bar{\Gamma})$, a **sequential competitive equilibrium** is a sequence of household distributions $\{N_t\}_{t=0}^\infty$, values $\{V_{o,t}^h\}_{t=0}^\infty$, and productive-sector wages $\{\bar{w}_{j,n,t}, w_{j,n,t}^M, w_{j,n,t}^F\}_{t=0}^\infty$ such that, in each period t :

- (i) Given N_t , wages form a temporary equilibrium;
- (ii) Values satisfy (18), with location and sector choice probabilities given by (19) and (20);
- (iii) The distribution of households evolves according to (29).

III.4 Welfare Analysis of a Sectoral Productivity Shock

To measure the welfare effect of a sectoral productivity shock, I first write each household's lifetime utility in terms of two objects the model delivers every period: its real income and the probability that it stays in its current location and sector. Combining equation (18) with $\mu_{oo} = 0$, the expected lifetime utility of household type h in origin o at time t is

$$\begin{aligned} V_{o,t}^h &= \log(W_{o,t}^h) + \delta V_{o,t+1}^h - \theta \log(\lambda_{oi,t}^h) - \nu \log(\lambda_{oo|i,t}^h) \\ &= \sum_{s=t}^{\infty} \delta^{s-t} \log \left(\frac{W_{o,s}^h}{(\lambda_{oi,s}^h)^\theta (\lambda_{oo|i,s}^h)^\nu} \right). \end{aligned} \quad (30)$$

Here, $\lambda_{oi,t}^h$ denotes the probability of remaining in the origin location, and $\lambda_{oo|i,t}^h$ denotes the probability of remaining in the origin sector, conditional on remaining in the origin location. Appendix B.1 derives this recursion.

To measure the welfare effect of a sectoral productivity shock, I compare two economies that differ only in the path of sectoral productivities from $t = 1$ on. I call the economy with

the new path, $\{A'_{j,n,t}\}_{t \geq 1}$, the *with-shock economy*, and the economy with the original path, $\{A_{j,n,t}\}_{t \geq 1}$, the *no-shock economy*. Following CDP, I assume that the change is unanticipated at $t = 0$ and that households fully learn the new productivity path at $t = 1$. Let x denote the value of a given variable in the no-shock economy and x' the value of the same variable in the with-shock economy. Because households do not anticipate the shock, they make their choices at $t = 0$, including where to move, expecting the original path, so every variable at $t = 0$ takes the same value in both economies, $x_{t=0} = x'_{t=0}$.

Let $\dot{x}_{t+1} \equiv x_{t+1}/x_t$, and $\hat{x}_{t+1} = \dot{x}'_{t+1}/\dot{x}_{t+1}$ denote the ratio of changes over time in the with-shock and no-shock equilibria.²⁹ Using this notation, I compute expected lifetime utility in the no-shock economy, $V_{o,0}^h$, and in the with-shock economy, $V_{o,0}'^h$. I define the consumption compensating variation for household type h in origin $\mathbf{o}$ at time $t = 0$, denoted by $\zeta_{\mathbf{o}}^h$, implicitly by

$$V_{o,0}'^h = V_{o,0}^h + \sum_{s=0}^{\infty} \delta^s \log(\zeta_{\mathbf{o}}^h) \iff \log(\zeta_{\mathbf{o}}^h) = (1 - \delta)(V_{o,0}'^h - V_{o,0}^h).$$

Substituting equation (30) for both economies into this definition, the terms at $t = 0$ cancel, and the welfare change in consumption-equivalent units depends only on the changes from $t = 1$ on:

$$Z_{\mathbf{o}}^h \equiv \log(\zeta_{\mathbf{o}}^h) = \sum_{s=1}^{\infty} \delta^s \log \left(\frac{\hat{W}_{\mathbf{o},s}^h}{\left(\hat{\lambda}_{\mathbf{o}i,s}^h\right)^{\theta} \left(\hat{\lambda}_{\mathbf{o}\mathbf{o}|i,s}^h\right)^{\nu}} \right), \quad (31)$$

where

$$\hat{W}_{\mathbf{o},s}^h = \begin{cases} \hat{w}_{i,k_m,s}^M / \hat{P}_{i,s} & \text{if } \mathbf{o} = (i, k_m), h = s_m, \\ \hat{w}_{i,k_f,s}^F / \hat{P}_{i,s} & \text{if } \mathbf{o} = (i, k_f), h = s_f, \\ \hat{\Phi}_{\mathbf{o},s} \hat{w}_{i,k_m,s}^M / \hat{P}_{i,s} & \text{if } \mathbf{o} = (i, k_m, k_f), h = c. \end{cases}$$

Appendix B.1 derives this expression in detail.

Equation (31) expresses the welfare change in terms of changes in real income, which for couples include the change in the value of the wife's participation option, $\hat{\Phi}_{\mathbf{o},s}$, and changes in the option value of moving, captured by the staying probabilities. The staying probabilities matter because a lower probability of staying indicates that a household's options elsewhere have improved relative to its origin, raising its welfare even if it ultimately stays. Conditional on the observed staying shares, a larger θ increases the welfare weight assigned to changes in the probability of remaining in the origin location. Similarly, a larger ν increases the

²⁹See Appendix D for the full derivation of the model in Dynamic Hat Algebra.

weight assigned to changes in the probability of remaining in the origin sector conditional on staying in that location.

To aggregate equation (31) across household types, I need everyone's welfare in the same units. Proportional changes are already comparable, since a 1% welfare gain represents the same change in utility for a spouse and a single person. Welfare levels are not, because economies of scale within marriage let a couple's income buy more than the same income spent by a single person, as explained above. Levels matter for the aggregate because the same proportional gain is a larger gain for a person who is better off. Following [Chiappori and Meghir \(2015\)](#), I therefore construct a Money Metric Welfare Index (MMWI) for singles and couples.

The MMWI converts each spouse's utility into the income a single person would need to achieve that utility. The key difference between a spouse and a single is the price each pays for the public good. A single pays the full market price for the public good, so the MMWI of a single is simply the wage, w . A spouse pays only a share of the public good's price equal to their bargaining weight, because the other spouse pays the rest and both enjoy all of it. When the wife stays at home, her home production further lowers this price. The MMWIs of the wife and the husband, denoted by m_f and m_m , are

$$m_f = \alpha^{1-\gamma} \beta^{\mathcal{H}\gamma} I(\mathcal{H}), \quad m_m = (1 - \alpha)^{1-\gamma} \beta^{\mathcal{H}\gamma} I(\mathcal{H}). \quad (32)$$

Appendix B.2 derives the construction of the index step by step.

The two spouses' MMWIs add up to more than the household's income, which is how the economies of scale appear in income terms. Summing across spouses, $m_f + m_m = (\alpha^{1-\gamma} + (1 - \alpha)^{1-\gamma}) \beta^{\mathcal{H}\gamma} I(\mathcal{H})$, where $\alpha^{1-\gamma} + (1 - \alpha)^{1-\gamma} > 1$. Thus, the spouses would need more income than the household has if each had to purchase the public good separately.

With these indices, I measure the aggregate welfare effect of the shock by weighting each person's welfare change by their MMWI before the shock,

$$\bar{Z} = \frac{\sum_i m_{i,0} Z_i}{\sum_i m_{i,0}}, \quad (33)$$

where i indexes individuals, Z_i is the welfare change in equation (31) for person i 's household type and origin, and $m_{i,0}$ is their MMWI at $t = 0$.³⁰ Both spouses in a couple share the couple's welfare change, but each counts with their own index. The aggregate therefore sums gains in income terms and is larger when gains go to people with larger indices.

The couple's problem and equation (31) show that the household, not the individual, determines how a sectoral shock is absorbed. A shock to either spouse's sector changes how

³⁰Because couples choose their destination before β is realized, I use the ex ante indices, $\bar{m}_f$ and $\bar{m}_m$, developed in Appendix B.2.

the couple jointly decides where to live and whether the wife works. A couple weighs the husband’s wage more when deciding where to live (Proposition 2) and adjusts the wife’s participation when either spouse’s wage changes (Proposition 1). The shock also affects people whose own jobs were never exposed. A spouse is affected when the other spouse’s job is hit because both share the couple’s payoff, and when wives enter the labor market, they change the wages of the workers they compete with. These mechanisms apply to any local shock, but who gains and who loses from it depends on which sectors it hits. The next section brings the model to the data, calibrating it to the US economy in 2000 and to the China Trade Shock. Section V then uses the model to quantify how couples change the economy’s adjustment to the shock and its distributional impacts.

IV. Bringing the Model to the Data

I now take the full quantitative model to the data to simulate the China Trade Shock. The model economy comprises 50 US states, 37 foreign trade partners, and 22 productive sectors, plus a non-employment sector.³¹ Each period is a quarter, and the economy starts in 2000Q1, which I match to the US economy in the 2000 Census: where households live, in which sectors they work, and how many married women participate in the market. I then solve the model for 200 quarters.

IV.1 Calibrating the Couple’s Problem

My model has four new parameters, all in the couple’s problem: the wife’s weight in the household objective, α ; the public-good expenditure share, γ ; and the lower bound and shape of the home-production shock, χ and κ . I discipline each with a distinct piece of variation. With Cobb–Douglas utility, the couple spends a constant share γ of its income on the public good and divides the rest between the wife and the husband in proportions α and $1 - \alpha$, so I calibrate both parameters to household expenditure shares. Whether the couple has the wife work depends instead on the spouses’ relative wage, through a rule whose slope in logs is κ/γ (equation (25)). I map this slope to the response of wives’ participation to their husbands’ exposure to the China Trade Shock (Fact 3). Given the slope, I calibrate χ internally to match married women’s participation rate in the 2000 Census. Table 4 summarizes the resulting values, and Appendix E.1 describes the construction in detail and compares the

³¹The foreign trade partners are China, 35 other countries in the World Input-Output Database, and a constructed Rest of the World. The productive sectors are 12 manufacturing sectors, wholesale and retail trade, construction, and 8 service sectors. This is CDP’s geography and sectoral partition (Caliendo et al., 2019).

values with those in the previous literature.

I measure the expenditure shares that pin down α and γ in couples' spending in the 2000–2007 Consumer Expenditure Interview Survey. The public-good share γ is the share of total spending that goes to market inputs into home production. The wife's weight α is her share of the couple's private consumption. The survey assigns only one private good by gender: adult apparel. But women spend more on apparel than men, so a wife's share of the couple's apparel spending overstates her share of the couple's resources. Following [Browning et al. \(2013\)](#), I correct for this by comparing single men and women with the same resources. A couple's apparel spending then reveals how it divides its resources between the spouses, and I set α to the wife's share.³² The resulting values are $\alpha = 0.47$ and $\gamma = 0.49$.

I calibrate κ and χ using the couple's rule for whether the wife works, equation (25). Writing it in terms of the probability that she stays at home and taking logs gives a relation that is linear in $\log(1 + r)$:

$$\log(1 - \rho(r)) = \underbrace{\kappa \log \chi}_{\text{intercept}} - \underbrace{(\kappa/\gamma)}_{\text{slope}} \log(1 + r). \quad (34)$$

Its slope pins down κ/γ , and given κ , its intercept pins down χ . Estimating the slope directly from the data has two problems. First, the relative wage r a couple faces is an equilibrium outcome, so it is endogenous. Second, I observe changes in relative wages only for couples in which the wife works, which creates a truncation problem.

To address the endogeneity of r , I use the variation behind Fact 3, the husband's exposure to the China Trade Shock in the PSID. When the husband is exposed, the shock lowers his wage much more than hers (Table E.1), so the couple's decision about whether she works responds to the change in their relative wage r . In the model, this is the only channel: any effect of the husband's lower earnings on the wife's participation works through r , which is the exclusion restriction behind equation (34). Equation (34) is linear, so I identify its slope with the following Wald ratio, measuring both changes within the same empirical experiment:

$$\frac{\kappa}{\gamma} = - \frac{\Delta \log(1 - \rho)}{\Delta \log(1 + r)}.$$

The Wald ratio also addresses truncation, because I estimate the participation response on all couples and the change in relative wages only on spouses who earn wages, so I never need the wage of a wife who does not work. The resulting values are $\kappa/\gamma = 4.44$ and, with $\gamma = 0.49$, $\kappa = 2.17$.³³ Conditional on κ/γ , I calibrate χ internally so that the model matches

³²Without this correction, the raw apparel share, 0.60, would give the wife the larger weight.

³³Wives of exposed husbands raise their labor force participation by 4.2 p.p. from a baseline of 0.78 (Panel

the participation rate of married women in the 2000 Census, 0.621, among couples in which the husband is employed, which yields $\chi = 1.92$.³⁴

The calibrated parameters imply that married women’s participation responds roughly one-for-one to their own wage, holding the husband’s wage fixed. Differentiating ρ with respect to the wife’s wage gives

$$e = \frac{\partial \log \rho}{\partial \log w_f} = \frac{\kappa}{\gamma} \cdot \frac{1 - \rho}{\rho} \cdot \frac{r}{1 + r}.$$

At the calibration target, $\rho_{t=0} = 0.621$, and at the relative wage at which equation (25) delivers that rate, $r_{t=0} = 0.71$, this elasticity is 1.12. The same κ/γ implies an elasticity of 0.47 in the PSID sample, where 78% of wives participate. The model’s wives are more responsive because more of them are out of the labor force in the 2000 US Census.³⁵ Wives in the model are also about twice as responsive to their own wage as single women are (Appendix F.4).

Table 4: Calibrated Couple’s Parameters

Object	Name	Value
α	Wife’s weight in the household objective	0.47
γ	Public-good expenditure share	0.49
κ/γ	Slope of the participation rule	4.44
κ	Pareto shape parameter for home productivity	2.17
χ	Pareto lower bound for home productivity	1.92

Notes. See Appendix E for details.

IV.2 The Rest of the Economy

Parameters. The model features ν , which governs the dispersion of preferences across sectors within a location (equation (20)), and θ , which governs their dispersion across locations (equation (19)). The larger a dispersion parameter, the more choices are driven by idiosyncratic preferences and the less they respond to differences in continuation values.

B of Table 3), and the husband’s exposure raises r by 12.2 log points (Table E.1). Appendix E.1 details the construction.

³⁴I exclude couples in which the husband is not employed because the model misses their participation. It predicts that these wives work more, because their husbands’ home production is low relative to any market wage, whereas in the data they work less, reflecting assortative matching in the marriage market (Appendix E.1).

³⁵The PSID value lies within the participation elasticities of 0.1 to 0.6 surveyed by Blundell and MaCurdy (1999), and the model’s value lies within their range for married women’s hours, from -0.01 to 2.03 .

I set ν to 5.34, the quarterly value estimated by CDP.³⁶ The response of population to import competition pins down θ , because, given ν , θ determines how much a state’s population responds when the value of living there changes. Autor et al. (2013) estimate that a \$1,000 increase in import exposure per worker lowers the working-age population of a commuting zone by 0.050 p.p. Following Rodríguez-Clare et al. (2026), I calibrate θ by indirect inference: I estimate the same regression on model-generated state-level data and choose θ so the two coefficients match.³⁷ The calibrated value, $\theta = 10.67$, yields a coefficient of -0.051 . Because $\nu < \theta$, households substitute more across sectors within a location than across locations.

I take the remaining parameters from the literature. I set the discount factor to $\delta = 0.99$, the standard quarterly value, take the sectoral trade elasticities $\{\eta_n\}$ from Caliendo and Parro (2015), and take the within-sector elasticity of substitution between male and female labor, $\sigma = 1.4$, from Acemoglu et al. (2004).³⁸

Observed inputs. I solve the model with dynamic hat algebra (Caliendo et al., 2019), which expresses the equilibrium in changes relative to the economy’s observed allocations (Appendix D). The method therefore never requires fundamental levels, such as productivities or mobility costs, so I use only observed allocations as inputs. Bilateral trade shares, output, and expenditure come from the World Input-Output Database for countries, and from the 2002 Commodity Flow Survey and the Bureau of Economic Analysis for US states. I measure household inputs, including the migration shares of each household type, using the 5% IPUMS Census 2000, the American Community Survey for 2001–2007, and the Current Population Survey. Table E.2 lists every input and its source, and Appendix E.2 describes how I build each input.

Quantifying the China Trade Shock. I represent the China Trade Shock as an increase in total factor productivity in *Chinese* manufacturing sectors (Caliendo et al., 2019). I calibrate the path of Chinese sectoral productivity over 2000–2007 so the model’s growth

³⁶Following Artuc et al. (2010), CDP estimate ν from sectoral transitions among men in the March CPS from 1975 to 2000. Because the CPS drops respondents who change residence, these transitions come only from workers who switch sectors without changing location, which is precisely the choice that ν governs in equation (20). I use the same ν for all household types, so any difference in how singles and couples switch sectors comes from the couple’s problem rather than from an assumed elasticity.

³⁷I estimate the regression on the 48 states in the sample of Autor et al. (2013), predicting state exposure with their instrument and rescaling it to the units of their commuting-zone measure.

³⁸I use 1.4, the lower bound of their estimated range, because the cohorts in their study were almost entirely retired by 2000Q1, when the quantitative model begins. Since then, as more women entered the labor force, they specialized in occupations where they had a comparative advantage, so men and women sort differently across occupations and are less substitutable within a sector (Ngai and Petrongolo, 2017; Cortes et al., 2023; Bhalotra et al., 2025).

in US imports from China matches the growth predicted by the first stage in [Autor et al. \(2013\)](#), which uses Chinese imports in other high-income countries to isolate China-driven productivity growth. After 2007, I hold Chinese productivity constant. I use the 2000–2007 window in [Autor et al. \(2013\)](#) because I calibrate both the shock and the dispersion of preferences across locations to the estimates in that paper, whereas the empirical analysis in Section II follows the 2001–2012 window in [Autor et al. \(2021\)](#). The model therefore defines the shock at the industry level, consistent with the reduced-form evidence in Section II. I quantify the shock by comparing the two economies defined in Section III.4: the *with-shock* economy includes the calibrated growth in Chinese productivity, whereas the *no-shock* economy eliminates it.

All results reported below are differences between the with-shock and no-shock economies. A positive employment effect therefore means that the China Trade Shock increased employment relative to a world without the shock, and a positive welfare effect means that the household type was better off because of it. I call the calibrated model the baseline economy. The counterfactual economies in Section V change the model, not the shock, and I compute the effect of the same shock within each of them.

V. How Couples Shape the Effects of the China Trade Shock

Couples change both how the economy adjusts to the China Trade Shock and its distributional effects. In this section, I first show how the shock affects the economy as a whole and each household type in the baseline economy. I then compare the baseline economy with a counterfactual economy populated only by singles to understand why the shock has these effects and how couples matter for them.

V.1 How the Economy Adjusts to the China Trade Shock

In the calibrated model, the China Trade Shock draws more people into work, moves workers out of manufacturing, and raises welfare for all household types. However, how people adjust and how much they gain depend on their marital status and where they live. I first show how the shock changes employment and how couples adjust, then how the shock changes welfare, and finally how these effects vary across states.

In the long run, the China Trade Shock raises the aggregate employment rate by 0.11 p.p. (Panel A of Table 5). Cheaper Chinese manufactured goods lower the US price index and raise real wages, so working becomes more attractive than staying out of work. Every group

works more, especially single women (Figure F.1b). Non-manufacturing sectors expand, absorbing workers leaving manufacturing and drawing in previously non-employed people. By $t = 199$, the manufacturing share of employment is permanently 0.29 p.p. lower (Figure F.1a), but the service sectors, which grow the most, gain 18% more jobs per capita than manufacturing loses (Figure F.1c).³⁹

Unlike a single individual, who works more simply because real wages rise, a couple responds as a unit, and each spouse adjusts through a different margin. Because the shock hits male-intensive manufacturing, it raises a wife's wage relative to her husband's, so more couples choose to have the wife work (Proposition 1). Married women's participation rises by 0.10 p.p. (Panel A of Table 5). A husband, by contrast, is usually already working, so instead of entering the market, he leaves manufacturing for jobs in other sectors. By $t = 199$, married men fill 53% of the non-manufacturing jobs created by the shock, although they held only 33% of non-manufacturing jobs in 2000Q1.

How a couple adjusts also depends on which spouse is exposed to the shock, because the couple's location follows the husband's job. The husband is usually the main earner, and the wife's wage matters only when she works, so a fall in his wage reduces the couple's location-based income more than a fall in hers (Proposition 2). As a result, the couple moves mainly when he is exposed. As in the second empirical fact, relative to a couple in which neither spouse is exposed, the share of couples that move rises about five times as much when only the husband is exposed as when only the wife is (Panel B of Table 5). By contrast, the wife's participation rises in every type of couple, slightly more when the husband is exposed.

As real wages rise and more people work, the average individual in the US gains an equivalent of a 0.18% increase in consumption. Every type of household gains, but how much depends on whether it is a single man, a single woman, or a couple (Panel A of Table 5). Single women gain the most, 34% more than the average individual, and single men the least. Single women benefit because they work in expanding sectors, rarely work in the 12 manufacturing sectors hit by the shock, and, unlike wives, are not tied to a husband's job or wage. Couples fall in between, but much closer to single men, because the husband is usually the main earner, so the household's income largely depends on his wage.

Because the husband is usually the main earner, his exposure to the shock also matters more for a couple's gain than the wife's (Panel B of Table 5). When his wage falls, the household's total income falls. When hers falls, the couple can fall back on her home production, which absorbs part of the loss. A couple in which neither spouse starts in manufacturing gains the most, about as much as the average individual. When only the wife is exposed,

³⁹Measured as manufacturing jobs per capita, the metric in CDP, the decline is similar in my model and in CDP (−0.21 vs −0.23 p.p.; Table F.1).

the couple’s gain falls by 10%. When only the husband is, it falls by more than twice as much, 22%, and when both are, by 30%.

Table 5: Long-Run Effects of the China Trade Shock

	Share (%)	Manuf. share of employment (p.p.)	Employment rate (p.p.)	Married women’s participation (p.p.)	Migration response (p.p.)	Welfare (% CE)	Welfare relative (%)
<i>Panel A. By household type</i>							
Aggregate	100.0	−0.293	0.112		+0.0166	0.175	—
Single men	11.7	−0.287	0.106		+0.0206	0.157	−10.1
Single women	15.0	−0.188	0.158		+0.0115	0.234	+33.9
Married men	36.7	−0.412	0.096		+0.0259	0.170	−2.9
Married women	36.7	−0.192	0.111	0.101	+0.0053	0.170	−2.9
<i>Panel B. Couples by exposure at $t = 1$</i>							
All couples	100.0			0.101	−0.0066	0.170	−5.5
Neither	76.6			0.100	−0.0109	0.180	—
Wife only	6.6			0.101	−0.0062	0.161	−10.3
Husband only	13.7			0.105	+0.0141	0.140	−22.1
Both in manuf.	3.1			0.103	+0.0078	0.125	−30.4

Notes. Responses at $t = 199$ (with-shock minus no-shock economy), except shares (2000Q1) and welfare. The manufacturing share is in p.p. of employment, and the employment rate is in p.p. of population. The participation response is the change in married women’s quarterly participation rate, in p.p.; I tag a non-working wife by her productive sector. In Panel A, the migration response is the difference between the shares of manufacturing and non-manufacturing workers who have changed state at least once by $t = 199$, in p.p., counting each person once; individuals are tagged by their sector at $t = 1$, married men by the husband’s sector, and married women by the wife’s (potential) sector. In Panel B, couples are tagged by both spouses’ sectors at $t = 1$, and the migration response is the change in the share of couples in the cell that have changed state at least once by $t = 199$, in p.p.; a negative response means that fewer couples change state than in the no-shock economy. Welfare is the money-metric consumption-equivalent gain, weighting each person by their money metric at 2000Q1. Married men and women carry the couple’s welfare, so their gains are equal. Welfare relative is $100 \times (G_g/G - 1)$ relative to the aggregate in Panel A and to couples in which neither spouse starts in manufacturing in Panel B. Blank cells are not defined for the group.

These national averages hide large differences across states, because manufacturing was far from evenly spread. In 2000Q1, manufacturing was concentrated around the Great Lakes, in Indiana, Michigan, Wisconsin, and Ohio, and across a Southern band from Arkansas to the Carolinas. It was much less present in the Mountain West and Florida (Figure 3a). The shock hits the states with the most manufacturing hardest, and people there respond both by leaving and, in couples, by having the wife work. The larger a state’s manufacturing share in

2000Q1, the more people it loses (Figure 3b), and the more married women’s participation rises (Figure 3c), so wives work more in the states losing people.

Welfare gains, however, track where people leave much more closely than where manufacturing was. The four states that lose the most people, Louisiana, Kentucky, Indiana, and Mississippi, are also the four that gain the least (Figures F.3a and F.3c). Only one of them, Indiana, is among the Great Lakes states with the highest manufacturing shares. The link to population is tight because people leave places whose value falls the most, so population losses reveal where the shock’s gains are smallest.⁴⁰

V.2 What Couples Change Relative When Everyone Decides Alone

Modeling couples changes not only who gains from the shock but also how the economy adjusts to it. To show this, I compare the baseline economy with an economy populated only by singles, which I call the all-singles economy, in which I split every couple into two singles.⁴¹ This comparison points to three results. First, with couples, women’s employment responds less to the shock, because a couple decides whether the wife works based on her wage relative to her husband’s. Second, couples change both the number and the composition of migrants, because the couple’s location follows the husband’s job. Third, couples redistribute the welfare gains from the shock, both between spouses and, through wages, across singles.

The all-singles economy faces the same shock as the baseline economy (Appendix F.3), so the two differ only in how they absorb it. To build it, I split every couple into two singles, reconstruct all inputs from the data, and recalibrate the dispersion of preferences across locations, θ , so this economy reproduces, in the short run, the same population response to import competition as the baseline economy. With ν unchanged, the recalibrated θ is 5% lower than in the baseline economy.⁴² I compare the same people across the two economies. In the all-singles economy, a married woman in the baseline economy is a single woman who chooses her location and sector on her own. Table 6 reports the main responses to the shock and the welfare gains in the baseline and all-singles economies, and Tables F.2 and F.3 report

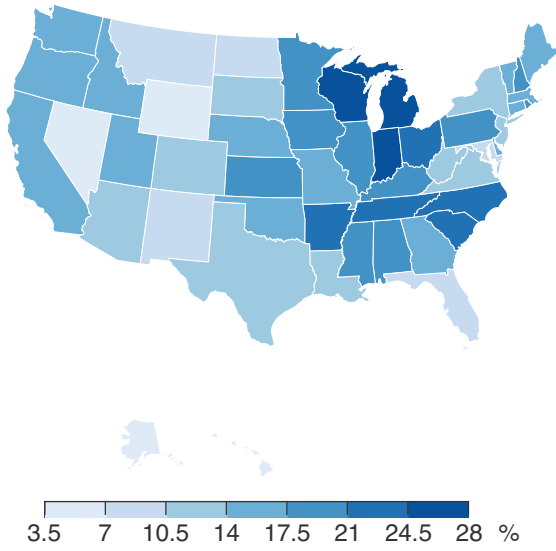
⁴⁰Appendix F.2 maps these effects state by state and shows that, although the geography of gains is nearly identical across household types, where a couple lives matters more for its gains than it does for singles.

⁴¹Appendix G describes four additional counterfactual economies and their results vis-à-vis the baseline economy. In the first, I partially shut down wives’ participation response to the shock. In the other three, I shut down migration in the baseline economy, in the all-singles economy, and in the economy with the partial participation shutdown.

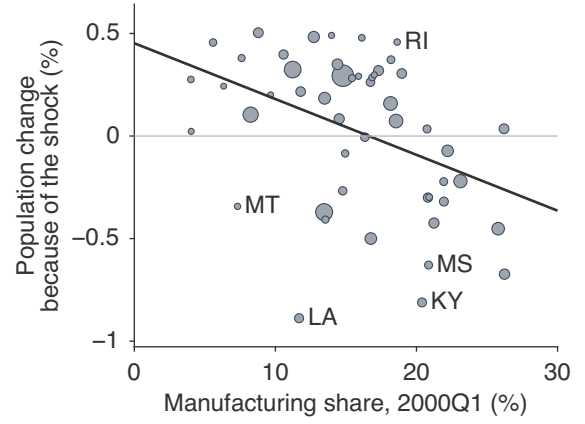
⁴²The target is a short-run moment, the population response to the shock over 2000–2007. Over that window, at the baseline economy’s θ , the all-singles economy responds 3% less to the shock, so matching the same moment requires a slightly lower θ . I return to the point below when I compare how many people move in each economy.

Figure 3: The China Trade Shock across States, by Initial Manufacturing Share

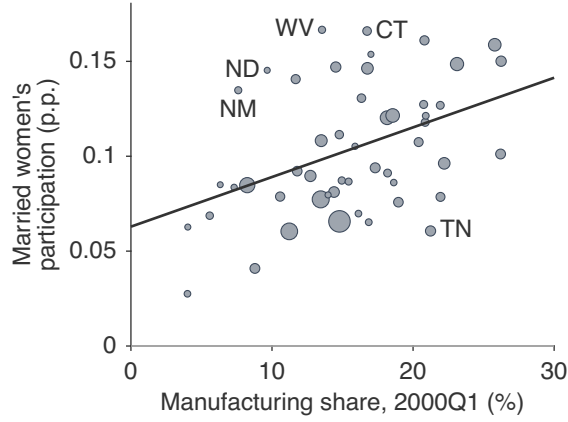
(a) Manuf. share of employment, 2000Q1 (%)



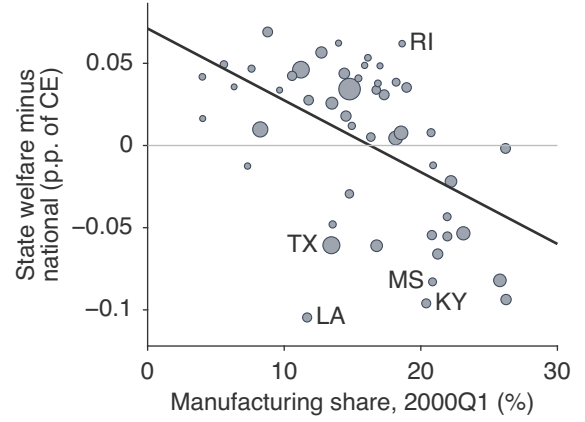
(b) Population change (%)



(c) Married women's participation (p.p.)



(d) State welfare minus national (p.p.)



Notes. Panel (a) is the manufacturing share of the state's employment in 2000Q1. In panels (b) to (d), each dot is a state, sized by its population in 2000Q1. The horizontal axis is the state's manufacturing share of employment in 2000Q1, in %. All outcomes are long-run responses ($t = 199$) in the baseline economy, defined as: the change in the state's population as a percentage of its no-shock level, which sums to zero across states because the national population is fixed; the change in married women's participation rate, in p.p., averaged over the couples living in the state; and the state's money-metric welfare gain minus the national gain (0.175), in p.p., for the people living in the state in 2000Q1. Lines are OLS fits; correlations, unweighted across the 50 states, are -0.41 , $+0.43$, and -0.50 . Labeled states are the five with the largest residuals.

results for every group.

Table 6: Responses and Welfare Effects of the China Trade Shock across Economies

	Baseline	All-singles
<i>Panel A. Employment (p.p.)</i>		
Employment rate	0.112	0.132
Women's employment rate	0.124	0.170
Married women's participation	0.101	
<i>Panel B. Migration</i>		
Migration response of the exposed (p.p.)	+0.0166	+0.0194
Share living in a different state because of the shock (%)		
Aggregate	0.150	0.130
Married women	0.159	0.116
<i>Panel C. Welfare gain (% CE)</i>		
Aggregate	0.175	0.178
Single men	0.157	0.166
Single women	0.234	0.194
Married men	0.170	0.164
Married women	0.170	0.193

Notes. Responses at $t = 199$, in levels. In Panel A, employment rates are in p.p. of population, and married women's participation is the change in their quarterly participation rate, in p.p. In Panel B, the migration response of the exposed is the difference, in p.p., between the shares of manufacturing and non-manufacturing workers who have changed state at least once by $t = 199$, counting each person once. Panel C reports money-metric consumption-equivalent gains (%), summed over $t = 2, \dots, 199$; each economy weights each person by their baseline money metric in 2000Q1. In the all-singles economy, married men and women are the same people as singles. Blank cells are not defined in that economy.

Result 1: With couples, women's employment responds less to the shock.

Relative to the all-singles economy, the aggregate employment gain in the baseline economy is 15.4% smaller, and the difference comes from married women. Women's employment rises 27% less in the baseline economy, even though men's employment rises slightly more (Panel A of Table 6). In the all-singles economy, every woman responds to her own wage. In the baseline economy, a couple decides whether the wife works based on her wage relative to her husband's, and the shock also raises his wage. As a result, women's employment responds only two-thirds as much to the same increase in female wages as in the all-singles

economy.⁴³

Within the baseline economy, married women’s employment already responds 21% less than single women’s to the same increase in female wages. By $t = 199$, a husband’s wage rises by 61% as much as his wife’s, so her wage relative to his rises by less than half as much as her own. If the couple looked only at her own wage, her participation would respond much more (Appendix F.4).

A wife increases her participation in every type of couple, not only when her husband is exposed, because the shock raises women’s wages relative to men’s in every state. By $t = 199$, the response is largest when only the husband is exposed, but only 5% larger than when neither spouse is (Panel B of Table 5).⁴⁴ That couples can adjust whether the wife works also matters for the economy as a whole. Compared with an economy in which I partially shut down the response of wives’ participation to the shock, the baseline economy has a 32% larger employment gain and a 5% larger aggregate welfare gain. Because the shutdown is only partial, these numbers understate how much it matters for the economy that couples can adjust whether the wife works (Appendix G.3).

Result 2: Couples change the number and the composition of migrants.

Relative to the all-singles economy, 14.9% more people end up in a different state in the baseline economy, even though the migration response of exposed workers is 14.5% smaller (Panel B of Table 6).⁴⁵ Couples make exposed workers move less, but they also move unexposed people, because an unexposed wife follows her husband when he moves. Most of the difference comes from married women, who are 37% more likely to end up in a different state than their counterfactual singles. As singles, wives would move only in response to their own wages, which the shock raises in every state, so they would have little reason to pay the cost of moving.

Couples also change the composition of migrants, because an exposed wife is tied to her husband’s location, whereas an exposed husband is not. Spouses relocate together, and the couple’s location follows the husband’s job. When only the wife is exposed, her migration response is only about a quarter of what it would be if she were single. By contrast, an

⁴³Women account for 35% of the gain in non-manufacturing employment in the baseline economy and 41% in the all-singles economy, mostly in other services and in accommodation and food.

⁴⁴In the short run, wives respond as in the reduced-form evidence. Wives whose husbands are exposed enter the market at the start of the shock, wives who are exposed themselves leave it, and wives in unexposed couples enter gradually (Figure F.2).

⁴⁵This is also why the all-singles economy needs a lower θ to match the population response over 2000–2007. Without unexposed spouses following their partners, the same θ moves fewer people. Because a lower θ makes singles more responsive to the shock, the recalibration, if anything, enlarges the 14.5% gap in the migration response of the exposed and shrinks the 14.9% gap here.

exposed husband migrates about as much as he would if he were alone. This explains why, as noted above, the migration response of exposed workers is 14.5% smaller in the baseline economy than in the all-singles economy.

Result 3: Couples redistribute the welfare gains from the shock.

Because the China Trade Shock hits mostly men’s jobs, being in a couple shifts gains from the wife to the husband. Relative to their counterfactual singles in the all-singles economy, married women gain 12% less and married men 3% more (Panel C of Table 6). A wife gains less than she would alone because her decision to work depends on her husband’s wage and her location is tied to his job, so she cannot fully take advantage of the expanding sectors. A husband, by contrast, gains more than he would alone because the couple pools both spouses’ incomes, and the shock raises his wife’s wage more than his.⁴⁶

However, when the wife is exposed to the shock, being in a couple lowers both spouses’ gains. In a couple in which only the wife is exposed, the husband gains 4% less and the wife 10% less than their counterfactual singles (Table F.4), because she adjusts less than she would alone, and her husband shares her loss. She adjusts less on every margin. Relative to her counterfactual single, she switches to other sectors 19% less, raises her participation 40% less, and migrates only about a quarter as much. When both spouses are exposed, the husband gains 7% less and the wife 29% less than their counterfactual singles.

Couples also change what singles gain because, in general equilibrium, the amount of work married women supply affects the wages singles earn. Because married women’s employment responds less to the shock in the baseline economy, women’s wages rise more. As a result, relative to the all-singles economy, single women gain 20% more and single men 5% less.⁴⁷ With couples, welfare gains are also more unequal across states, especially for wives, because living as a couple ties a wife’s welfare to where the couple lives (Appendix F.2).

Taken together, the counterfactuals show that when couples decide together, a shock to one spouse becomes a shock to the household. As a result, couples change both how the economy adjusts to a local shock and how gains are distributed. Under the China Trade Shock, women’s employment responds less, and more people relocate, even though exposed workers move less. Women’s employment responds less because couples decide whether the wife works based on her wage relative to her husband’s, and more people relocate because couples follow the husband’s job. Because the China Trade Shock hits mostly men’s jobs,

⁴⁶Relative to the all-singles economy, aggregate gains in the baseline economy are only 2% smaller, so couples mostly redistribute the gains rather than change their size. When only the husband is exposed, the couple gains 5% more than his counterfactual single and 26% less than her counterfactual single (Table F.4).

⁴⁷Relative to the all-singles economy, the female wage response in the baseline economy is 12% larger, the male wage response is 9% smaller, and the relative wage rises 63% more (Panel E of Table F.2).

couples also redistribute gains from wives to husbands and, through wages, from single men to single women.

VI. Conclusion

Couples, who represent more than half of US households, decide together where to live and whether the wife works. I show that because they optimize together, a shock to one spouse becomes a shock to the household, so couples change both how the economy adjusts to a local shock and its distributional impacts. Because the husband is usually the main earner, the couple's location follows his job, so an exposed wife moves less than she would alone, and an unexposed wife moves when her husband does. At the same time, a couple has a margin of adjustment that a single person lacks. When the husband's wage falls relative to his wife's, the couple can decide that she works more.

Using individual-level exposure to the China Trade Shock in the PSID, I show that couples' responses to a local shock depend on which spouse is hit. Comparing individuals within the same commuting zone, I find that exposed workers became less likely to be employed and more likely to leave their commuting zone. However, a couple's out-migration rose only when the husband was exposed. A wife's labor force participation rose when her husband was exposed and fell when she was exposed herself.

To quantify what these joint decisions imply for the economy as a whole, I develop a dynamic spatial and trade model in which a household can be a single man, a single woman, or a couple. The model's novelty is that couples decide together. Each period, a couple chooses one location and a sector for each spouse, so any move must benefit the couple as a whole, and then decides whether the wife works in the market or at home. Because male and female labor are imperfect substitutes and sectors use them in different proportions, the same shock can affect the two spouses differently. The model also captures the economies of scale of marriage. A couple pays once for a household good, such as housing, that both spouses enjoy in full, and when the wife stays at home, her home production increases this good. Because spouses share this good, I measure each person's welfare as the income a single person would need to reach it, so that gains can be added up across spouses and singles. I calibrate the parameter governing how strongly a wife's participation responds to her wage relative to her husband's to the third empirical fact: the rise in participation among wives whose husbands are exposed.

In the model, the China Trade Shock is, overall, a boom for US workers. Although the manufacturing share of employment falls by 0.29 p.p., cheaper Chinese goods raise real wages, and the employment rate rises by 0.11 p.p., with every group working more. On

average, individuals gain the equivalent of a 0.18% increase in consumption. Couples adjust differently from singles. Because the shock hits manufacturing, a male-intensive sector, it lowers a husband's wage relative to his wife's, so more couples choose to have the wife work, while the husband moves out of manufacturing into other sectors. The husband is usually the main earner, and the wife's wage matters only when she works, so a fall in his wage lowers the couple's location payoff more than a fall in hers. As a result, a couple moves mainly when he is exposed. Single women gain the most, 34% more than the average individual, and single men the least. Couples fall in between, much closer to single men, because the husband's wage drives the household's gain.

Couples change how the economy adjusts to the shock, making women's employment respond less and leading more people to relocate. Relative to an economy populated only by singles, which I call the all-singles economy, the employment gain from the shock is 15.4% smaller. A couple decides whether the wife works based on her wage relative to her husband's, and the shock also raises his wage, so her participation responds less than it would if only her own wage mattered. Even so, wives work more in every type of couple in the long run, not only when her husband is exposed, because the shock raises women's wages relative to men's everywhere. Couples also change the number and the composition of migrants. Compared with an all-singles economy, 14.9% more people move to a different state, even though exposed workers' migration response is 14.5% smaller. An unexposed wife moves when her husband does, whereas when only the wife is exposed, her migration response is only about a quarter of what it would be if she were single.

Couples also redistribute the welfare gains from the shock, both between spouses and, through wages, across singles. Because the China Trade Shock hits mostly men's jobs, being in a couple shifts gains from the wife to the husband. Relative to their counterfactual singles in the all-singles economy, married women gain 12% less and married men 3% more. A wife gains less than she would alone because her decision to work depends on her husband's wage and her location is tied to his job. A husband, by contrast, gains more than he would alone because the couple pools both spouses' incomes, and the shock raises his wife's wage more than his. When the wife is exposed, however, both spouses would gain more as singles, because she adjusts less than she would alone, and her husband shares her loss. Across singles, gains shift from single men to single women, because married women's employment responds less to the shock, so women's wages rise more. Relative to the all-singles economy, single women gain 20% more, while single men gain 5% less.

Because couples mostly redistribute gains from a local shock rather than change their size, aggregate gains give an incomplete picture of who benefits. Understanding how the economy adjusts to a local shock, and how its gains are distributed, requires treating the

household, and not only the worker, as the unit that decides where to live and work.

The mechanisms behind these results are not specific to the China Trade Shock. In any local shock, couples decide together where to live and whether the wife works, so these mechanisms apply regardless of which sectors the shock hits. What is specific to this shock is who gains. Because the China Trade Shock hits manufacturing, a male-intensive sector, it exposes husbands more than wives and draws wives into the labor market. A shock to a female-intensive sector could reverse this pattern, although its welfare consequences need not mirror it, because the husband is usually the main earner and the couple's location would still follow his job. The model provides a framework to study such shocks, which I leave for future research.

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Appendix

“It Takes Two to Tango”: Joint Location Choices and Local Shocks

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A. Robustness Exercises

A.1 The China Trade Shock across Sample Commuting Zones

Given the PSID sample restrictions and the size of the PSID, I include 375 commuting zones out of the 722 that [Autor et al. \(2021\)](#) use in their analysis. My results could therefore be driven by which zones are included in the PSID rather than by differential exposure to the China Trade Shock. To assess this concern, I replicate their main results using the 375 CZs represented in the sample.⁴⁸

Table [A.1](#) first compares the CZs in the sample with the full set of CZs in [Autor et al. \(2021\)](#). Because the restricted sample is a subset of the full sample, the two groups are not independent, and a conventional difference-in-means test is therefore ill-defined. The final column instead reports the standardized difference, defined as the difference in means between the restricted and full samples divided by the square root of the average of their variances. This measure is expressed in standard-deviation units, so it is comparable across variables measured on different scales. Following [Imbens and Rubin \(2015\)](#), absolute standardized differences below 0.25 indicate comparability. All standardized differences in Table [A.1](#) are 0.13 or smaller, including the difference for the change in import penetration. By this criterion, the CZs in the PSID sample are comparable to their full sample with respect to both the control variables and the China Trade Shock itself.

Next, I estimate Equation (2) of [Autor et al. \(2021\)](#) for the CZs in the sample:

$$\Delta Y_{i,t+h} = \alpha_t + \beta_{1,h} \Delta IP_i^{China,US} + X'_{i,t} \beta_2 + \varepsilon_{i,t+h},$$

where $\Delta Y_{i,t+h}$ denotes the change in outcome Y for CZ i between $t = 2000$ and year $t+h$. As in their paper, $\Delta IP_i^{China,US}$ is instrumented with $\Delta IP_i^{China,Others}$, following the identification logic described in Section [II](#). The analysis considers their three main outcome categories: employment, income, and population headcount.

Estimated on the CZs in the PSID sample, their specification yields responses that closely track their full-sample estimates, except for the changes in population of younger age groups. Figure [A.1](#) replicates their employment results for the manufacturing employment-to-population ratio in panel a, the non-manufacturing employment-to-population ratio in panel b, and the total wage-and-salary employment-to-population ratio in panel c. Across all three outcomes, the estimates based on the full set of CZs closely align with those based only on the CZs in the PSID sample.

⁴⁸This exercise uses the replication package provided by David Dorn on his website. Because the analysis uses the geocoded restricted version of the PSID, I cannot disclose the identities of the commuting zones in the sample, nor can I provide a map at any geographic level below the state.

Table A.1: Comparing CZs in the Sample with All CZs

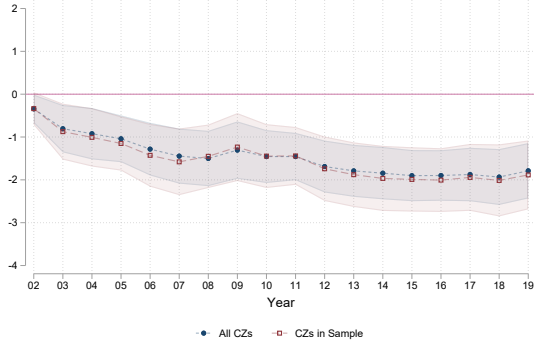
	Full		Restricted			Standardized
	Mean	SD	Mean	SD	Diff	Difference
Control variables (in 2000)						
Manufacturing emp./total emp.	16.18	7.46	15.68	6.91	-0.49	-0.07
Female emp./total emp.	64.38	5.51	64.54	5.21	0.16	0.03
Routine occupation emp./total emp.	31.90	2.37	32.20	2.16	0.30	0.13
Offshorability index	0.00	0.51	0.06	0.48	0.07	0.13
College educated/total pop.	53.61	7.47	54.41	6.88	0.80	0.11
Foreign born/total pop.	14.76	12.81	15.74	12.89	0.97	0.08
Non-white population/total pop.	18.18	10.95	18.81	10.36	0.63	0.06
Population 65+/total pop.	12.37	2.91	12.15	2.81	-0.21	-0.07
Population 40-64/total pop.	30.10	1.87	30.02	1.79	-0.08	-0.04
Population 0-17/total pop.	25.63	2.22	25.65	2.14	0.02	0.01
Δ log population 1970-1990/2	12.31	12.25	12.77	12.35	0.47	0.04
Change in CZ import penetration (2000 to 2012)						
Imports by US	0.89	0.59	0.88	0.55	-0.01	-0.02
Imports by other high-inc. countries	1.22	0.69	1.21	0.64	-0.01	-0.02
Number of Commuting Zones	722		375			

The income responses in the sample CZs also closely track the full-sample estimates. Figure A.2 reports the corresponding results for income: personal income per capita in panel a, government transfers per capita in panel b, and total labor compensation per worker in panel c. The only visible divergence is a somewhat larger increase in government transfers among the sample CZs, although the coefficients are not statistically distinguishable.

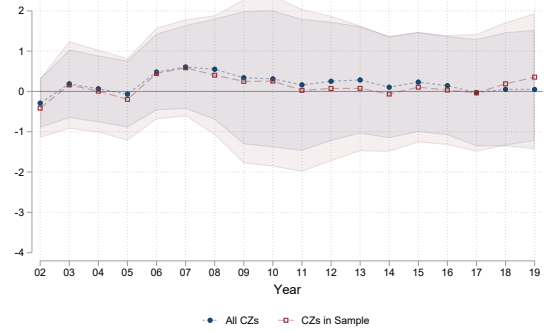
Finally, population headcounts, which Autor et al. (2021) use to measure migration responses, are the only outcomes for which the two sets of estimates diverge, and only among younger age groups (Figure A.3). The estimates are similar for the total population and for individuals ages 40–64. However, the population decline among individuals ages 25–39 is larger in the sample CZs, and the estimates indicate a statistically significant decline among individuals ages 18–24 that is absent from their full-sample results. The difference among individuals aged 25–39 is relevant for my sample, whose average age is 37: it suggests that young adults left the sample CZs somewhat more than they left the average CZ. My main estimates, however, compare exposed and non-exposed individuals, so a population decline common to both groups within a CZ does not, by itself, drive the estimated differences.

Figure A.1: China Trade Shock Impact on Employment

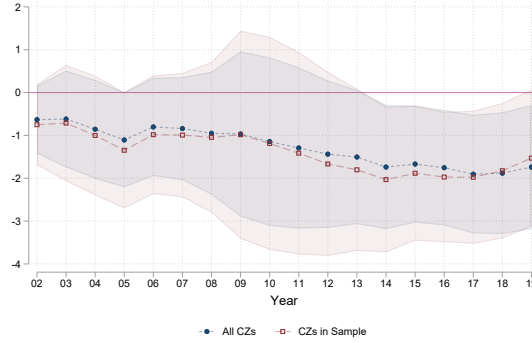
(a) Manufacturing Emp./Working-age pop.



(b) Non-manufacturing Emp./Working-age pop.



(c) Total Wage and Salary Emp./Working-age pop.



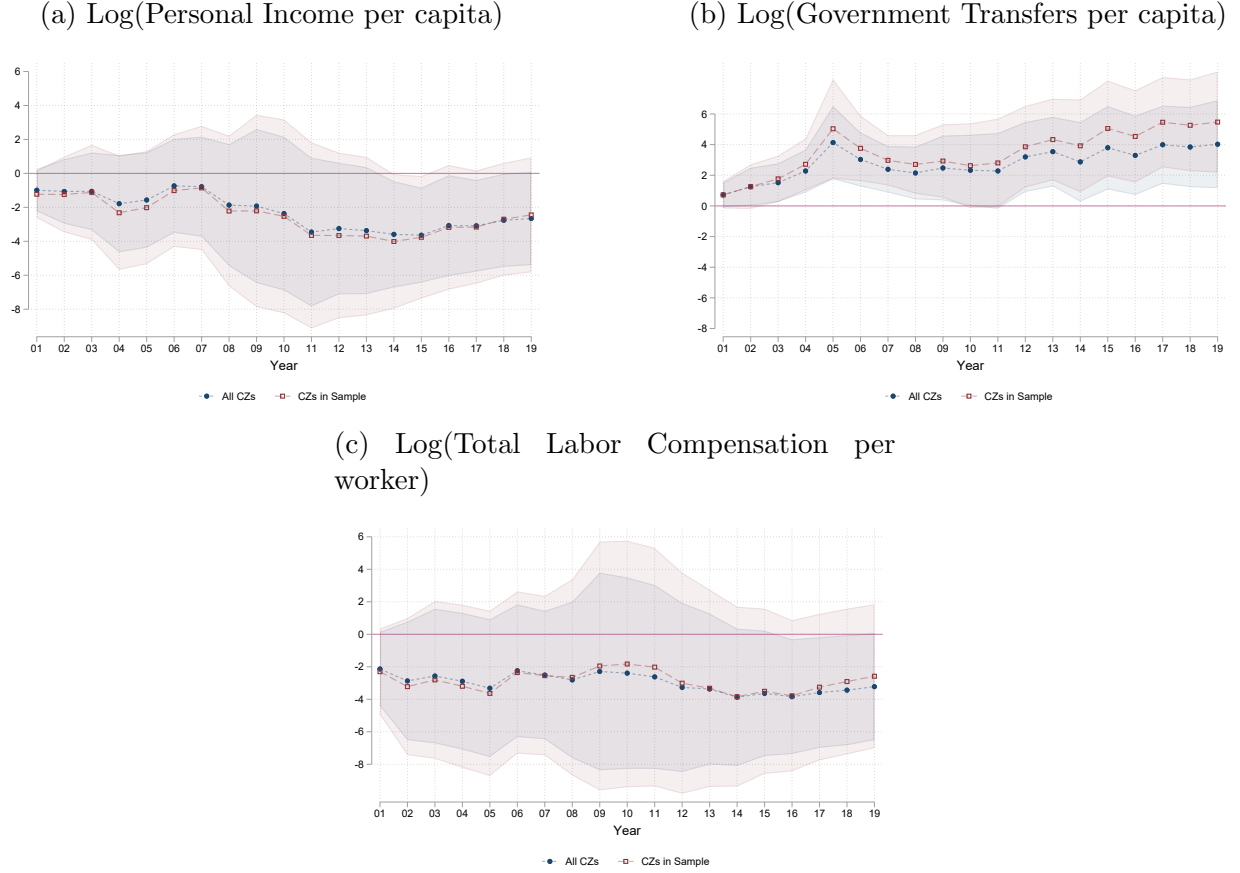
Notes. In each panel, I plot the original result in [Autor et al. \(2021\)](#) for that outcome variable in blue and, in red, the result when I consider only the CZs in the sample. A CZ is considered in the sample if I can estimate its fixed effect when estimating equation (5).

Taken together, the two exercises indicate that, although the PSID sample restrictions reduce geographic coverage, they do not appear to select local labor markets in which the China Trade Shock had systematically different effects. The CZs represented in the PSID are comparable to the full sample in [Autor et al. \(2021\)](#) in terms of observable characteristics, including exposure to the China Trade Shock, and estimating their specification on these CZs produces similar coefficients.

A.2 The China Trade Shock and Household Composition

One potential concern is that the China Trade Shock alters household structure. Such changes could bias the results through two channels: the shock may affect marriage, divorce, or fertility decisions that subsequently shape out-migration responses, and couples who re-

Figure A.2: China Trade Shock Impact on Log Income

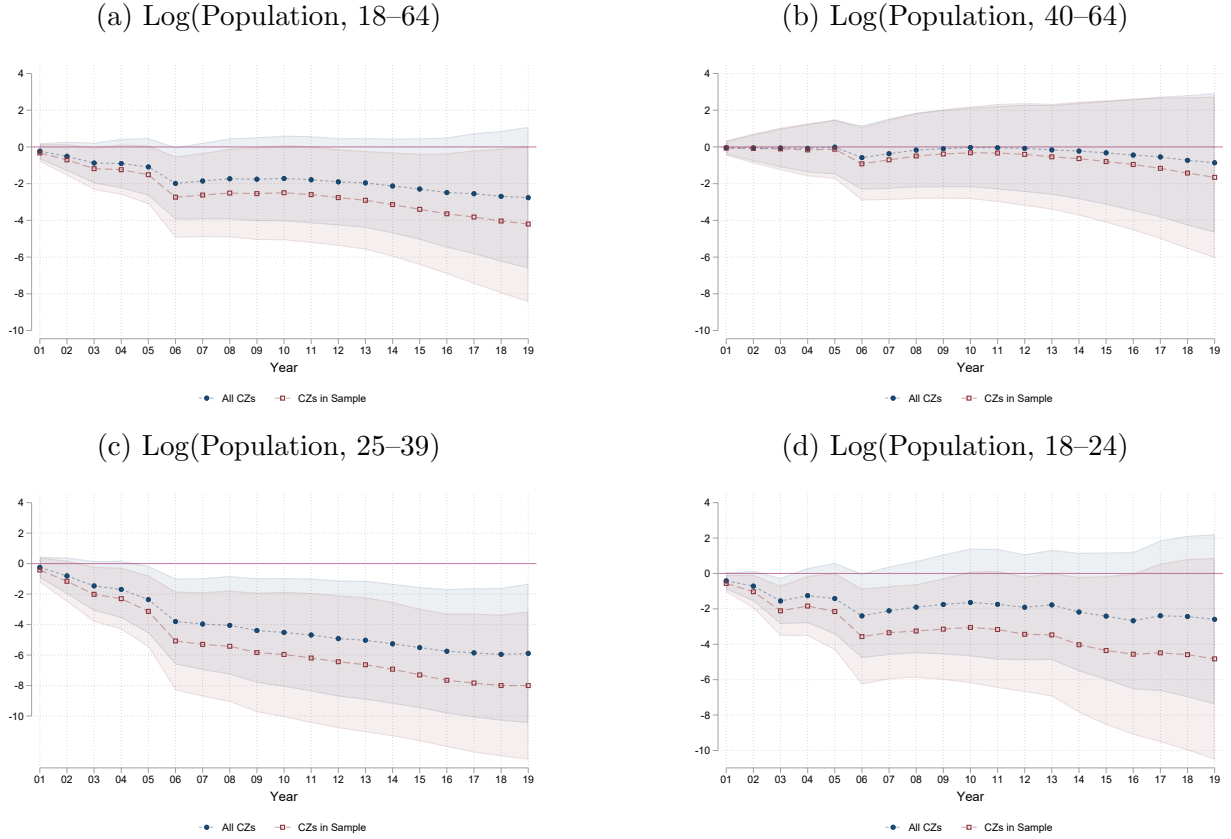


Notes. In each panel, I plot the original result in [Autor et al. \(2021\)](#) for that outcome variable in blue and, in red, the result when I consider only the CZs in the sample. A CZ is considered in the sample if I can estimate its fixed effect when estimating equation (5).

main together after the shock may differ systematically from those who divorce. To assess this concern, I use the full sample of individuals and estimate equation (4) for the probabilities of marrying, divorcing, and having a new child. Figure A.4 shows that, between 2001 and 2013, exposed individuals were no more likely than non-exposed individuals to marry, divorce, or have a child.

At first glance, this result may appear inconsistent with [Autor et al. \(2019\)](#), who find that a one-unit trade shock reduces the share of previously married women by 0.21 p.p. and increases the share of never-married women by 1.2 p.p.. The apparent discrepancy reflects differences in how marital status is measured. In the ACS, marital status records legal status and does not separately identify cohabiting women. Consequently, women who transition from single to cohabiting are classified as married in my data, whereas they are classified as single in [Autor et al. \(2019\)](#). In addition, because the ACS is a repeated cross-section, a

Figure A.3: China Trade Shock Impact on Log Population Headcounts



Notes. In each panel, I plot the original result in [Autor et al. \(2021\)](#) for that outcome variable in blue and, in red, the result when I consider only the CZs in the sample. A CZ is considered in the sample if I can estimate its fixed effect when estimating equation (5).

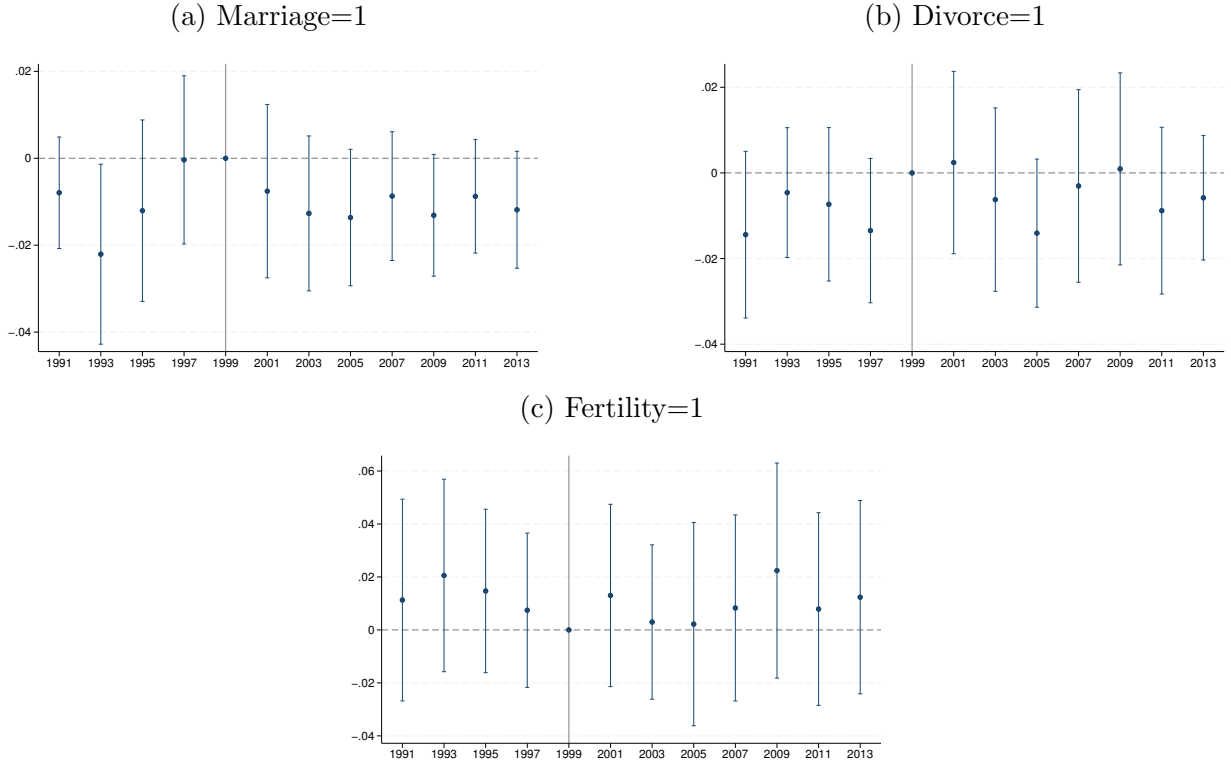
woman's prior marital status cannot be recovered once she is observed as married. Women who transition from divorced to married are therefore classified simply as married in their analysis, whereas they are excluded from my sample.

I also find no robust effect of trade shocks on fertility, in contrast to [Autor et al. \(2019\)](#). One likely explanation is that I allow both men and women to be exposed, whereas they focus exclusively on women. My estimates therefore capture a broader set of household shocks and adjustment margins.

A.3 Other Migration Drivers

The asymmetric migration response within couples could instead reflect two other drivers: the presence of children or gender differences in responses to the shock. First, the behavioral differences I attribute to joint decision-making may reflect the presence of children rather than couple status itself. To address this concern, I extend equation (4) to a triple-difference

Figure A.4: Exposure to the China Trade Shock and Family Outcomes

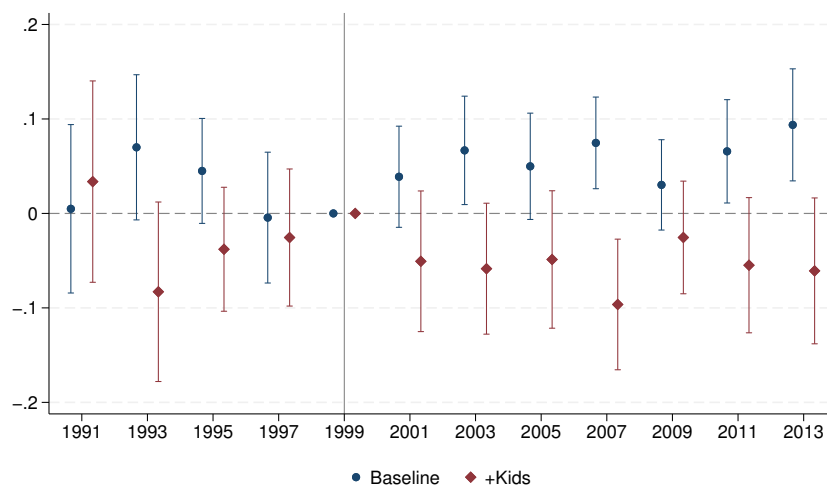


Notes. Each panel plots the estimates of equation (4) for the outcome named in its title. Robust standard errors are two-way clustered at the industry and individual levels. Confidence intervals are constructed at the 95% level. In the equivalent static difference-in-differences model, the coefficient of interest is not statistically significant for any of the three outcomes.

specification that accounts for whether an individual has a child younger than 18. If individuals with children respond differently from those without children, the coefficient on the triple interaction should be statistically different from zero. Figure A.5 shows that this coefficient is not statistically significant in any year except 2007. Thus, exposure does not generate systematically different out-migration responses among individuals with and without children. Individuals with children nevertheless have a baseline out-migration probability that is 4.2 p.p. lower than that of individuals without children. Therefore, the two groups differ in their intercepts, even though their responses to exposure are similar.

Second, the estimated differences could reflect gender-specific responses to the shock. To address this concern, I extend equation (4) to a triple-difference specification that accounts for whether the individual is a woman. If women and men respond differently to the shock, the coefficient on the triple interaction should be statistically different from zero. Figure A.6 shows that this coefficient is not statistically significant in any year during the shock. Thus, exposed women do not exhibit a systematically different out-migration response from

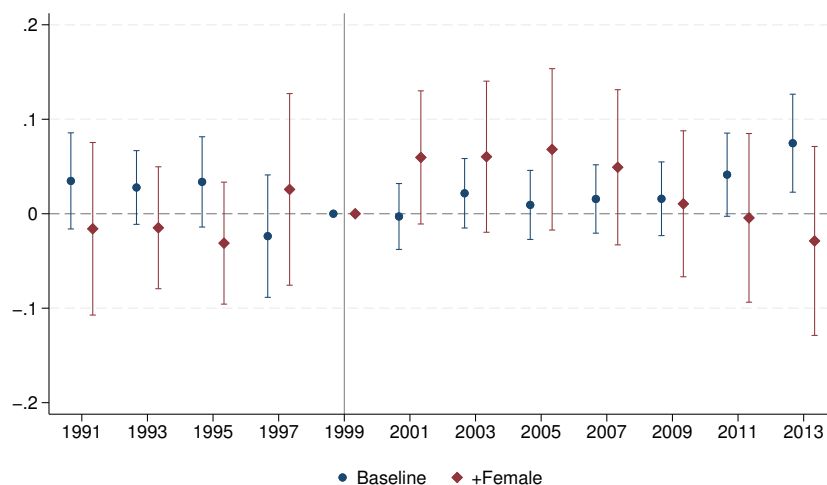
Figure A.5: Exposure to the China Trade Shock and Out-Migration Responses, by Parental Status



Notes. Robust standard errors are two-way clustered at the industry and individual levels. Confidence intervals are constructed at the 95% level. In blue, I plot the coefficient on the interaction between exposure and year. In red, I plot the coefficient on the triple interaction among exposure, year, and an indicator for having a child younger than 18.

exposed men.

Figure A.6: Exposure to the China Trade Shock and Out-Migration Responses, by Gender



Notes. Robust standard errors are two-way clustered at the industry and individual levels. Confidence intervals are constructed at the 95% level. In blue, I plot the coefficient on the interaction between exposure and year. In red, I plot the coefficient on the triple interaction among exposure, year, and an indicator for being a woman.

Taken together, these results indicate that the asymmetric migration response among

couples, depending on which partner is exposed, is driven neither by the presence of children in the household nor by general gender differences in responses to the shock.

A.4 Additional Tables

Table A.2: Exposure to the China Trade Shock and Labor Market Outcomes

	(1)	(2)	(3)
	Employed=1	Unemployed=1	Lab Force=1
Exposed=1	-0.007 (0.019)	-0.002 (0.008)	-0.008 (0.017)
(Exposed=1)x(Post=1)	-0.063*** (0.017)	0.023** (0.010)	-0.039*** (0.012)
Baseline Mean	0.90	0.04	0.94
	(1)	(2)	(3)
	Weekly Hours	Hourly Wage	Labor Income
Exposed=1	-0.454 (1.644)	-0.677 (4.011)	1,978.003 (8,565.422)
(Exposed=1)x(Post=1)	-2.058** (0.889)	-2.581** (1.160)	-5595.397** (2,273.988)
Baseline Mean	40.62	24.26	50,236.60
Observations	38,634	38,634	38,634

Notes. Robust standard errors are two-way clustered at the industry and individual levels.

* for $p < 0.10$, ** for $p < 0.05$, *** for $p < 0.01$.

Table A.3: Binary versus Continuous Exposure to the China Trade Shock

	(1)	(2)	(3)
	Employed=1	Unemployed=1	Labor Force=1
Exposed=1	-0.007 (0.019)	-0.002 (0.008)	-0.008 (0.017)
(Exposed=1)x(Post=1)	-0.063*** (0.017)	0.023** (0.010)	-0.039*** (0.012)
Shock	0.003* (0.002)	-0.000 (0.001)	0.003** (0.001)
(Shock)x(Post=1)	-0.007*** (0.002)	0.003*** (0.001)	-0.003*** (0.001)
Observations	38,634	38,634	38,634
R2	0.08	0.05	0.06
Baseline Mean	0.90	0.04	0.94

Notes. Robust standard errors are two-way clustered at the industry and individual levels.

* for $p < 0.10$, ** for $p < 0.05$, *** for $p < 0.01$.

Table A.4: Exposure to the China Trade Shock and Out-Migration Responses

	(1)
	Out-Migration=1
Exposed=1	-0.064 (0.042)
(Exposed=1)x(Post=1)	0.047** (0.021)
Observations	37,443
R^2	0.09
Baseline Mean	0.07

Notes. Robust standard errors are two-way clustered at the industry and individual levels. * for $p < 0.10$, ** for $p < 0.05$, *** for $p < 0.01$.

Table A.5: Wife's Exposure to the China Trade Shock and Husband's Labor Market Outcomes

	(1)	(2)
	Husband Employed=1	Husband's Hourly Wage
Exposed Wife=1	-0.021 (0.020)	-1.527 (1.355)
(Exposed Wife=1)x(Post=1)	-0.030 (0.026)	-9.349*** (1.557)
Observations	14,083	14,083
R^2	0.10	0.33
Baseline Mean	0.95	30.42

Notes. All monetary values are in 2017 USD, using the PCE index, and include zeros. Robust standard errors are two-way clustered at the wife's industry and individual levels. * for $p < 0.10$, ** for $p < 0.05$, *** for $p < 0.01$.

Table A.6: Couple's Exposure to the China Trade Shock and Household Income Responses

	(1)	(2)
	Household Income	
Exposed Husband=1	7,357.215 (11692.540)	
(Exposed Husband=1)x(Post=1)	3,930.551 (6,330.419)	
Exposed Wife=1		529.105 (12003.901)
(Exposed Wife=1)x(Post=1)		-2348.701 (4,316.531)
Observations	14,083	14,083
R^2	0.35	0.35
Baseline Mean	120226.29	120600.92

Notes. All monetary values are in 2017 USD, using the PCE index, and include zeros. Robust standard errors are two-way clustered at the husband's industry and household levels in Column 1 and the wife's industry and household levels in Column 2. * for $p < 0.10$, ** for $p < 0.05$, *** for $p < 0.01$.

B. Model Derivations

This appendix derives the choice probabilities and value function under the nested Gumbel shock and then develops the money-metric measure used to compare welfare across singles and couples.

B.1 Choice Probabilities and Expected Values

The derivation follows Appendix B.2 of [Rodríguez-Clare et al. \(2026\)](#). Fix h , $\mathbf{o}$, and t , and suppress these indices whenever doing so creates no ambiguity. Define $x_{\mathbf{d}} \equiv \delta V_{\mathbf{d},t+1} - \mu_{\mathbf{o}\mathbf{d}}$. The household chooses $\mathbf{d}$ if and only if $x_{\mathbf{d}} + \varepsilon_{\mathbf{d}} \geq x_{\mathbf{z}} + \varepsilon_{\mathbf{z}}$ for every $\mathbf{z}$.

Choice probabilities. Let $G_{\mathbf{d}}(\cdot)$ denote the partial derivative of F in equation (17) with respect to its $\mathbf{d}$ -th argument. For any $\mathbf{d} \in \mathcal{S}_h(j)$,

$$G_{\mathbf{d}}(\varepsilon) = \frac{1}{\theta} \left(\sum_{\mathbf{z} \in \mathcal{S}_h(j)} e^{-\varepsilon_{\mathbf{z}}/\nu} \right)^{\nu/\theta-1} e^{-\varepsilon_{\mathbf{d}}/\nu} F(\varepsilon).$$

The choice probability for $\mathbf{d}$ is $\int G_{\mathbf{d}}(\varepsilon_{\mathbf{d}}, \{\varepsilon_{\mathbf{d}} + x_{\mathbf{d}} - x_{\mathbf{z}}\}_{\mathbf{z} \neq \mathbf{d}}) d\varepsilon_{\mathbf{d}}$. Evaluating each remaining argument at $\varepsilon_{\mathbf{z}} = \varepsilon_{\mathbf{d}} + x_{\mathbf{d}} - x_{\mathbf{z}}$ yields $e^{-\varepsilon_{\mathbf{z}}/\nu} = e^{-\varepsilon_{\mathbf{d}}/\nu} e^{(x_{\mathbf{z}} - x_{\mathbf{d}})/\nu}$ and therefore

$$\sum_{\mathbf{z} \in \mathcal{S}_h(\ell)} e^{-\varepsilon_{\mathbf{z}}/\nu} = e^{-\varepsilon_{\mathbf{d}}/\nu} e^{-x_{\mathbf{d}}/\nu} \Omega_{\ell}, \quad \Omega_{\ell} \equiv \sum_{\mathbf{z} \in \mathcal{S}_h(\ell)} e^{x_{\mathbf{z}}/\nu},$$

so Ω_{ℓ} is shorthand for the inclusive value $\Omega_{\mathbf{o}\ell,t}^h$, where $\Omega_{\mathbf{o}j,t}^h \equiv \sum_{\mathbf{z} \in \mathcal{S}_h(j)} \exp [\delta V_{\mathbf{z},t+1}^h - \mu_{\mathbf{o}\mathbf{z}}]^{1/\nu}$. Substituting, and writing $T \equiv e^{-x_{\mathbf{d}}/\theta} \sum_{\ell} \Omega_{\ell}^{\nu/\theta}$,

$$\Pr(\mathbf{d}) = \frac{e^{x_{\mathbf{d}}/\nu}}{\Omega_j} \cdot \frac{\Omega_j^{\nu/\theta}}{\sum_{\ell} \Omega_{\ell}^{\nu/\theta}} \int_{-\infty}^{\infty} \frac{1}{\theta} T e^{-\varepsilon_{\mathbf{d}}/\theta} \exp(-T e^{-\varepsilon_{\mathbf{d}}/\theta}) d\varepsilon_{\mathbf{d}}.$$

The integrand is the density of a univariate Gumbel distribution with scale θ , so the integral equals one. The first fraction corresponds to

$$\lambda_{\mathbf{o}\mathbf{d}|j,t}^h = \frac{\exp [\delta V_{\mathbf{d},t+1}^h - \mu_{\mathbf{o}\mathbf{d}}]^{1/\nu}}{\Omega_{\mathbf{o}j,t}^h}, \quad (\text{B.1})$$

while the second corresponds to

$$\lambda_{\mathbf{o}j,t}^h = \frac{(\Omega_{\mathbf{o}j,t}^h)^{\nu/\theta}}{\sum_{\ell=1}^L (\Omega_{\mathbf{o}\ell,t}^h)^{\nu/\theta}}. \quad (\text{B.2})$$

Interpretation for ν and θ . ν and θ are scale parameters of the preference shocks. Their inverses are semi-elasticities of choice shares with respect to continuation values, which are measured in log-utility units.

For two destinations $\mathbf{d}$ and $\mathbf{d}'$ in the same location j , equation (B.1) implies

$$\frac{\partial \log (\lambda_{\mathbf{od}|j,t}^h / \lambda_{\mathbf{od}'|j,t}^h)}{\partial (\delta V_{\mathbf{d},t+1}^h)} = \frac{1}{\nu}$$

while quation (B.2) implies

$$\frac{\partial \log (\lambda_{\mathbf{oj},t}^h / \lambda_{\mathbf{oj}',t}^h)}{\partial (\nu \log \Omega_{\mathbf{oj},t}^h)} = \frac{1}{\theta}.$$

The implied response to wages therefore depends on the discount factor δ and on how persistent the wage change is. Only in a static version of the model, populated with singles, $1/\nu$ and $1/\theta$ are wage elasticities: of a sector's within-location share with respect to its real wage, and of a location's share with respect to a proportional change in all of its real wages, for choices with small shares (see Rodríguez-Clare et al., 2026)

Expected value. The joint probability that $x_{\mathbf{d}} + \varepsilon_{\mathbf{d}} \leq a$ and that $\mathbf{d}$ is chosen is obtained by integrating the same expression up to $a - x_{\mathbf{d}}$. This yields $\lambda_{\mathbf{od},t}^h \exp(-\tilde{T} e^{-a/\theta})$, where $\tilde{T} \equiv \sum_{\ell} \Omega_{\ell}^{\nu/\theta}$. Conditional on $\mathbf{d}$ being chosen, the maximized payoff therefore follows a Gumbel distribution with location $\theta \log \tilde{T}$ and scale θ , implying a mean of $\theta \log \tilde{T} + \theta \bar{e}$, where $\bar{e}$ is the Euler–Mascheroni constant. Because this expression does not depend on $\mathbf{d}$,

$$\mathbb{E} \left[\max_{\mathbf{d}} \{x_{\mathbf{d}} + \varepsilon_{\mathbf{d}}\} \right] = \theta \log \left(\sum_{\ell=1}^L \Omega_{\ell,t}^{\nu/\theta} \right) + \theta \bar{e},$$

which, after dropping the constant, delivers equation (18).

Welfare recursion. From equation (19) evaluated at the origin location i , $\sum_{\ell} \Omega_{\ell,t}^{\nu/\theta} = (\lambda_{\mathbf{oi},t}^h)^{-1} \Omega_{\mathbf{oi},t}^{\nu/\theta}$. From equation (20) evaluated at the origin and $\mu_{\mathbf{oo}} = 0$, $\Omega_{\mathbf{oi},t} = (\lambda_{\mathbf{oo}|i,t}^h)^{-1} \exp(\delta V_{\mathbf{o},t+1}^h)^{1/\nu}$. Combining,

$$\theta \log \left(\sum_{\ell} \Omega_{\ell,t}^{\nu/\theta} \right) = \delta V_{\mathbf{o},t+1}^h - \theta \log (\lambda_{\mathbf{oi},t}^h) - \nu \log (\lambda_{\mathbf{oo}|i,t}^h),$$

which, substituted into equation (18) and iterated forward, gives equation (30).

Welfare change. Because the with-shock and no-shock economies take the same values at $t = 0$, the level of any variable in the with-shock economy equals its level in the no-shock

economy times the cumulative relative changes,

$$x'_t = x_t \prod_{s=1}^t \hat{x}_s.$$

Evaluating equation (30) at $t = 0$ in both economies and subtracting, the period-0 terms cancel, and

$$V'_{o,0} - V_{o,0}^h = \sum_{t=1}^{\infty} \delta^t \sum_{s=1}^t \log \left(\frac{\hat{W}_{o,s}^h}{\left(\hat{\lambda}_{oi,s}^h \right)^{\theta} \left(\hat{\lambda}_{oo|i,s}^h \right)^{\nu}} \right) = \frac{1}{1-\delta} \sum_{s=1}^{\infty} \delta^s \log \left(\frac{\hat{W}_{o,s}^h}{\left(\hat{\lambda}_{oi,s}^h \right)^{\theta} \left(\hat{\lambda}_{oo|i,s}^h \right)^{\nu}} \right),$$

where the second equality exchanges the order of summation and uses $\sum_{t=s}^{\infty} \delta^t = \delta^s / (1 - \delta)$. Multiplying by $1 - \delta$ gives equation (31).

B.2 The Money-Metric Welfare Index

I follow [Chiappori and Meghir \(2015\)](#) to construct a Money-Metric Welfare Index (MMWI), defined as the income each spouse would require to attain their utility level if they faced the full price of public consumption. For notational simplicity, I suppress the indices $\mathbf{d}$ and t .

Let $u_g \equiv \gamma \log B + (1 - \gamma) \log c_g$, for $g \in \{f, m\}$, denote the log utility of spouse g . Substituting equation (23) into u_g , I obtain

$$\begin{aligned} u_f &= \log \frac{I(\mathcal{H})}{P} + \mathcal{H} \gamma \log \beta + K + (1 - \gamma) \log \alpha, \\ u_m &= \log \frac{I(\mathcal{H})}{P} + \mathcal{H} \gamma \log \beta + K + (1 - \gamma) \log(1 - \alpha), \end{aligned}$$

where $K \equiv \gamma \log \gamma + (1 - \gamma) \log(1 - \gamma)$. In levels, $U_g = \mathcal{A}_g \beta^{\mathcal{H} \gamma} I(\mathcal{H}) / P$ with $\mathcal{A}_f = e^K \alpha^{1-\gamma}$ and $\mathcal{A}_m = e^K (1 - \alpha)^{1-\gamma}$. Ex ante utility corresponds to

$$\mathbb{E}[U_g] = (\mathcal{A}_g / \mathcal{A}) \mathbb{E}[\mathcal{U}]. \quad (\text{B.3})$$

Thus, each spouse's expected utility is a fixed multiple of the couple's expected utility. The ratio of private consumption is $c_f^* / c_m^* = \alpha / (1 - \alpha)$ and is independent of wages, β , and $\mathcal{H}$. Because the model contains no distribution factors, an increase in the wife's wage raises household income without changing her share of it.

1. Conditional sharing rule (CSR). The CSR allocates between the spouses the income remaining after expenditure on the public good:

$$\tilde{\zeta}_f = Pc_f^* = \alpha(1 - \gamma)I, \quad \tilde{\zeta}_m = Pc_m^* = (1 - \alpha)(1 - \gamma)I, \quad \tilde{\zeta}_f + \tilde{\zeta}_m = (1 - \gamma)I.$$

The CSR therefore excludes both the γI spent on the public good and the increase in public-good production generated by home production.

2. Lindahl prices. One unit of B costs the couple $P_B \equiv P\beta^{-\mathcal{H}}$. Thus, when the wife remains at home, home production reduces the effective price of the public good. Each spouse's personalized price equals their marginal willingness to pay for B , expressed in units of income:

$$P_g = P \frac{\partial u_g / \partial B}{\partial u_g / \partial c_g} = \frac{\gamma}{1 - \gamma} \cdot \frac{Pc_g^*}{B^*} \implies P_f = \alpha P_B, \quad P_m = (1 - \alpha)P_B.$$

These personalized prices satisfy the Samuelson condition $P_f + P_m = P_B$. Because both spouses value B identically, each bears a share of its cost equal to their bargaining weight.

3. Generalized sharing rule (GSR). The GSR adds each spouse's valuation of public expenditure at their personalized price to their private expenditure:

$$\zeta_f^* = Pc_f^* + P_f Q^* = \alpha(1 - \gamma)I + \alpha\gamma I = \alpha I, \quad \zeta_m^* = (1 - \alpha)I.$$

A wife who remains at home ($\mathcal{H} = 1$, $I = w^M$) has no labor earnings but is allocated resources equivalent to αw^M . The home-production shock does not directly affect the GSR; instead, it operates through the Lindahl price.

4. Money-Metric Welfare Index (MMWI). The MMWI of spouse g , denoted by m_g , is the income that spouse g would need to attain utility u_g when facing a reference price vector rather than personalized prices. An individual with preferences $B^\gamma c^{1-\gamma}$ and income m , facing price P for private consumption and $\bar{P}_B$ for the public good, attains

$$v(m) = \log m - (1 - \gamma) \log P - \gamma \log \bar{P}_B + K.$$

Equating $v(m_g)$ with u_g and solving for m_g yields the general formula $m_g = \zeta_g^* (\bar{P}_B / P_g)^\gamma$.

The remaining question is which reference price $\bar{P}_B$ to use. If I use the couple's own effective price, $\bar{P}_B = P\beta^{-\mathcal{H}}$, then $m_f = \alpha^{1-\gamma}I$ and $m_m = (1 - \alpha)^{1-\gamma}I$. Under this reference price, the index does not capture home production: for a wife who stays at home, it equals $\alpha^{1-\gamma}w^M$ regardless of her draw of β . I therefore use the market price, $\bar{P}_B = P$, so that the index explicitly accounts for home production. In this case, $v(m) = \log(m/P) + K$, and

setting $v(m_f) = u_f$ yields

$$m_f = \alpha^{1-\gamma} \beta^{\mathcal{H}\gamma} I, \quad m_m = (1 - \alpha)^{1-\gamma} \beta^{\mathcal{H}\gamma} I. \quad (\text{B.4})$$

Rewriting the wife's index as $m_f = \alpha I \cdot \alpha^{-\gamma} \cdot \beta^{\mathcal{H}\gamma}$ separates three forces. The first term, αI , is her GSR share. The second term, $\alpha^{-\gamma}$, corresponds to the Lindahl-price adjustment. The third, $\beta^{\mathcal{H}\gamma}$, captures the value of home production for spouses.

Summing equation (B.4) across spouses, I can express the gains from the public nature of B as

$$\frac{m_f + m_m}{\beta^{\mathcal{H}\gamma} I} = G(\alpha, \gamma) \equiv \alpha^{1-\gamma} + (1 - \alpha)^{1-\gamma} > 1 \quad \text{whenever } 0 < \gamma < 1.$$

Thus, the spouses would jointly require more income than the household possesses if each had to purchase the public good separately at its full market price.

Couples solve the mobility problem in equation (18) before β is realized. The relevant ex ante index is therefore the certain income $\bar{m}_g = \alpha_g^{1-\gamma} \mathbb{E}[\beta^{\mathcal{H}\gamma} I(\mathcal{H})]$ that allows a person with the same preferences to attain $\mathbb{E}[U_g]$.⁴⁹ With $\alpha_f \equiv \alpha$ and $\alpha_m \equiv 1 - \alpha$,

$$\bar{m}_f = \alpha^{1-\gamma} \Phi w^M, \quad \bar{m}_m = (1 - \alpha)^{1-\gamma} \Phi w^M. \quad (\text{B.5})$$

where Φ is the term defined in Section III. Summing equation (B.5) across spouses gives the ex ante counterpart of $G(\alpha, \gamma)$:

$$\bar{m}_f + \bar{m}_m = G(\alpha, \gamma) \Phi w^M = G(\alpha, \gamma) w^M (1 + r) \frac{\kappa/\gamma - \rho}{\kappa/\gamma - 1}.$$

Dividing by P gives the couple's money-metric indirect utility, $\bar{W}^c$, in Section III. Relative to household income when the wife works, $w^M(1 + r)$, the spouses' combined index is therefore scaled up twice: once by $G(\alpha, \gamma)$, because the public good is shared, and once by the value of the option to stay at home.

5. MMWI for singles. The central assumption is that singles have the same preferences as spouses but cannot share the public good with another household member. A single of gender g with wage w^g therefore solves

$$\max \gamma \log B^g + (1 - \gamma) \log c^g \quad \text{s.t.} \quad P(c^g + B^g) = w^g.$$

This problem implies $c^g = (1 - \gamma)w^g/P$ and $B^g = \gamma w^g/P$, with indirect utility $u_s^g = \log \frac{w^g}{P} + K$. The constant K does not affect choices and cancels out in every change in welfare. Thus,

⁴⁹Household income is $I = w^M(1 + r)$ when the wife works and $I = w^M$ when she stays at home, so $\beta^{\mathcal{H}\gamma} I = w^M \max\{1 + r, \beta^{\mathcal{H}\gamma}\}$ and $\mathbb{E}[\beta^{\mathcal{H}\gamma} I] = \Phi w^M$.

the model's $W^{s_g} = w^g/P$ is an exact representation of these preferences, and no quantitative result changes. What a single lacks is not the public good itself but its *publicness*: a single person must pay its full price. Accordingly, the MMWI for a single of gender g is

$$m^g = \frac{w^g}{P}.$$

6. Money-Metric-Weighted Aggregate Welfare. Starting from the aggregate welfare effect of a sectoral productivity shock,

$$Z = \underbrace{\sum_{i=1}^L \sum_{k=0}^K N_{o,0}^{s_m} Z_o^{s_m}}_{Z^{s_m}} + \underbrace{\sum_{i=1}^L \sum_{k=0}^K N_{o,0}^{s_f} Z_o^{s_f}}_{Z^{s_f}} + \underbrace{\sum_{i=1}^L \sum_{k_m=0}^K \sum_{k_f=1}^K N_{o,0}^c Z_o^c}_{Z^c}, \quad (\text{B.6})$$

I can express the per-person consumption-equivalent change in utility as

$$\bar{Z}^u = \frac{\sum N^{s_m} Z^{s_m} + \sum N^{s_f} Z^{s_f} + \sum N^c Z^c}{\sum N^{s_m} + \sum N^{s_f} + \sum N^c}.$$

The measure $\bar{Z}^u$ averages percentage changes defined relative to different bases: for a single, the base is w/P ; for a spouse, it is a share of the household's full income, together with a shared public good. To express the per-person consumption-equivalent change in income terms, I therefore construct a money-metric-weighted measure that aggregates across singles and couples.

Because each spouse's expected utility is a constant multiple of the couple's expected utility, the consumption-equivalent change of each spouse is identical to that of the couple when expressed in hat notation. The money-metric-weighted measure is therefore

$$\bar{Z} = \frac{\sum m_i Z_i}{\sum m_i} = \bar{Z}^u + \frac{\text{Cov}(m_i, Z_i)}{\bar{m}}.$$

The covariance term captures whether the gains from the shock accrue to individuals with larger money metrics, such as spouses, or to those with smaller money metrics, such as singles.

C. Quantitative Model

Section III presents a version of the model in which firms produce with labor alone. The model I solve in Sections IV and V has a richer production block, built as in Caliendo et al. (2019). Compared to the simplified model, the quantitative model includes: (i) firms also use a fixed local factor, structures, and intermediate inputs from every sector; (ii) sectors trade as in Eaton and Kortum (2002); and (iii) the rents from structures flow through a global portfolio, so trade need not be balanced. This appendix presents that production block and the equilibrium it implies.

Households are modeled as in Section III.2, so their preferences are not repeated here. Preferences, location and sector choices, the couple's problem, and wives' participation do not change, and neither do the value functions (18), the choice probabilities (19) and (20), the participation probability (25), the law of motion (29), or the labor supplies (28).

C.1 Technology

Intermediate goods. Each sector k in region i produces a continuum of varieties of an intermediate good. A producer of a variety with efficiency a combines structures, $S_{i,k}$, effective labor, $\mathcal{L}_{i,k,t}$, and materials from every sector n , $G_{i,k,t}^n$:

$$q_{i,k,t}(a) = a \left[A_{i,k,t} S_{i,k}^{\xi_i} \mathcal{L}_{i,k,t}^{1-\xi_i} \right]^{\omega_{i,k}} \prod_{n=1}^K (G_{i,k,t}^n)^{\omega_{i,k}^n}. \quad (\text{C.1})$$

Here, $\omega_{i,k} \in (0, 1]$ is the share of value added in gross output, $\omega_{i,k}^n \geq 0$ is the share of materials from sector n , with $\sum_{n=1}^K \omega_{i,k}^n = 1 - \omega_{i,k}$, and $\xi_i \in [0, 1)$ is the share of structures in value added. Effective labor is the CES aggregate of male and female labor in equation (9). Productivity $A_{i,k,t}$ multiplies value added rather than gross output, so a change in productivity lowers a sector's costs in proportion to its value-added share, as in CDP. Structures are fixed in supply in each region-sector pair and are rented at rate $R_{i,k,t}$.

Cost minimization splits production costs among inputs in fixed shares, such that the unit cost of the input bundle is

$$x_{i,k,t} = \Xi_{i,k} \left[R_{i,k,t}^{\xi_i} \bar{w}_{i,k,t}^{1-\xi_i} \right]^{\omega_{i,k}} \prod_{n=1}^K P_{i,n,t}^{\omega_{i,k}^n}, \quad (\text{C.2})$$

where $\bar{w}_{i,k,t}$ is the CES wage index in equation (10), $P_{i,n,t}$ is the price of the sector- n composite good in region i (defined below), and $\Xi_{i,k}$ is a constant. Structures receive a share $\xi_i \omega_{i,k}$ of costs, labor a share $(1 - \xi_i) \omega_{i,k}$, and materials from sector n a share $\omega_{i,k}^n$. Within labor, firms choose how many men and women to hire exactly as in the simplified model, so the

labor demands (11) and (12) and the gender-specific wages (13) continue to hold, with $\mathcal{L}_{i,k,t}$ the effective labor used in value added. A producer with efficiency a therefore produces at unit cost $x_{i,k,t}/(a A_{i,k,t}^{\omega_{i,k}})$. In the simplified model, the corresponding unit cost is the producer price $p_{i,k,t} = \bar{w}_{i,k,t}/A_{i,k,t}$.

Because structures are in fixed supply, a region-sector pair faces decreasing returns to labor. As more workers enter a pair, each works with fewer structures, the rental rate of structures rises, and the pair's wage falls. Structures therefore act as a congestion force: wages fall where households arrive and rise where households leave, so the gain from moving toward a place shrinks as more households move there. The labor-only model in Section III has constant returns to labor and abstracts from such force.

Sectoral final goods and trade. In each region j and sector n , a representative sectoral final-good firm aggregates the varieties bought from their lowest-cost suppliers into the sector- n composite good, $Q_{j,n,t}$, using a CES aggregator.⁵⁰ The sectoral final-good firms are the ones that trade. As in the simplified model, goods are traded within each sector, and shipping a sector- n good from region i to region j entails an iceberg trade cost $\tau_{ij,n} \geq 1$, with $\tau_{jj,n} = 1$. The sectoral final-good firm in j buys each variety from its lowest-cost supplier, net of the trade cost.

Following Eaton and Kortum (2002) and Caliendo and Parro (2015), efficiencies are drawn independently across regions and varieties from a Fréchet distribution, $\Pr(a \leq \bar{a}) = \exp(-\bar{a}^{-\eta_n})$, where η_n is the sectoral trade elasticity of the simplified model. The price of the sector- n composite in region j

$$P_{j,n,t} = C_n \left(\sum_i (x_{i,n,t} \tau_{ij,n})^{-\eta_n} A_{i,n,t}^{\eta_n \omega_{i,n}} \right)^{-1/\eta_n}, \quad (\text{C.3})$$

where C_n is a constant. The share of region j 's spending on sector- n goods bought from region i is

$$\pi_{ij,n,t} = \frac{(x_{i,n,t} \tau_{ij,n})^{-\eta_n} A_{i,n,t}^{\eta_n \omega_{i,n}}}{\sum_\ell (x_{\ell,n,t} \tau_{\ell j,n})^{-\eta_n} A_{\ell,n,t}^{\eta_n \omega_{\ell,n}}}. \quad (\text{C.4})$$

Two features of the trade block are new relative to the simplified model. First, sectors are also linked through materials: sector k in region j buys the goods of every other sector n as inputs, in proportions given by the input-output coefficients $\omega_{j,k}^n$. Second, productivity enters trade shares raised to $\eta_n \omega_{i,n}$. A productivity gain lowers costs only on the value-added part of production, so it raises a region's market share less in sectors that rely more

⁵⁰The elasticity of substitution across varieties, ς_n , satisfies $\varsigma_n < 1 + \eta_n$ and enters the equilibrium only through the constant C_n .

on materials.

The sectoral final good is not traded. Local households buy it as part of the regional consumption good, which aggregates the sectoral composites with the Cobb-Douglas shares ι_n , so the regional price index is still $P_{j,t} = \prod_{k=1}^K P_{j,k,t}^{\iota_k}$, as in equation (15). Local intermediate firms in every sector buy it as a material. Because firms buy materials from every sector, a change in the price of one sector's goods spreads to the costs of all sectors that use them (Caliendo and Parro, 2015).

Rentiers and the global portfolio. Each region has a mass one of rentiers who own its structures. They rent the structures to local intermediate firms and send the rents to a global portfolio, whose total revenue is

$$\mathcal{R}_t = \sum_i \sum_{k=1}^K R_{i,k,t} S_{i,k}.$$

In return, the rentiers of region j receive a constant share ϖ_j of the portfolio, with $\sum_j \varpi_j = 1$, and spend it on the regional consumption good. Under this framework, trade can be unbalanced.

Region j spends $\varpi_j \mathcal{R}_t$ out of the portfolio, but its own structures earn $\sum_k R_{j,k,t} S_{j,k}$, so its trade deficit is

$$\varpi_j \mathcal{R}_t - \sum_{k=1}^K R_{j,k,t} S_{j,k}. \quad (\text{C.5})$$

The deficits add up to zero across regions, and they change over time only because rents change.⁵¹

C.2 Market Clearing

As in the simplified model, I denote the value of the gross output of sector k in region i by $p_{i,k,t} Y_{i,k,t}$. Let $X_{j,k,t}$ denote region j 's total expenditure on the sector- k composite good. The value of gross output is the sum of what every region spends on sector- k goods from i :

$$p_{i,k,t} Y_{i,k,t} = \sum_j \pi_{ij,k,t} X_{j,k,t}. \quad (\text{C.6})$$

⁵¹Allowing for unbalanced trade matters for how the China Trade Shock is quantified in Section IV.2. Under balanced trade, every additional dollar of imports from China would have to be paid for with a dollar of US exports, so the China Trade Shock would push US workers into export sectors. With the portfolio, the US can keep running a deficit, and the shock works mainly through cheaper imports and lower manufacturing employment. Thus, I set the shares ϖ_j so that equation (C.5) reproduces each region's observed trade imbalance in 2000 (Caliendo et al., 2019).

Goods markets. Region j buys sector- n goods for two uses: as materials for its own firms and as final consumption for its households and rentiers. Goods-market clearing therefore requires

$$X_{j,n,t} = \sum_{k=1}^K \omega_{j,k}^n p_{j,k,t} Y_{j,k,t} + \iota_n P_{j,t} Q_{j,t}, \quad (\text{C.7})$$

$$P_{j,t} Q_{j,t} = \sum_{k=1}^K (w_{j,k,t}^M M_{j,k,t} + w_{j,k,t}^F F_{j,k,t}) + \varpi_j \mathcal{R}_t, \quad (\text{C.8})$$

where $P_{j,t} Q_{j,t}$ is final expenditure in region j . Households spend all of their market income on the regional consumption good. Couples spend $I(\mathcal{H})$ in equation (22), which includes the wife's wage only when she works, and the female labor supply $F_{j,k,t}$ in equation (28) already weights each couple by the probability that she does. Home production, both in the non-employment sector and by wives who stay at home, is not bought in the market, so it does not enter final expenditure.

Factor markets. Labor and structures in each region-sector pair receive their cost shares of gross output:

$$w_{j,n,t}^M M_{j,n,t} + w_{j,n,t}^F F_{j,n,t} = \bar{w}_{j,n,t} \mathcal{L}_{j,n,t} = (1 - \xi_j) \omega_{j,n} p_{j,n,t} Y_{j,n,t}, \quad (\text{C.9})$$

$$R_{j,n,t} S_{j,n} = \xi_j \omega_{j,n} p_{j,n,t} Y_{j,n,t}. \quad (\text{C.10})$$

Dividing equation (C.10) by equation (C.9) shows that rents are proportional to the wage bill, so the global portfolio is

$$\mathcal{R}_t = \sum_i \sum_{k=1}^K \frac{\xi_i}{1 - \xi_i} \bar{w}_{i,k,t} \mathcal{L}_{i,k,t}. \quad (\text{C.11})$$

Substituting the rental rate into equation (C.2) writes the cost of the input bundle in terms of labor,

$$x_{j,n,t} = \tilde{\Xi}_{j,n} \left[\bar{w}_{j,n,t} \left(\frac{\mathcal{L}_{j,n,t}}{S_{j,n}} \right)^{\xi_j} \right]^{\omega_{j,n}} \prod_{k=1}^K P_{j,k,t}^{\omega_{j,k}^k}, \quad (\text{C.12})$$

where $\tilde{\Xi}_{j,n}$ is a constant. Equation (C.12) therefore summarizes the congestion force. Holding wages fixed, more effective labor per unit of structures raises a pair's costs, lowers its market share, and therefore lowers the wage it can pay.

These conditions differ from those in Section III in two ways. First, labor receives only the share $(1 - \xi_j) \omega_{j,n}$ of gross output, rather than all of it, because structures and materials take the rest. Second, expenditures include materials firms buy from each other and income

from the global portfolio, so goods markets clear with trade imbalances rather than under balanced trade.

C.3 Equilibrium

In the quantitative model, the economic geography at time t consists of the time-varying exogenous sectoral productivities and the time-invariant shares of single individuals born in each region, migration costs, iceberg trade costs, home production in the non-employment sector, and stocks of structures: $\Gamma_t = \{A_{i,k,t}, \bar{s}_i, \mu_{od}, \tau_{ij,k}, y_j, S_{i,k}\}_{i,j=1, k=1}^{L,K}$. The remaining time-invariant parameters, which now include the structure shares, the portfolio shares, the value-added shares, and the input-output coefficients, are collected in the vector $\bar{\Gamma} = \left\{ N, L, K, \delta, \chi, \kappa, \alpha, \gamma, \sigma, \nu, \theta, \{\xi_i, \varpi_i\}_{i=1}^L, \{\psi_{k,m}, \psi_{k,f}, \eta_k, \iota_k\}_{k=1}^K, \{\omega_{i,k}, \omega_{i,k}^n\}_{i=1, k,n=1}^{L,K} \right\}$.

Definition C.1. *Given $(N_t, \Gamma_t, \bar{\Gamma})$, a **temporary equilibrium** of the quantitative model is a vector of productive-sector wages $\{\bar{w}_{j,n,t}, w_{j,n,t}^M, w_{j,n,t}^F\}$ and rental rates $\{R_{j,n,t}\}$ such that, for every productive region-sector pair jn :*

- (i) *The wage index satisfies (10), and male and female labor markets clear, (28), with labor demands given by (11)–(12) and participation probabilities by (25);*
- (ii) *Labor and structures receive their cost shares of gross output, (C.9) and (C.10);*
- (iii) *Goods markets clear: gross output and expenditure satisfy (C.6), (C.7), and (C.8), with the global portfolio given by (C.11).*

Given these wages and rental rates, input-bundle costs, prices, and trade shares follow from equations (C.2), (C.3), and (15).

Because the household problem is unchanged, the sequential competitive equilibrium differs from the one in Section III only through the temporary equilibrium.

Definition C.2. *Given $(N_0, \Gamma_t, \bar{\Gamma})$, a **sequential competitive equilibrium** of the quantitative model is a sequence of household distributions $\{N_t\}_{t=0}^\infty$, values $\{V_{o,t}^h\}_{t=0}^\infty$, productive-sector wages $\{\bar{w}_{j,n,t}, w_{j,n,t}^M, w_{j,n,t}^F\}_{t=0}^\infty$, and rental rates $\{R_{j,n,t}\}_{t=0}^\infty$ such that, in each period t :*

- (i) *Given N_t , wages and rental rates form a temporary equilibrium of the quantitative model;*
- (ii) *Values satisfy (18), with location and sector choice probabilities given by (19) and (20);*
- (iii) *The distribution of households evolves according to (29).*

D. Dynamic Hat Algebra

This appendix develops the Dynamic Hat Algebra used to solve and simulate the quantitative model k in Appendix C. It expresses the equilibrium entirely in terms of time changes and ratios across the with-shock and no-shock economies, so I never have to recover the fundamentals' levels. The appendix proceeds in two parts. First, I state the two propositions that characterize the no-shock economy: one for the temporary equilibrium at a given point in time and another for the full sequential equilibrium, along with the algorithm used to solve them. I then derive the corresponding results for the with-shock economy, defined by an alternative path of sectoral productivities.

D.1 Dynamic Dot and Hat Algebra

Notation. Let $\dot{x}_{t+1} = x_{t+1}/x_t$ denote the proportional change in any variable x between t and $t + 1$ in the no-shock economy. Let $\hat{x}_{t+1} = \dot{x}'_{t+1}/\dot{x}_{t+1}$, where $\dot{x}'_{t+1} = x'_{t+1}/x'_t$, denote the ratio of the changes in the with-shock economy to those in the no-shock economy. Primes denote levels in the with-shock economy throughout.

For every feasible origin $\mathbf{o}$, define $u_{\mathbf{o},t}^h = \exp(V_{\mathbf{o},t}^h)$, and define regional expenditure as $E_{j,t} \equiv P_{j,t}Q_{j,t}$. Because local sectoral productivities $\{A_{j,n,t}\}$ are the only fundamentals that vary over time, a quantitative application begins with a path of productivity changes $\{\dot{A}_{j,n,t}\}$ and solves the equilibrium system below.

Dot algebra. For couples, define the quality-adjusted value of destination $\mathbf{d}$ as

$$\Phi_{\mathbf{d},t} = \mathcal{A} \left[(1 + r_{\mathbf{d},t}) + \chi^\kappa \frac{\gamma}{\kappa - \gamma} (1 + r_{\mathbf{d},t})^{1-\kappa/\gamma} \right].$$

Because $\mathcal{A}$ is constant, it cancels from all proportional changes and cross-economy ratios of Φ . I retain it in the level expressions below only for completeness. The proportional change in Φ is

Proposition D.1. *Given the temporary-equilibrium allocation at t and labor supplies at $t + 1$, the temporary equilibrium at $t + 1$ can be computed without knowing the levels of the fundamentals. It is characterized by the following system of equations for all region-sector pairs (j, n)*

$$\dot{\mathcal{L}}_{j,n,t+1} = \left(s_{j,n,m,t} \dot{M}_{j,n,t+1}^{(\sigma-1)/\sigma} + s_{j,n,f,t} \dot{F}_{j,n,t+1}^{(\sigma-1)/\sigma} \right)^{\sigma/(\sigma-1)}, \quad (\text{D.1})$$

$$\dot{x}_{j,n,t+1} = \left(\dot{\mathcal{L}}_{j,n,t+1}^{\xi_j} \dot{w}_{j,n,t+1} \right)^{\omega_{j,n}} \prod_{k=1}^K \dot{P}_{j,k,t+1}^{\omega_{j,n}^k}, \quad (\text{D.2})$$

$$\dot{P}_{j,n,t+1} = \left(\sum_i \pi_{ij,n,t} (\dot{x}_{i,n,t+1})^{-\eta_n} \dot{A}_{i,n,t+1}^{\eta_n \omega_{i,n}} \right)^{-1/\eta_n}, \quad (\text{D.3})$$

$$\pi_{ij,n,t+1} = \pi_{ij,n,t} \left(\frac{\dot{x}_{i,n,t+1}}{\dot{P}_{j,n,t+1}} \right)^{-\eta_n} \dot{A}_{i,n,t+1}^{\eta_n \omega_{i,n}}, \quad (\text{D.4})$$

$$X_{j,n,t+1} = \sum_{k=1}^K \omega_{j,k}^n \sum_{\ell} \pi_{j\ell,k,t+1} X_{\ell,k,t+1} + \iota_n E_{j,t+1}, \quad (\text{D.5})$$

$$E_{j,t+1} = \sum_{k=1}^K \dot{w}_{j,k,t+1} \dot{\mathcal{L}}_{j,k,t+1} \bar{w}_{j,k,t} \mathcal{L}_{j,k,t} + \varpi_j \mathcal{R}_{t+1}, \quad (\text{D.6})$$

$$\dot{w}_{j,n,t+1} \dot{\mathcal{L}}_{j,n,t+1} \bar{w}_{j,n,t} \mathcal{L}_{j,n,t} = (1 - \xi_j) \omega_{j,n} \sum_{\ell} \pi_{j\ell,n,t+1} X_{\ell,n,t+1}, \quad (\text{D.7})$$

$$\mathcal{R}_{t+1} = \sum_i \sum_{k=1}^K \frac{\xi_i}{1 - \xi_i} \dot{w}_{i,k,t+1} \dot{\mathcal{L}}_{i,k,t+1} \bar{w}_{i,k,t} \mathcal{L}_{i,k,t}, \quad (\text{D.8})$$

where $s_{j,n,m,t}$ and $s_{j,n,f,t}$ are the male and female shares of the wage bill. Gender-specific wages and the regional price index follow from

$$\dot{w}_{j,n,t+1}^M = \dot{w}_{j,n,t+1} \left(\frac{\dot{\mathcal{L}}_{j,n,t+1}}{\dot{M}_{j,n,t+1}} \right)^{1/\sigma}, \quad (\text{D.9})$$

$$\dot{w}_{j,n,t+1}^F = \dot{w}_{j,n,t+1} \left(\frac{\dot{\mathcal{L}}_{j,n,t+1}}{\dot{F}_{j,n,t+1}} \right)^{1/\sigma}, \quad (\text{D.10})$$

$$\dot{P}_{j,t+1} = \prod_{k=1}^K \dot{P}_{j,k,t+1}^{\iota_k}. \quad (\text{D.11})$$

Moreover, for each destination relevant to couples,

$$\dot{r}_{\mathbf{d},t+1} = \frac{\dot{w}_{j,n_f,t+1}^F}{\dot{w}_{j,n_m,t+1}^M}, \quad (\text{D.12})$$

$$r_{\mathbf{d},t+1} = r_{\mathbf{d},t} \dot{r}_{\mathbf{d},t+1}, \quad (\text{D.13})$$

$$\rho_{\mathbf{d},t+1} = 1 - \chi^\kappa (1 + r_{\mathbf{d},t+1})^{-\kappa/\gamma}, \quad (\text{D.14})$$

$$\dot{\Phi}_{\mathbf{d},t+1} = \frac{(1 + r_{\mathbf{d},t+1}) + \chi^\kappa \frac{\gamma}{\kappa - \gamma} (1 + r_{\mathbf{d},t+1})^{1-\kappa/\gamma}}{(1 + r_{\mathbf{d},t}) + \chi^\kappa \frac{\gamma}{\kappa - \gamma} (1 + r_{\mathbf{d},t})^{1-\kappa/\gamma}}. \quad (\text{D.15})$$

In the labor-only model of Section III, $\xi_j = 0$ and $\omega_{j,n} = 1$, so the input-bundle cost equals the wage index, the wage bill equals gross output, and the system reduces to that model's trade block.

Building on Proposition D.1, I next characterize the sequential equilibrium in time dif-

ferences. Equation (20) implies that the ratio of within-location shares between $t + 1$ and t is

$$\frac{\lambda_{od|j,t+1}^h}{\lambda_{od|j,t}^h} = \frac{\exp [\delta (V_{d,t+2}^h - V_{d,t+1}^h)]^{1/\nu}}{\Omega_{oj,t+1}^h / \Omega_{oj,t}^h}, \quad \frac{\Omega_{oj,t+1}^h}{\Omega_{oj,t}^h} = \sum_{z \in S_h(j)} \lambda_{oz|j,t}^h (\dot{u}_{z,t+2}^h)^{\delta/\nu},$$

where the second equality follows from the time invariance of μ_{oz} . Define the proportional change in the inclusive value of location j as

$$D_{oj,t}^h \equiv \sum_{z \in S_h(j)} \lambda_{oz|j,t}^h (\dot{u}_{z,t+2}^h)^{\delta/\nu}. \quad (\text{D.16})$$

The location shares in equation (19) and the value function in equation (18) depend on continuation values only through the inclusive values. Their time differences can therefore be expressed entirely in terms of $D_{oj,t}^h$.

Proposition D.2. *Given the economy's initial allocation, including the initial location shares $\lambda_{oj,0}^h$ and within-location shares $\lambda_{od|j,0}^h$, together with an anticipated convergent sequence of productivity changes, the sequential equilibrium in time differences can be solved without recovering the levels of the fundamentals. The solution satisfies the following system of nonlinear equations for all h :*

$$\lambda_{od|j,t+1}^h = \frac{\lambda_{od|j,t}^h (\dot{u}_{d,t+2}^h)^{\delta/\nu}}{\sum_{z \in S_h(j)} \lambda_{oz|j,t}^h (\dot{u}_{z,t+2}^h)^{\delta/\nu}}, \quad (\text{D.17})$$

$$\lambda_{oj,t+1}^h = \frac{\lambda_{oj,t}^h (D_{oj,t}^h)^{\nu/\theta}}{\sum_{\ell=1}^L \lambda_{o\ell,t}^h (D_{o\ell,t}^h)^{\nu/\theta}}, \quad (\text{D.18})$$

$$\dot{u}_{o,t+1}^h = \dot{W}_{o,t+1}^h \left(\sum_{\ell=1}^L \lambda_{o\ell,t}^h \left(\sum_{z \in S_h(\ell)} \lambda_{oz|t}^h (\dot{u}_{z,t+2}^h)^{\delta/\nu} \right)^{\nu/\theta} \right)^{\theta}, \quad (\text{D.19})$$

$$N_{d,t+1}^h = \sum_{o \in S_h} \lambda_{od|j,t}^h \lambda_{oj,t}^h N_{o,t}^h, \quad (\text{D.20})$$

$$M_{j,n,t+1} = N_{j,n,t+1}^{s_m} + \sum_{n_f=1}^K N_{j,n,n_f,t+1}^c, \quad (\text{D.21})$$

$$F_{j,n,t+1} = N_{j,n,t+1}^{s_f} + \sum_{n_m=0}^K \rho_{j,n_m,n,t+1} N_{j,n_m,n,t+1}^c, \quad (\text{D.22})$$

for all feasible origins and all sectors at each t , where $D_{o\ell,t}^h$ is defined in equation (D.16) and the sectoral prices, trade shares, and participation objects solve the temporary-equilibrium system in Proposition D.1.

Because the migration costs μ_{od} are time-invariant, they cancel from all ratios and therefore need not be recovered in levels. The flow term in the couple's continuation value is the only one that contains an additional factor. In particular, because the couple's indirect utility is $W_{o,t}^c = \Phi_{o,t} w_{i,k_m,t}^M / P_{i,t}$, its proportional change is $\dot{\Phi}_{o,t+1} \dot{w}_{i,k_m,t+1}^M / \dot{P}_{i,t+1}$. Thus, the relevant term is the *ratio* defined in equation (D.15), rather than the level $\Phi_{o,t+1}$.

Dynamic hat algebra. The path of sectoral productivity fundamentals in the with-shock economy, $\{A'_{j,n,t}\}_{t \geq 1}$, defines the corresponding productivity hats $\{\hat{A}_{j,n,t}\}_{t \geq 1}$. Under CDP's timing, households do not anticipate the change at $t = 0$. Therefore, $\lambda'_{oj,0} = \lambda_{oj,0}^h$, $\lambda'_{od|j,0} = \lambda_{od|j,0}^h$, and $N'_{o,1} = N_{o,1}^h$.

Dividing each with-shock migration equation in Proposition D.2 by its no-shock counterpart, and using $\dot{\lambda}_{od|j,t}^h = \lambda_{od|j,t}^h / \lambda_{od|j,t-1}^h$ and $\dot{\lambda}_{oj,t}^h = \lambda_{oj,t}^h / \lambda_{oj,t-1}^h$, yields the following with-shock analogue of equation (D.16):

$$\hat{D}_{oj,t}^h \equiv \sum_{z \in \mathcal{S}_h(j)} \lambda'_{oz|j,t-1} \dot{\lambda}_{oz|j,t}^h (\hat{u}_{z,t+1}^h)^{\delta/\nu}. \quad (\text{D.23})$$

Proposition D.3. *Given the no-shock economy and a convergent sequence of productivity changes in the with-shock economy relative to the no-shock path, I can solve the with-shock sequential equilibrium without recovering the fundamental levels. For $t \geq 2$, it is characterized by the following system of nonlinear equations for all h :*

$$\lambda'_{od|j,t}^h = \frac{\lambda'_{od|j,t-1}^h \dot{\lambda}_{od|j,t}^h (\hat{u}_{d,t+1}^h)^{\delta/\nu}}{\hat{D}_{oj,t}^h}, \quad (\text{D.24})$$

$$\lambda'_{oj,t}^h = \frac{\lambda'_{oj,t-1}^h \dot{\lambda}_{oj,t}^h (\hat{D}_{oj,t}^h)^{\nu/\theta}}{\sum_{\ell=1}^L \lambda'_{o\ell,t-1}^h \dot{\lambda}_{o\ell,t}^h (\hat{D}_{o\ell,t}^h)^{\nu/\theta}}, \quad (\text{D.25})$$

$$\hat{u}_{o,t}^h = \hat{W}_{o,t}^h \left(\sum_{\ell=1}^L \lambda'_{o\ell,t-1}^h \dot{\lambda}_{o\ell,t}^h \left(\sum_{z \in \mathcal{S}_h(\ell)} \lambda'_{oz|t-1}^h \dot{\lambda}_{oz|t}^h (\hat{u}_{z,t+1}^h)^{\delta/\nu} \right)^{\nu/\theta} \right)^{\theta}, \quad (\text{D.26})$$

$$N'_{d,t+1}^h = \sum_{o \in \mathcal{S}_h} \lambda'_{od|j,t}^h \lambda'_{oj,t}^h N_{o,t}^h, \quad (\text{D.27})$$

$$M'_{j,n,t+1} = N'_{j,n,t+1}{}^{sm} + \sum_{n_f=1}^K N'_{j,n,n_f,t+1}{}^c, \quad (\text{D.28})$$

$$F'_{j,n,t+1} = N'_{j,n,t+1}{}^{sf} + \sum_{n_m=0}^K \rho'_{j,n_m,n,t+1} N'_{j,n_m,n,t+1}{}^c. \quad (\text{D.29})$$

In period $t = 1$, when households first learn the new path, the migration equations instead

become

$$\lambda'_{od|j,1} = \frac{v_{od|j}^h (\hat{u}_{d,2}^h)^{\delta/\nu}}{\sum_{\mathbf{z} \in \mathcal{S}_h(j)} v_{\mathbf{oz}|j}^h (\hat{u}_{\mathbf{z},2}^h)^{\delta/\nu}}, \quad (\text{D.30})$$

$$\lambda'_{oj,1} = \frac{\lambda_{oj,1}^h \left(\sum_{\mathbf{z} \in \mathcal{S}_h(j)} v_{\mathbf{oz}|j}^h (\hat{u}_{\mathbf{z},2}^h)^{\delta/\nu} \right)^{\nu/\theta}}{\sum_{\ell=1}^L \lambda_{o\ell,1}^h \left(\sum_{\mathbf{z} \in \mathcal{S}_h(\ell)} v_{\mathbf{oz}|\ell}^h (\hat{u}_{\mathbf{z},2}^h)^{\delta/\nu} \right)^{\nu/\theta}}, \quad (\text{D.31})$$

$$\hat{u}_{o,1}^h = \hat{W}_{o,1}^h \left(\sum_{\ell=1}^L \lambda_{o\ell,1}^h \left(\sum_{\mathbf{z} \in \mathcal{S}_h(\ell)} v_{\mathbf{oz}|\ell}^h (\hat{u}_{\mathbf{z},2}^h)^{\delta/\nu} \right)^{\nu/\theta} \right)^{\theta}, \quad (\text{D.32})$$

with $v_{od|j}^h \equiv \lambda_{od|j,1}^h (\hat{u}_{d,1}^h)^{\delta/\nu}$. The with-shock temporary equilibrium is characterized by

$$\hat{x}_{j,n,t+1} = \left(\hat{\mathcal{L}}_{j,n,t+1}^{\xi_j} \hat{w}_{j,n,t+1} \right)^{\omega_{j,n}} \prod_{k=1}^K \hat{P}_{j,k,t+1}^{\omega_{j,n}^k}, \quad (\text{D.33})$$

$$\hat{P}_{j,n,t+1} = \left(\sum_i \pi'_{ij,n,t} \dot{\pi}_{ij,n,t+1} (\hat{x}_{i,n,t+1})^{-\eta_n} \hat{A}_{i,n,t+1}^{\eta_n \omega_{i,n}} \right)^{-1/\eta_n}, \quad (\text{D.34})$$

$$\pi'_{ij,n,t+1} = \pi'_{ij,n,t} \dot{\pi}_{ij,n,t+1} \left(\frac{\hat{x}_{i,n,t+1}}{\hat{P}_{j,n,t+1}} \right)^{-\eta_n} \hat{A}_{i,n,t+1}^{\eta_n \omega_{i,n}}, \quad (\text{D.35})$$

$$X'_{j,n,t+1} = \sum_{k=1}^K \omega_{j,k}^n \sum_{\ell} \pi'_{j\ell,k,t+1} X'_{\ell,k,t+1} + \iota_n E'_{j,t+1}, \quad (\text{D.36})$$

$$E'_{j,t+1} = \sum_{k=1}^K \bar{w}'_{j,k,t+1} \mathcal{L}'_{j,k,t+1} + \varpi_j \mathcal{R}'_{t+1}, \quad (\text{D.37})$$

$$\bar{w}'_{j,n,t+1} \mathcal{L}'_{j,n,t+1} = (1 - \xi_j) \omega_{j,n} \sum_{\ell} \pi'_{j\ell,n,t+1} X'_{\ell,n,t+1}, \quad (\text{D.38})$$

where the with-shock wage bill at $t+1$ and the with-shock portfolio are

$$\bar{w}'_{j,n,t+1} \mathcal{L}'_{j,n,t+1} = \hat{w}_{j,n,t+1} \hat{\mathcal{L}}_{j,n,t+1} \dot{w}_{j,n,t+1} \dot{\mathcal{L}}_{j,n,t+1} \bar{w}'_{j,n,t} \mathcal{L}'_{j,n,t}, \quad (\text{D.39})$$

$$\mathcal{R}'_{t+1} = \sum_i \sum_{k=1}^K \frac{\xi_i}{1 - \xi_i} \bar{w}'_{i,k,t+1} \mathcal{L}'_{i,k,t+1}. \quad (\text{D.40})$$

Effective labor, gender-specific wages, the regional price index, and the relative wage follow from

$$\hat{\mathcal{L}}_{j,n,t+1} = \frac{\dot{\mathcal{L}}'_{j,n,t+1}}{\dot{\mathcal{L}}_{j,n,t+1}}, \quad (\text{D.41})$$

$$\hat{w}_{j,n,t+1}^M = \hat{w}_{j,n,t+1} \left(\frac{\hat{\mathcal{L}}_{j,n,t+1}}{\hat{M}_{j,n,t+1}} \right)^{1/\sigma}, \quad (\text{D.42})$$

$$\hat{w}_{j,n,t+1}^F = \hat{w}_{j,n,t+1} \left(\frac{\hat{\mathcal{L}}_{j,n,t+1}}{\hat{F}_{j,n,t+1}} \right)^{1/\sigma}, \quad (\text{D.43})$$

$$\hat{P}_{j,t+1} = \prod_{k=1}^K \hat{P}_{j,k,t+1}^{\ell_k}, \quad (\text{D.44})$$

$$\hat{r}_{\mathbf{d},t+1} = \frac{\hat{w}_{j,n_f,t+1}^F}{\hat{w}_{j,n_m,t+1}^M}. \quad (\text{D.45})$$

The corresponding with-shock level objects satisfy

$$r'_{\mathbf{d},t} = r'_{\mathbf{d},t-1} \dot{r}_{\mathbf{d},t} \hat{r}_{\mathbf{d},t}, \quad (\text{D.46})$$

$$\rho'_{\mathbf{d},t} = 1 - \chi^\kappa (1 + r'_{\mathbf{d},t})^{-\kappa/\gamma}, \quad (\text{D.47})$$

$$\hat{\Phi}_{\mathbf{d},t} = \frac{\Phi'_{\mathbf{d},t}}{\Phi_{\mathbf{d},t}}, \quad (\text{D.48})$$

with $\Phi'_{\mathbf{d},t}$ evaluated at $r'_{\mathbf{d},t}$.

D.2 Solution Algorithms

Solution algorithm for the no-shock economy. Given an initial equilibrium at $t = 0$ and an anticipated convergent sequence of sectoral productivity changes $\left\{ \dot{A}_{j,n,t} \right\}_{j=1, n=1, t=0}^{L,K,T}$, the algorithm as follows:

1. Fix a sufficiently large terminal horizon T and guess a path for the changes in continuation values $\left\{ \dot{u}_{\mathbf{o},t+1}^{h,(0)} \right\}_{t=0}^T$, subject to the terminal condition $\dot{u}_{\mathbf{o},T+1}^{h,(0)} = 1$ for every feasible origin $\mathbf{o}$.
2. Decompose the initial migration matrix into location shares $\lambda_{\mathbf{o}j,0}^h = \sum_{\mathbf{d} \in \mathcal{S}_h(j)} \lambda_{\mathbf{o}\mathbf{d},0}^h$ and within-location shares $\lambda_{\mathbf{o}\mathbf{d}|j,0}^h = \lambda_{\mathbf{o}\mathbf{d},0}^h / \lambda_{\mathbf{o}j,0}^h$. Using Proposition D.2, update these objects forward in the following order: the within-location shares, $D_{\mathbf{o}j,t}^h$, and then the location shares.
3. Starting from the initial allocation, apply the law of motion to recover the entire path of household masses $\left\{ N_{\mathbf{d},t}^{s_m,(0)}, N_{\mathbf{d},t}^{s_f,(0)}, N_{\mathbf{d},t}^{c,(0)} \right\}_{t=0}^T$, and aggregate these masses into sectoral male labor supplies $\left\{ M_{j,n,t}^{(0)} \right\}_{t=0}^T$.
4. Solve the temporary equilibrium sequentially for each period $t \geq 0$:

- (a) Guess the participation rates $\{\rho_{\mathbf{d},t+1}^{(0)}\}$ and use them to construct the sectoral female labor supplies $\{F_{j,n,t+1}^{(0)}\}$.
 - (b) Conditional on the labor aggregates and the path of fundamentals, compute the change in effective labor, $\{\dot{\mathcal{L}}_{j,n,t+1}^{(0)}\}$, and solve the system in Proposition D.1 for the wage indices, input-bundle costs, sectoral prices, trade shares, and expenditures, $\{\dot{w}_{j,n,t+1}^{(0)}, \dot{x}_{j,n,t+1}^{(0)}, \dot{P}_{j,n,t+1}^{(0)}, \pi_{ij,n,t+1}^{(0)}, X_{j,n,t+1}^{(0)}\}$. Then recover the gender-specific wages, $\{\dot{w}_{j,n,t+1}^{M,(0)}, \dot{w}_{j,n,t+1}^{F,(0)}\}$, and the regional price indices, $\{\dot{P}_{j,t+1}^{(0)}\}$.
 - (c) Recover $\{\dot{r}_{\mathbf{d},t+1}^{(0)}\}$, construct the levels $r_{\mathbf{d},t+1}^{(0)} = r_{\mathbf{d},t} \dot{r}_{\mathbf{d},t+1}^{(0)}$, and update $\{\rho_{\mathbf{d},t+1}^{(1)}, \dot{\Phi}_{\mathbf{d},t+1}^{(1)}\}$.
 - (d) Iterate over steps (a) through (c) until the participation block converges.
5. Given the temporary-equilibrium path and the guessed continuation values, solve backward from T for the updated path $\{\dot{u}_{\mathbf{o},t+1}^{h,(1)}\}_{t=0}^T$ using the $\dot{u}^h$ equation in Proposition D.2. This backward solution requires both the location shares and the within-location shares.
 6. Use the updated path as the new guess and repeat steps 2 through 5 until the sequential equilibrium converges.

Solution algorithm for the with-shock equilibrium. Given the no-shock sequential equilibrium and a convergent sequence of changes in fundamentals, $\{\hat{A}_{j,n,t}\}_{t \geq 1}$, that defines the with-shock economy, the with-shock equilibrium is computed as follows:

1. Because the temporary equilibrium and migration shares at $t = 0$ are unchanged, initialize all with-shock objects at their no-shock values.
2. Fix a sufficiently large horizon T and guess a path $\{\hat{u}_{\mathbf{o},t}^{h,(0)}\}_{t=1}^{T+1}$, imposing $\hat{u}_{\mathbf{o},T+1}^{h,(0)} = 1$ for all feasible origins $\mathbf{o}$ and household types h .
3. Use the guessed continuation values to compute the path of with-shock migration shares. At $t = 1$, construct $v_{\mathbf{o}|\mathbf{j}}^h$ using the no-shock within-location shares and $\hat{u}_{\mathbf{d},1}^{h,(0)}$, and apply the period-1 equations in Proposition D.3. For $t \geq 2$, update, in sequence, the within-location shares, $\hat{D}_{\mathbf{o},t}^h$ from equation (D.23), and the location shares.
4. Starting from the same initial allocation as in the no-shock economy, use the with-shock shares to compute the implied path of with-shock household populations $\{N_{\mathbf{d},t}^{'sm,(0)}, N_{\mathbf{d},t}^{'sf,(0)}, N_{\mathbf{d},t}^{'c,(0)}\}_{t=1}^{T+1}$.

5. Given the with-shock household masses, recover the path of with-shock sectoral male labor supply $\left\{M_{j,n,t}'^{(0)}\right\}_{t=1}^{T+1}$.
6. Solve the with-shock temporary equilibrium period by period. For each $t \geq 0$, proceed as follows:
 - (a) Guess the with-shock participation rates $\left\{\rho_{\mathbf{d},t+1}'^{(0)}\right\}$.
 - (b) Use these participation rates to compute with-shock female labor supply $\left\{F_{j,n,t+1}'^{(0)}\right\}$.
 - (c) Construct $\left\{\hat{M}_{j,n,t+1}^{(0)}\right\}$, $\left\{\hat{F}_{j,n,t+1}^{(0)}\right\}$ and $\left\{\hat{\mathcal{L}}_{j,n,t+1}^{(0)}\right\}$. Given these objects and the changes in fundamentals, solve the system in Proposition D.3 for $\left\{\hat{w}_{j,n,t+1}^{(0)}, \hat{x}_{j,n,t+1}^{(0)}, \hat{P}_{j,n,t+1}^{(0)}, \pi_{ij,n,t+1}'^{(0)}, X_{j,n,t+1}'^{(0)}\right\}$ and the regional price indices $\left\{\hat{P}_{j,t+1}^{(0)}\right\}$, and recover $\left\{\hat{w}_{j,n,t+1}^{M,(0)}, \hat{w}_{j,n,t+1}^{F,(0)}\right\}$ from the firms' first-order conditions. Finally, recover $\left\{\hat{r}_{\mathbf{d},t+1}^{(0)}\right\}$.
 - (d) Recover $\left\{r_{\mathbf{d},t+1}'^{(0)}\right\}$ and update $\left\{\rho_{\mathbf{d},t+1}'^{(1)}, \Phi_{\mathbf{d},t+1}'^{(1)}\right\}$. If the updated $\rho_{\mathbf{d},t+1}'^{(1)}$ differs from its initial guess, return to step (b) and iterate until the participation block converges.
 - (e) Repeat steps (a) through (d) sequentially for each period t .
7. Given the with-shock temporary-equilibrium path and the guessed continuation values, solve backward from T for the updated path $\left\{\hat{u}_{o,t}^{h,(1)}\right\}_{t=1}^{T+1}$ using the $\hat{u}^h$ equations in Proposition D.3. At $t = 1$, $\hat{u}_{o,1}^h$ appears on both sides through θ , so solve this equation as a fixed point.
8. Use the updated path as the new guess and repeat steps 3 through 7 until the continuation-value path converges.
9. Compute welfare using equation (31), with $\hat{\lambda}_{oi,s}^h$ and $\hat{\lambda}_{oo|i,s}^h$ constructed from the with-shock and no-shock location and within-location staying shares.

E. Quantification of the Model

This appendix details the model’s quantification in two parts, following Section IV. First, I describe the calibration of the couple’s maximization problem. Second, I describe the rest of the economy: the inputs I observe directly in the data, how I assign each non-employed married woman to her potential sector, and how I build the migration matrices by household type.

E.1 Calibrating the Couple’s Problem

This subsection documents the calibration of the couple’s maximization problem in equation (22), with $\beta \sim \text{Pareto}(\chi, \kappa)$. Four parameters govern it: the wife’s weight in the household objective, α ; the public-good expenditure share, γ ; and the lower bound and shape of the home-production shock, χ and κ . I identify the four parameters from distinct pieces of variation. Expenditure shares pin down α and γ , the PSID Wald ratio pins down κ/γ , and the level of married women’s participation pins down χ .

Estimating α and γ . The optimal allocations for private and public consumption in equation (23) are Cobb-Douglas shares, so both parameters map exactly onto expenditure shares. The parameter α maps onto the share of female private consumption in total private consumption, and γ maps onto the share of public expenditure in total expenditure:

$$\alpha = \frac{c_f^*}{c_f^* + c_m^*}, \quad \gamma = \frac{b^*}{b^* + c_f^* + c_m^*}.$$

I use the Consumer Expenditure Interview Survey (CEX), 2000–2007, to construct three inputs.⁵² First, the *assignable private goods* c_m and c_f are adult apparel and footwear.⁵³ Second, the *public good* b is the market input to home production: because $B = \beta^H b$, the object I need is what the household combines with the wife’s home time. It comprises shelter, fuels and utilities, food at home, cable and internet services, do-it-yourself repair materials, and household operations such as domestic services, lawn care, and appliance repair. Household operations are the *market substitutes* for home time, so omitting them would measure b selectively on precisely the margin the model is about. Third, I construct *total expenditure* Y as consumption only.⁵⁴

The sample consists of household-year pairs with complete twelve-month expenditure

⁵²The complete list of expenditure codes entering each of the three objects is available upon request.

⁵³Children’s, boys’, girls’, and infants’ apparel are excluded, since the model has no children.

⁵⁴The CEX expenditure file also carries asset stocks, debt balances, loans, principal repayments, and asset-sale receipts. All of these are excluded, as are transfers out of the household and gifts.

records. Couples are intact married couples with both spouses present, aged 25–65; singles are one-person consumer units in the same age band. I drop households containing a 16- or 17-year-old, because the CEX books apparel for ages 16 and over under the adult men’s and women’s codes, so a teenager’s clothing would otherwise be read as a spouse’s assignable private consumption. The couples and singles samples are disjoint by construction.

I estimate the wife’s weight in the household objective, α , from apparel, the only assignable good in the CEX, correcting for the fact that women spend more on apparel than men. Apparel is only a *subset* of private consumption, so the raw apparel ratio, 0.60 in this sample, is not α . Taken at face value, the raw ratio would imply that the wife has the larger Pareto weight. To recover α , I follow [Browning et al. \(2013\)](#): I estimate an Engel curve for apparel among *singles* of each gender and recover the resource shares ϱ_f and ϱ_m such that, evaluated at each spouse’s own resources $\varrho_g Y$, these Engel curves reproduce the aggregate apparel spending observed in couples. Using both ϱ_f and ϱ_m , I recover $\alpha = \varrho_f / (\varrho_f + \varrho_m)$. The correction is substantial: it moves α from 0.60 to 0.47, which *reverses* which spouse has the larger bargaining power.

[Voena \(2015\)](#) estimates a value of 0.3, which is one-third smaller than the one I estimate. The two numbers do not align because α captures different objects in the two papers. In [Voena \(2015\)](#)’s world, α prices the wife’s outside option given changes in divorce laws across US states, while in my model, α reflects her observed consumption. In addition, she estimates α using data from the PSID between 1980 and 1990, years when female labor force participation was lower than in the 2000s, and women’s bargaining power is expected to rise as they enter the labor force.

I measure the public-good expenditure share, γ , directly from expenditure data rather than as the residual implied by the resource shares. One alternative would be to set γ equal to the residual $1 - \varrho_f - \varrho_m$. The residual is 0.13, implying that the couple spends roughly \$5,400 a year on public goods, while couples are *observed* spending \$22,300 a year on shelter, utilities, and food alone. The residual is this small because the apparel Engel curves are essentially flat ($R^2 = 0.004$). [Browning et al. \(2013\)](#)’s method allows me to recover the *ratio*, but it carries almost no information about the *level* of resources, and the residual absorbs the error. I therefore measure γ directly as the share of total spending devoted to market inputs for home production, including shelter, utilities, food at home, and market substitutes for home time, such as domestic services and appliance repair. This yields $\gamma = 0.4887$.

[Del Boca and Flinn \(1995\)](#) estimate γ to be 0.204. The two values differ because 0.204 is an estimate based on divorced parents, whose only joint consumption concerns their children; they cannot enjoy economies of scale in housing, utilities, or transportation, among others.

For couples who live together, joint consumption is therefore expected to account for a significant share of total consumption.

The CEX is a stratified, multistage, clustered sample, and the BLS does not publish the design variables needed for an analytic variance. Thus, following the BLS recommendation, I re-run the *entire* estimator on each of the 44 replicate weight vectors and take the spread across replicates as the sampling variance. The resulting standard errors are 0.021 for α and 0.006 for γ .

κ/γ from the China Trade Shock in the PSID. As shown in Section IV, the participation rule satisfies

$$\log(1 - \rho(r)) = \underbrace{\kappa \log \chi}_{\text{intercept}} - \underbrace{(\kappa/\gamma)}_{\text{slope}} \log(1 + r). \quad (\text{E.1})$$

This equation is a structural relation, not a regression. Cross-sectional variation in the relative wage r is not exogenous: r is an equilibrium object. In addition, I observe r only when the wife participates in the market. I therefore use the empirical design in Section II to identify the participation block.

In particular, I identify κ/γ from the experiment in which the *husband's* industry is exposed. The wife is not directly displaced, so the shock affects her participation decision only through r , which is exactly the exclusion restriction required by equation (E.1). Because the equation is linear, the parameter is a Wald ratio:

$$\frac{\kappa}{\gamma} = - \frac{\Delta \log(1 - \rho)}{\Delta \log(1 + r)}. \quad (\text{E.2})$$

To construct the numerator of equation (E.2), I use the estimates in Panel B of Table 3. Wives of exposed husbands raise labor-force participation by 4.2 p.p. from a baseline of 0.78, so ρ increases from 0.78 to 0.822. Then, the numerator is:

$$\Delta \log(1 - \rho) = \log(1 - 0.822) - \log(1 - 0.78) = -0.212.$$

To construct the denominator, I estimate the static version of equation (5) on $\log(\text{Hourly Wage})$ for each spouse. The sample consists of individuals who have at least one observation with positive wages before and during the shock. Table E.1 shows that when the husband is exposed to the shock, his hourly wage decreases by 16.4 log points while her wage decreases by 4.2 log points. Since the husband's wage falls by more than his wife's, the relative wage she faces rises. Using the estimates in Table E.1, r increases by 12.2 log points, which implies an increase of 13%. The r implied by the baseline mean is 0.88. However, this number includes only employed individuals, while the numerator considers all

individuals in the sample. Then, the correct value for r_0 is 0.607. Thus, the denominator of equation (E.2) is

$$\Delta \log(1 + r) = \log(1 + 0.686) - \log(1 + 0.607) = 0.0477.$$

Substituting the numerator and the denominator into equation (E.2),

$$\frac{\kappa}{\gamma} = -\frac{-0.212}{0.0477} = 4.44.$$

With $\gamma = 0.4887$, I obtain $\kappa = \gamma \cdot \frac{\kappa}{\gamma} = 2.17$, which satisfies the integrability restriction $\kappa > \gamma$.

Table E.1: Husband's Exposure to the China Trade Shock and log(Hourly Wage)

	(1) Husband	(2) Wife
Exposed Husband=1	-0.078*	0.150***
	(0.042)	(0.052)
(Exposed Husband=1)x(Post=1)	-0.164*	-0.042
	(0.086)	(0.070)
Observations	12,023	9,979
R^2	0.35	0.31
Baseline Mean	3.31	2.91

Notes. Robust standard errors are two-way clustered at the husband's industry and individual levels. Given that I restrict the sample to individuals who have at least one observation with positive wages before and during the shock, the number of observations in this table does not match the number of observations in Fact 3. * for $p < 0.10$, ** for $p < 0.05$, *** for $p < 0.01$.

χ as a Level Restriction. The participation rule in equation (E.1) is log-linear in $1 - \rho$: its *slope* in $\log(1 + r)$ identifies κ/γ , and its *intercept* identifies χ . With κ/γ estimated above and $\kappa = \gamma \cdot (\kappa/\gamma)$, χ is the single remaining free parameter, and I set it so that the model reproduces the observed *level* of married women's participation in 2000Q1, $\rho_0 = 0.621$. Married women's participation is therefore a *targeted* moment and is not reported as an untargeted success of the model.

I calibrate χ only on couples in which the husband is employed in a productive sector, because the model misses the participation of wives of non-employed husbands. In the data, wives of non-employed husbands work *less*, whereas the model predicts that they work *more*.

Since ρ is monotone in r , and a non-employed husband's income is his home production, $P_{j,t}y_j$, the ratio $r_{d,t} = w_{j,n_f,t}^F/(P_{j,t}y_j)$ is mechanically the largest anywhere in the model, inducing wives to work. The data instead reflect strong positive assortative matching in the marriage market (Browning et al., 2014), which the model abstracts from. I denote the origins in which the husband is employed by $\bar{o}$.

Let $m_{\bar{o},0}$ be the mass of couples in origin $\bar{o}$ at $t = 0$ and $r_{\bar{o},0} = w_{\bar{o},0}^F/w_{\bar{o},0}^M$ its wage ratio. I then set χ such that the mass-weighted average participation rate the model generates equals the one in the data:

$$\sum_{\bar{o}} m_{\bar{o},0} \rho(r_{\bar{o},0}; \chi) = \rho_0. \quad (\text{E.3})$$

Since ρ is strictly decreasing in χ , equation (E.3) has a unique root, and it yields $\chi = 1.92$. This satisfies the support restriction $\chi \geq 1$ and leaves the participation margin interior in every origin at $t = 0$.

E.2 The Rest of the Economy

I measure the economy's trade and production side over 2000–2007 using international and US data. Bilateral trade shares $\{\pi_{ij,n,t}\}$ and region-sector output and expenditure come from the World Input-Output Database (WIOD) for countries, and from the 2002 Commodity Flow Survey (CFS) and the Bureau of Economic Analysis (BEA) for US states. Value-added shares, $\{\omega_{i,k}\}$, and input-output coefficients, $\{\omega_{i,k}^n\}$, come from the same sources (Appendix C). The structures share in value added, ξ_i , is 1 minus the share of labor compensation in value added, which I measure for each US state using BEA data and for other countries using OECD input-output tables. It is common to all sectors of a region and averages 0.395 across US states. I set the portfolio shares, $\{\varpi_i\}$, so the model reproduces each region's 2000 trade imbalance. Final-good expenditure shares $\{\iota_n\}$ come from the BEA input-output tables. Panel A of Table E.2 summarizes these inputs and their sources.

Foreign countries. In the quantitative model, foreign countries enter only through trade and the global portfolio. The household block applies to the 50 US states. Each foreign country has a fixed labor force that does not migrate and is not split by gender. Each country also has a single-factor market, so wages and rents change proportionally across all sectors.

I construct household-side inputs from US microdata. I measure the initial distribution of households across states and sector pairs, $\{N_{\bar{o},0}^{s,m}, N_{\bar{o},0}^{s,f}, N_{\bar{o},0}^c\}$, and the state-level share of singles, $\bar{s}_i$, using the 5% IPUMS Census 2000. I measure male and female employment,

wages, and wives' labor force participation using the 2000 Census and the American Community Survey (ACS) for 2001–2007. I recover the sector-specific gender-intensity parameters $\{\psi_{k,m}, \psi_{k,f}\}$ from gender-specific hours worked in each sector. Panel B of Table E.2 summarizes these inputs and their sources.

Table E.2: Observed Quantitative Inputs

Object	Description	Source
<i>Panel A: Trade and Production Inputs</i>		
$\pi_{ij,n,t}$	Trade shares between countries	WIOD, 2000–2007
	Trade shares among US states	2002 CFS and WIOD
	Trade shares, US states and other countries	WIOD and BEA state employment
$p_{i,k,t} Y_{i,k,t}$	Output and expenditure by region $\times$ sector	BEA (US states), WIOD (other countries)
$\omega_{i,k}, \omega_{i,k}^n$	Value-added shares and input-output coefficients	BEA (US states), WIOD (other countries)
ξ_i	Structures share in value added	BEA (US states), OECD input-output tables (other countries)
ϖ_i	Shares of the global portfolio	Trade imbalances in 2000, same sources as trade shares
ι_n	Final-good expenditure shares	BEA input-output tables
<i>Panel B: Household Inputs</i>		
$\bar{s}_i$	State-level share of singles	IPUMS Census 2000
$N_{o,0}^{s,m}, N_{o,0}^{s,f}$	Initial populations of single men and women by state $\times$ sector	IPUMS Census/ACS
$N_{o,0}^c$	Initial population of couples by state $\times$ husband-wife sector pair	IPUMS Census/ACS
$M_{o,t}, F_{o,t}$	Male and female employment by state $\times$ sector	IPUMS Census/ACS
$w_{i,k,t}^M, w_{i,k,t}^F$	Male and female wages by state $\times$ sector	IPUMS Census/ACS
$\psi_{k,m}, \psi_{k,f}$	Sector-specific gender intensities	Hours worked by gender, IPUMS Census/ACS
$\lambda_{od,0}^h$	Initial transition probabilities	ACS (states) and CPS (sectors)

Notes. WIOD: World Input-Output Database; CFS: Commodity Flow Survey; BEA: Bureau of Economic Analysis; CPS: Current Population Survey. Panel B includes individuals aged 25–65 across 50 states, excluding widows. Non-employment means being out of the labor force. Sectors are classified according to a 22-sector partition of NAICS industries.

Assignment of non-employed wives to their productive sector. The model assigns every wife to a productive sector, but the 2000 Census does not indicate which sector a non-employed married woman would work in. In the 2000 Census, which I use to construct the

initial distribution of couples across states and sector pairs, $\{N_{o,0}^c\}$, a married woman who is out of the labor force is recorded as non-employed. Thus, I do not observe the counterfactual sector she would have worked in if the couple had decided she would participate in the market. In the model, couples choose the wife's productive sector first and her participation second, so she is never assigned to the non-employment sector itself. I therefore need to distribute the non-employed wives across productive sectors.

If I distributed them across productive sectors in the same proportions as employed wives, I would ignore a selection problem. The sectors in which married women are more likely to be employed are also the ones in which they are less likely to be non-employed. Following the distribution of employed wives would therefore assign a larger share of non-employed wives to sectors least likely to be their potential sector.

To recover the potential sector, I return to the model. I drop the time index and write the labor supply of married women in state j and sector n as

$$F_{j,n}^c = \rho_{j,n} N_{j,n}^c.$$

The mass of non-employed wives in the same cell, which I denote by $\text{Non-}F_{j,n}^c$, is

$$\text{Non-}F_{j,n}^c = (1 - \rho_{j,n}) N_{j,n}^c.$$

The ratio of non-employed to employed wives is therefore

$$\frac{\text{Non-}F_{j,n}^c}{F_{j,n}^c} = \frac{(1 - \rho_{j,n})}{\rho_{j,n}},$$

which implies that the mass of non-employed wives in that cell is

$$\text{Non-}F_{j,n}^c = \underbrace{F_{j,n}^c}_{\text{observed}} \times \underbrace{\frac{1 - \rho_{j,n}}{\rho_{j,n}}}_{\text{the model's odds of non-employment}}.$$

Dividing by $\rho_{j,n}$ therefore corrects the selection problem and assigns each non-employed wife to her productive sector.

These cell-level masses are in shares rather than headcounts, so nothing in the model's odds forces them to sum to the number of non-employed married women actually observed in state j . I therefore normalize them within each state, rescaling the $\{\text{Non-}F_{j,n}^c\}_n$ proportionally so that they add up to the observed state total.

Building the migration matrix. Since I solve the model with Dynamic Hat Algebra, the time-invariant mobility costs μ_{od} cancel from the recursion that governs the choice probabilities (Proposition D.2). The recursion requires only two initial objects for each household

type: the location shares $\lambda_{oj,0}^h$ of equation (19) and the within-location shares $\lambda_{od|j,0}^h$ of equation (20).

Following CDP’s Appendix E, I build the initial migration matrix as the product of an interstate probability from the ACS and a sectoral transition probability from the Current Population Survey (CPS), where an interstate mover’s sectoral transition is imputed from the destination state’s sector matrix:

$$\lambda_{(i,k)(j,n),0}^h = \underbrace{f_{ij}^h}_{\text{ACS}} \times \underbrace{P_j^h(n | k)}_{\text{CPS}}.$$

Summing over the destination sectors of location j gives $\lambda_{oj,0}^h = f_{ij}^h$, and dividing by that sum gives $\lambda_{od|j,0}^h = P_j^h(n | k)$.⁵⁵

I build the matrices in three steps: interstate flows from the ACS, sectoral transitions from the CPS, and a mapping of both onto the model’s full grid. First, I derive interstate flows from the ACS migration question for 2001–2007, which records the state of residence one year earlier. The resulting state-to-state matrix is therefore annual, whereas the model period is quarterly. Following CDP’s Appendix E, I assume that interstate moves are evenly distributed throughout the year and that a household makes at most one such move annually, so the quarterly matrix retains one-fourth of the moves and imputes the remaining three-fourths as non-moves:

$$f_{i \rightarrow j}^q = \frac{1}{4} f_{i \rightarrow j} \quad (j \neq i), \quad f_{i \rightarrow i}^q = \frac{1}{4} f_{i \rightarrow i} + \frac{3}{4}.$$

I apply this adjustment to every quarter from 2000 to 2007. The adjustment is quantitatively important: combining the *annual* interstate probability with the *quarterly* sector matrix without it would inflate mobility by roughly a factor of six, implying a quarterly own-state retention rate of 0.959 for single men against 0.994 in CDP. The error would fall entirely on the location margin, which is calibrated to the population’s response to the shock.

Next, I estimate sectoral transitions from the CPS on fewer sectors than the model’s 22 sectors plus non-employment, because disaggregating by household type would otherwise leave too few observations per cell. I therefore pool the 12 manufacturing sub-sectors into a single manufacturing sector and the 8 service sub-sectors into a single service sector, leaving an aggregated five-sector structure: non-employment, manufacturing, retail, construction, and services. I estimate transitions on this aggregation separately for single men, single women, and couples, with couples moving on the joint space of both spouses’ groups.

⁵⁵Where an origin puts no mass on a location, the within-location share is undefined. I set it to zero rather than to a uniform distribution, since the two factors only ever enter as a product, and a uniform distribution would place mass on destinations that the data indicate are unreachable once the location share moves away from zero.

Combining the first two steps gives a transition matrix across five sectors and 50 states, by household type, which I then map onto the model's grid of 22 productive sectors. Let $\tilde{o}$ denote the origin in the five-sector grid and $\tilde{d}$ denote the corresponding destination. The production side considers 22 productive sectors across 50 states. Applying the same sectoral aggregation to the production side would lose the dispersion across manufacturing sectors in the China Trade Shock. I map the matrices onto the full grid by factorizing each transition probability into a group-level move and a within-group destination. For an individual of gender $g \in \{m, f\}$ in a household of type h ,

$$\underbrace{P_{h,g}(\mathbf{d} \mid \mathbf{o})}_{\text{model's grid}} = \underbrace{P_h(\tilde{\mathbf{d}} \mid \tilde{\mathbf{o}})}_{\text{ACS + CPS, by household type}} \times \underbrace{P_g(\mathbf{d} \mid \tilde{\mathbf{d}}, \mathbf{o})}_{\text{within-group composition, by gender}},$$

so that household type governs *which* broad sector, and which state, a household moves to, and the within-group composition governs *where within* that sector it lands. Because this factorizes a single conditional distribution, the rows of the resulting matrix sum to one by construction. The within-group composition only redistributes mass among sectors of the same group *in the same state*, so it leaves the location shares unchanged and acts only on the within-location shares.

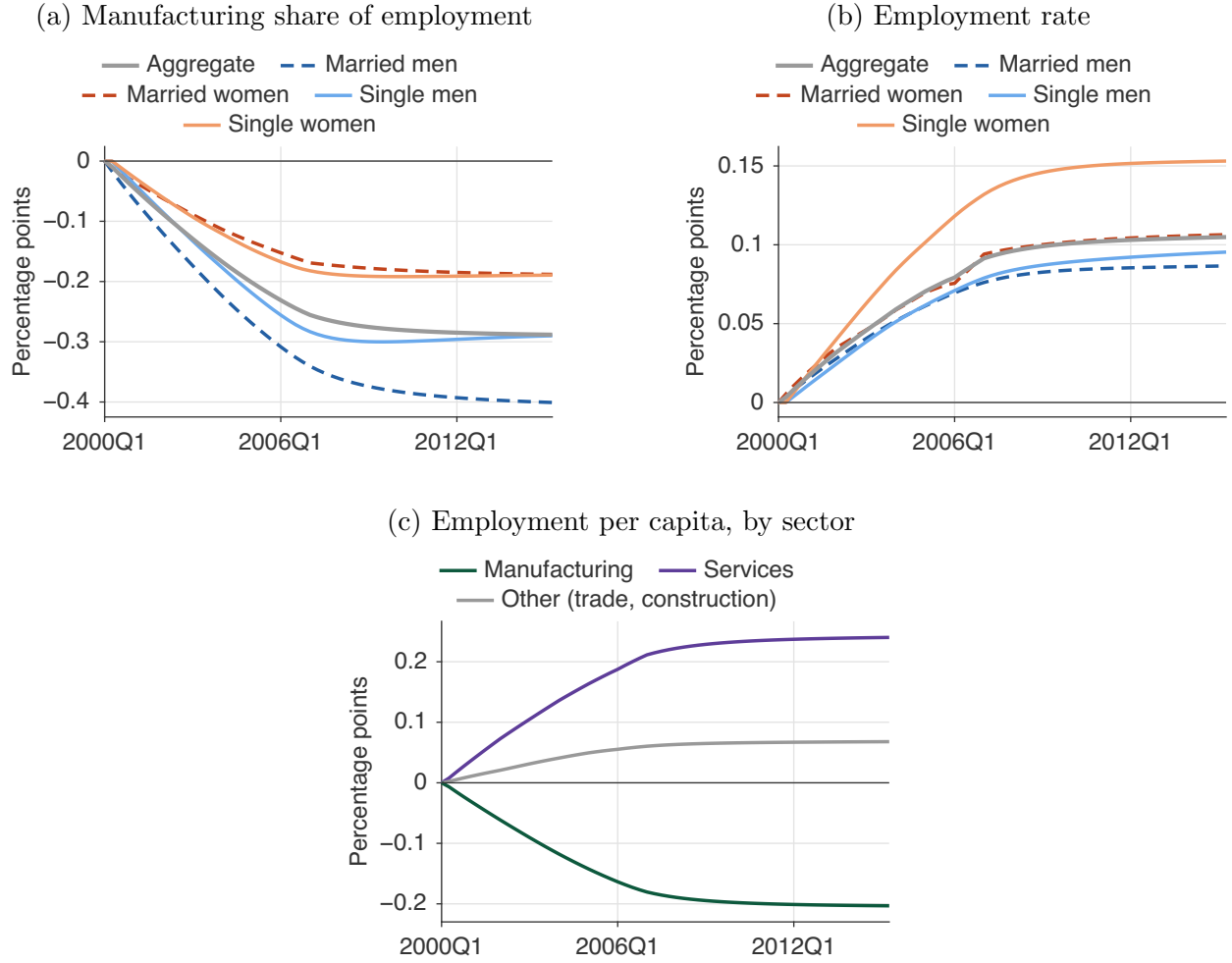
To build the within-group composition, I split the CPS sample by sex and compute, within manufacturing and within services, the share of men and of women going to each sub-sector. This step matters: men and women sort differently within both groups, with men concentrated in heavy and durable manufacturing and women in lighter, non-durable goods. Without it, the model would miss one of the channels through which the shock affected men and women differently.

F. Additional Quantitative Results

F.1 Short-Run Dynamics

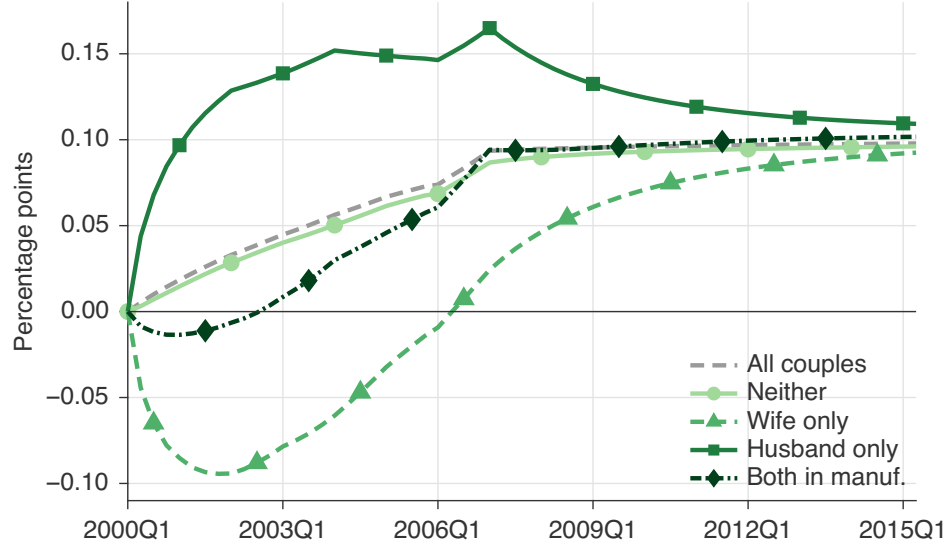
Section [V.1](#) reports the long-run effects of the China Trade Shock, at $t = 199$. Figure [F.1](#) shows how employment responds over the first 62 quarters: the manufacturing share of employment declines over the first 15 years and never recovers, every group works more, especially single women, and services gain more jobs per capita than manufacturing loses. Figure [F.2](#) shows married women’s participation response over the same period, by the couple’s exposure; its long-run values are in Table [5](#).

Figure F.1: Employment Effects of the China Trade Shock in the Short Run



Notes. Responses to the shock (with-shock minus no-shock economy) over the first 62 quarters (2000Q1–2015Q2). Panel (a) is the manufacturing share of employment, in p.p. of employment; panel (b) is the employment rate, in p.p. of population; panel (c) is employment per capita by sector, in p.p. of population, where manufacturing covers the 12 manufacturing sectors and other covers wholesale and retail trade and construction.

Figure F.2: Married Women's Short-Run Participation Response by Couples' Exposure



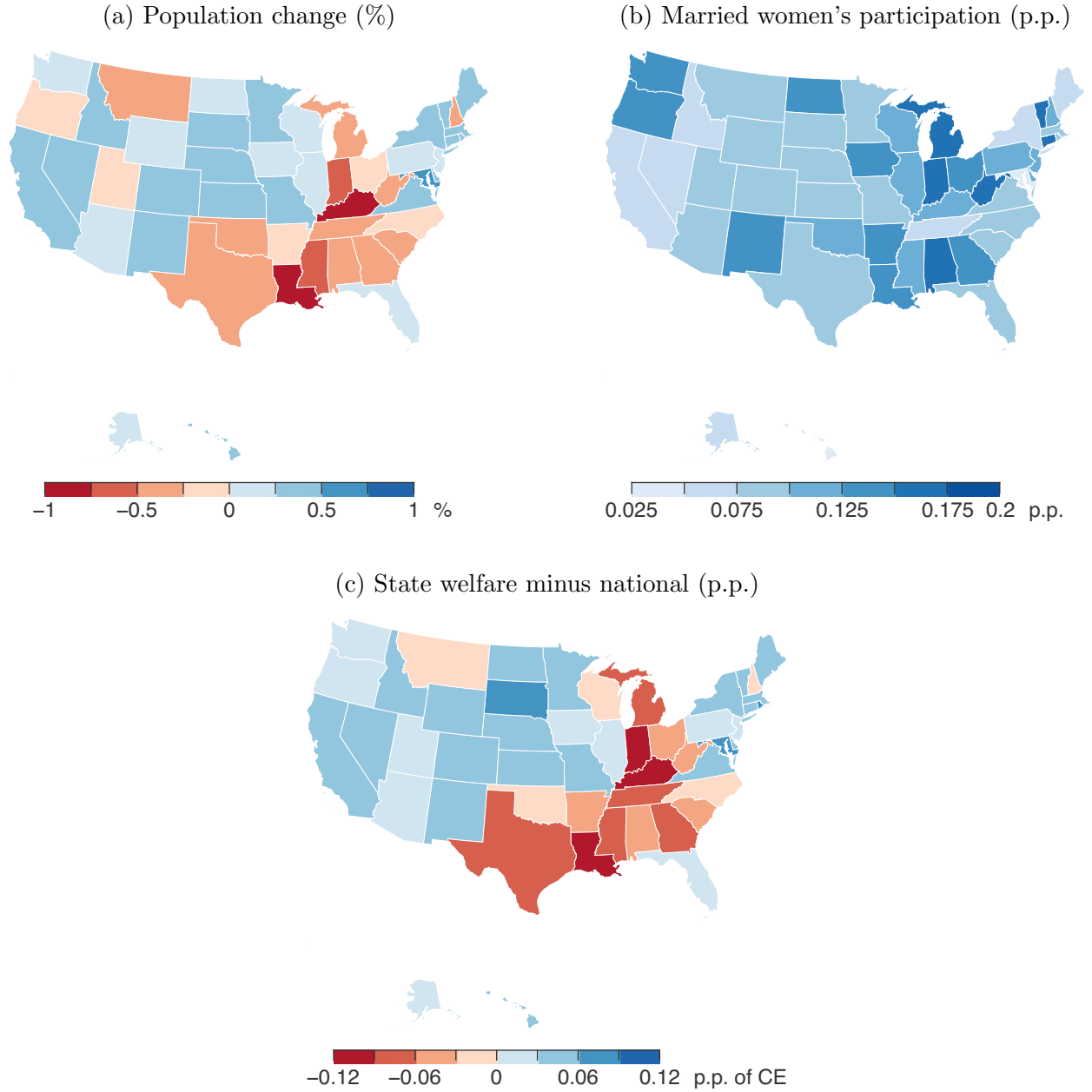
Notes. Baseline economy. Change in married women's quarterly participation rate (with-shock minus no-shock economy), in p.p., over the first 62 quarters (2000Q1–2015Q2), for the couples that started in each cell at $t = 1$. Couples are tagged by both spouses' sectors at $t = 1$; a non-working wife is tagged by her potential sector

F.2 The China Trade Shock across States

Figure F.3 maps the long-run effects of the China Trade Shock in each state: the change in population, in married women's participation, and in welfare relative to the national gain. The geography of gains is nearly identical across household types (Figure F.4), but where a couple lives matters more for its gains than it does for singles: across states, couples' gains vary 35% more than single men's and about twice as much as single women's. A couple must live in one place, so it cannot take one job in one state and the other in another, and its gains depend more on where it starts.

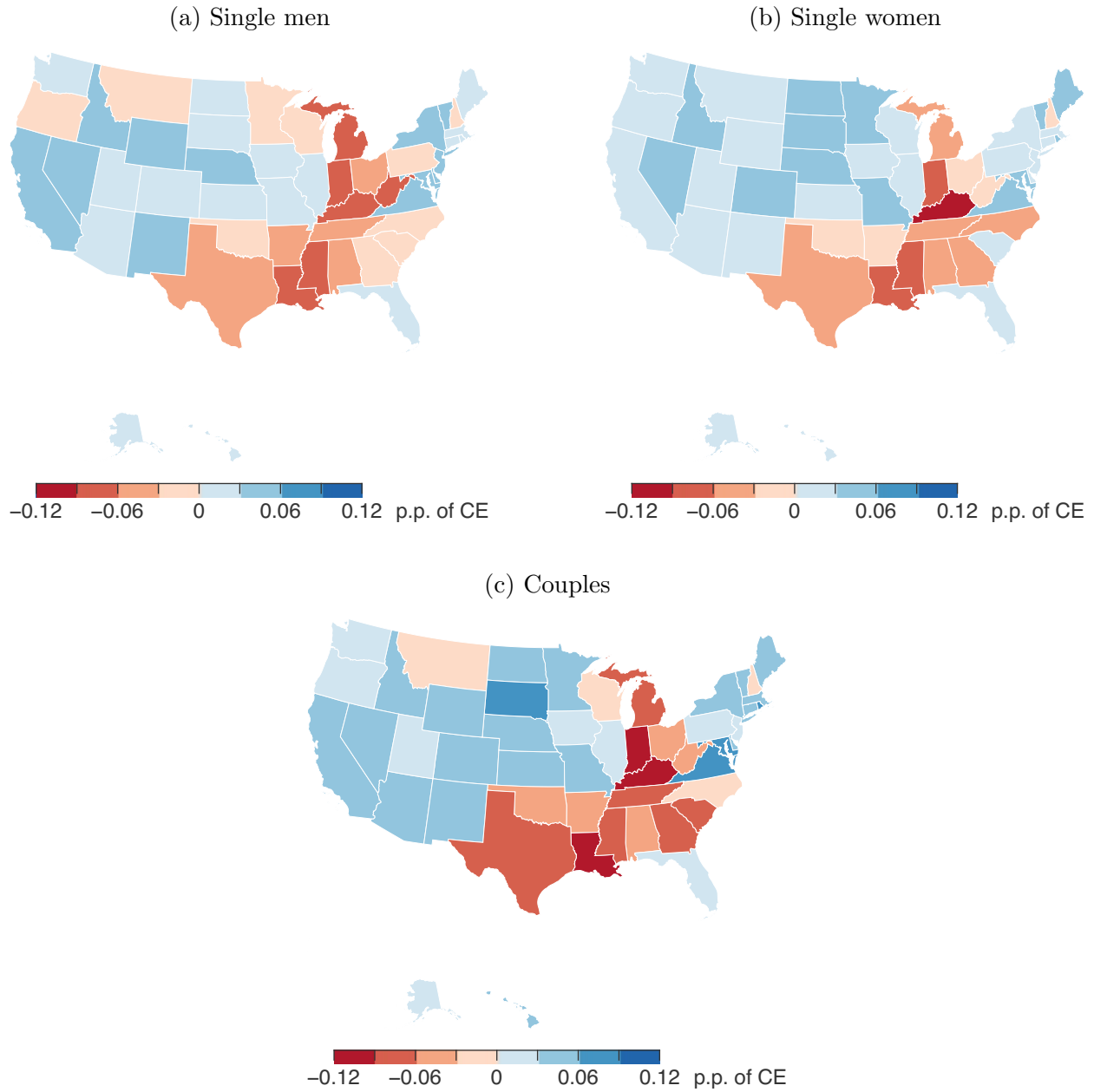
With couples, welfare is more unequal across states. Relative to the all-singles economy, welfare gains in the baseline economy are 37% more dispersed across states (Panel B of Table F.3), even though the map of gains barely changes (Figure F.5). The difference is much larger for wives than for husbands. Relative to their counterfactual singles, married women's gains are about twice as dispersed across states, whereas married men's are only 14% more dispersed, because living as a couple ties a wife's welfare to where the couple lives.

Figure F.3: The China Trade Shock across States



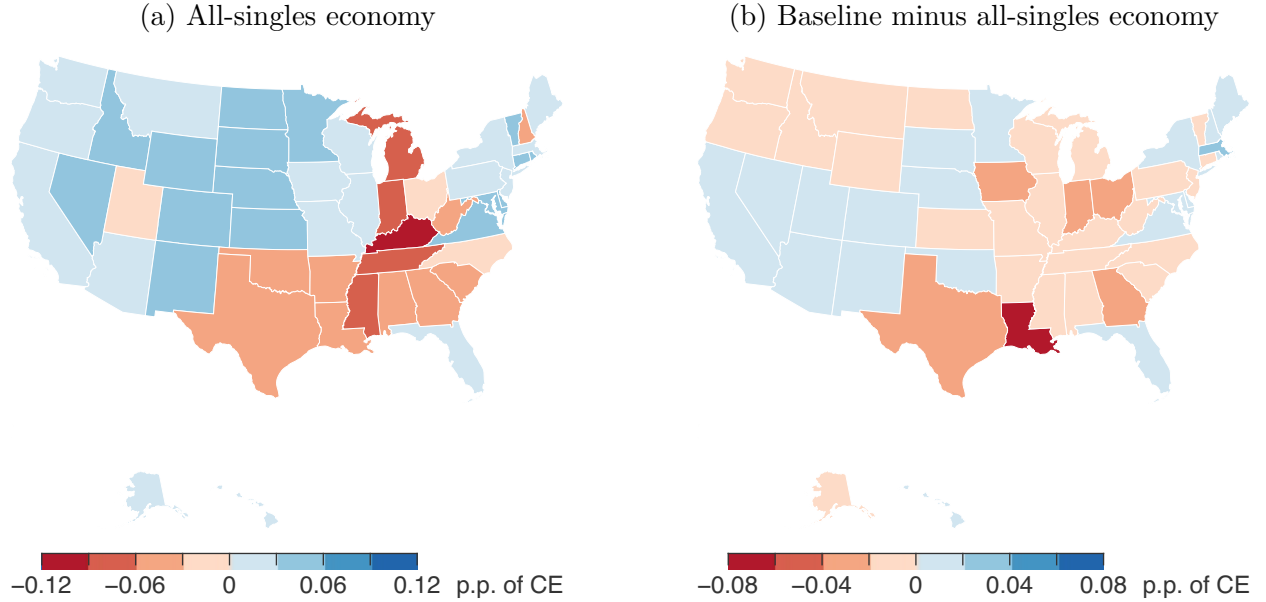
Notes. Panels (a) to (c) are long-run responses ($t = 199$): the change in the state's population as a percentage of its no-shock level, which sums to zero across states because the national population is fixed; the change in married women's participation rate, in p.p., averaged over the couples living in the state; and the state's money-metric welfare gain minus the national gain (0.175), in p.p., for the people living in the state in 2000Q1.

Figure F.4: Distribution of Welfare Effects by Household Type



Notes. State welfare minus the group's own national welfare, money-metric consumption-equivalent, in p.p., for the people living in the state in 2000Q1. The population-weighted coefficient of variation of state welfare gains is 0.23 for single men, 0.16 for single women, and 0.31 for couples.

Figure F.5: Distribution of Welfare Effects in the All-Singles Economy



Notes. Money-metric consumption-equivalent welfare gains, in p.p., for the same people located at their 2000Q1 state, weighting both economies by the baseline money metrics. Panel (a) is state welfare minus the national gain of the all-singles economy (0.178), on the same scale as Figure F.3c. Panel (b) is the baseline economy's state welfare minus the all-singles economy's.

F.3 The Same Trade Shock in the Baseline and All-Singles Economies

The household block changes how the gains from the China Trade Shock are distributed, but not the size of the shock where trade operates. In Table F.1, I compare CDP with the baseline economy and the all-singles economy. Manufacturing jobs per capita fall by 0.206 p.p. in the baseline economy and by 0.202 p.p. in the all-singles economy, so the decline in the baseline economy is only 2% larger. Welfare in the rest of the world does not move either. The mean gain of the other 36 regions is 0.156% in the baseline economy and 0.158% in the all-singles economy, and in both economies their gains correlate with those in CDP at 0.997. Nor do the sectors that drive the shock change. I compute each sector's contribution to the change in employment at $t = 199$, as in Figures 2 and 5 of [Caliendo et al. \(2019\)](#). Across manufacturing industries, the contributions to the manufacturing employment decline in the baseline and the all-singles economy have a rank correlation of 0.94, and across non-manufacturing sectors, the contributions to the non-manufacturing employment gain have a rank correlation of 0.98. In both economies, computers, electronics, and furniture lead the decline, and other services and health lead the gain.

Table F.1: Same Shock in the Baseline and All-Singles Economies

	CDP	Baseline	All-singles
<i>Manufacturing, $t = 199$</i>			
Manuf. jobs per capita (p.p.)	−0.228	−0.206	−0.202
Baseline relative to economy (%)	−9.9	—	+1.6
<i>Rest of the world (36 regions)</i>			
Mean welfare gain (%)	0.158	0.156	0.158
Corr. with CDP	—	0.997	0.997

Notes. Responses at $t = 199$. Manufacturing jobs per capita is manufacturing employment divided by population, expressed in p.p.; Baseline relative to economy is $100 \times (\text{baseline}/X - 1)$. CDP is the economy of [Caliendo et al. \(2019\)](#). Rest of the world: consumption-equivalent welfare gains of the 36 regions (35 countries and the rest of the world; China excluded), computed as in [Caliendo et al. \(2019\)](#) and summed over $t = 2, \dots, 199$. Table [G.2](#) compares every economy.

F.4 Why Women’s Employment Responds Less with Couples

Women’s employment responds less to the shock in the baseline economy than in the all-singles economy because a couple decides whether the wife works based on her wage relative to her husband’s, not on her own wage alone. To isolate this mechanism, I recompute married women’s participation response at $t = 199$ as if the couple considered only the wife’s wage. I hold the husband’s real wage at its no-shock path, so that the relative wage $r_{d,t}$ in equation (25) moves only with the wife’s real wage, and I keep every parameter and all other wages and prices at their values in the baseline economy.⁵⁶ This is a partial-equilibrium exercise, so wages do not respond to the additional wives who would enter the market.

In the baseline economy, married women’s participation rises less than half as much as it would if the couple looked only at the wife’s own wage. By $t = 199$, it rises by 0.10 p.p. instead of 0.24 p.p., a response 58% smaller (Table 6). The reason is that the shock also raises husbands’ wages. By $t = 199$, a husband’s real wage rises by 61% as much as his wife’s, so her wage relative to his rises by only 39% as much as her own.

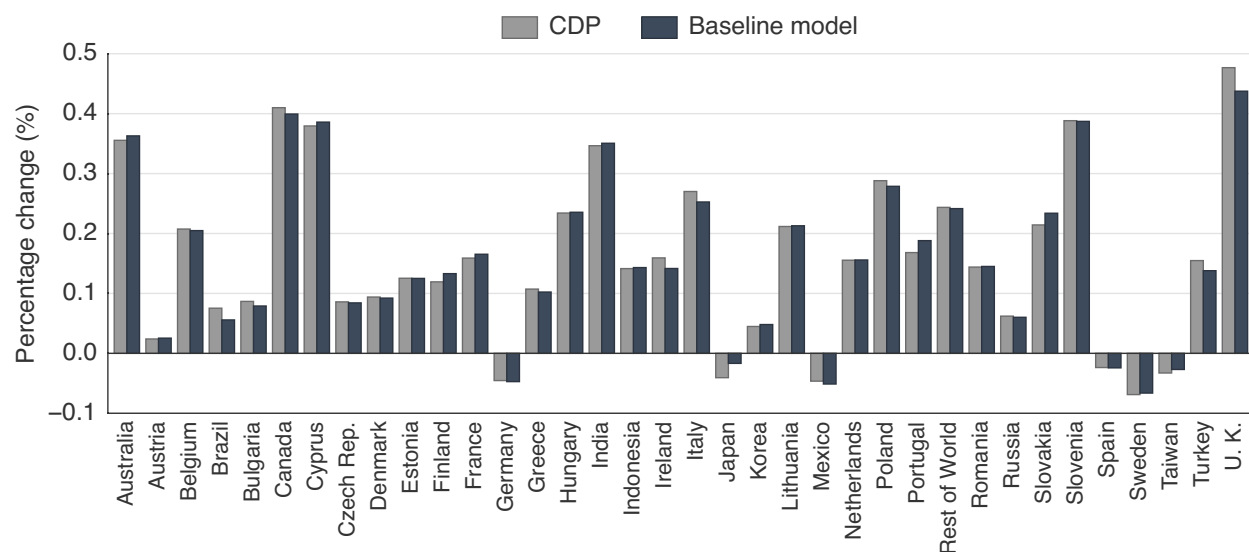
The smaller response does not stem from the parameters governing participation. If anything, wives respond more strongly to wages than single women do. A 1% increase in a wife’s wage, holding her husband’s fixed, raises her participation by 1.12% (Section IV), whereas a permanent 1% increase in real wages in all sectors raises single women’s participation by 0.51% by $t = 199$, given the dispersion of preferences across sectors, ν .

⁵⁶I hold the husband’s real wage, rather than his nominal wage, fixed because the shock lowers the price level, so nominal wages fall even as real wages rise.

Wives are therefore about twice as responsive to their wage as single women are to theirs, and women's employment still responds less in the baseline economy than in the all-singles economy.

F.5 Additional Figures and Tables

Figure F.6: Comparison of Welfare Effects in the Rest of the World



Notes. Consumption-equivalent welfare gains of the 36 regions (35 countries and the rest of the world; China excluded), calculated in both models as in [Caliendo et al. \(2019\)](#) and summed over $t = 2, \dots, 199$.

Table F.2: Responses to the China Trade Shock in the Baseline and All-Singles Economies: All Groups

	Baseline	All-singles
<i>Panel A. Manufacturing</i>		
Manuf. share of employment (p.p.)	−0.293	−0.291
<i>Panel B. Employment rate (p.p.)</i>		
Aggregate	0.112	0.132
Men	0.099	0.092
Women	0.124	0.170
Single men	0.106	0.092
Single women	0.158	0.170
Married men	0.096	0.093
Married women	0.111	0.170
<i>Panel C. Married women's participation (p.p.)</i>		
All couples	0.101	
Neither	0.100	
Wife only	0.101	
Husband only	0.105	
Both in manuf.	0.103	
<i>Panel D. Migration</i>		
Migration response of the exposed (p.p.)	+0.0166	+0.0194
Share living in a different state because of the shock (%)		
Aggregate	0.150	0.130
Single men	0.151	0.150
Single women	0.127	0.116
Married men	0.159	0.151
Married women	0.159	0.116
Couples' migration response (p.p.)		
All couples	−0.0066	
Neither	−0.0109	
Wife only	−0.0062	
Husband only	+0.0141	
Both in manuf.	+0.0078	
<i>Panel E. Wages</i>		
Female real-wage response (%)	0.405	0.362
Male real-wage response (%)	0.236	0.258
Relative wage r response (%)	0.169	0.104

Notes. Responses at $t = 199$, in levels. Panel A is in p.p. of employment and Panel B in p.p. of population. Panel C is the change in married women's quarterly participation rate, in p.p., by the couple's exposure at $t = 1$. In Panel D, the migration response of the exposed is the difference between the shares of manufacturing and non-manufacturing workers who have changed state at least once by $t = 199$, in p.p., counting each person once. Panel E reports employment-weighted log changes in real wages ($\times 100$). Table G.4 reports every economy.

Table F.3: Welfare Effects of the China Trade Shock in the Baseline and All-Singles Economies: All Groups

	Baseline	All-singles
<i>Panel A. Welfare gain (% CE)</i>		
Aggregate	0.175	0.178
Single men	0.157	0.166
Single women	0.234	0.194
Couples	0.170	0.178
Married men	0.170	0.164
Married women	0.170	0.193
Couples, by exposure		
Neither	0.180	0.184
Wife only	0.161	0.174
Husband only	0.140	0.161
Both in manuf.	0.125	0.155
<i>Panel B. Spatial</i>		
CV of state welfare	0.278	0.204

Notes. Money-metric consumption-equivalent gains (%), summed over $t = 2, \dots, 199$. Each row represents the same people in both economies, and each economy weights each person by their baseline money metric in 2000Q1. In the baseline economy, married men and women carry the couple's welfare; in the all-singles economy, they are the same people as singles, and couples' rows average the two former spouses. In Panel B, CV is the population-weighted coefficient of variation of state welfare gains. Weighting the all-singles economy by its own wages instead, its aggregate gain is 0.177. Table G.5 reports every economy.

Table F.4: Couples and the Same Spouses as Singles

	Couple (baseline)	Husband's counterfactual single	Wife's counterfactual single
All couples	0.170	0.164	0.193
Neither	0.180	0.172	0.195
Wife only	0.161	0.168	0.179
Husband only	0.140	0.134	0.190
Both in manuf.	0.125	0.135	0.177

Notes. Money-metric consumption-equivalent gains (%), weighting both economies by the baseline money metric at 2000Q1. Couples are tagged by both spouses' sectors at $t = 1$; a non-working wife is tagged by her potential sector. The couple's welfare is based on the baseline economy; the husband's and the wife's counterfactual singles are the two former spouses in the all-singles economy. Table G.6 adds the welfare gain from migration.

G. Additional Counterfactual Exercises

G.1 The Economies and the Same Trade Shock

Besides the all-singles economy in Section V.2, I study four counterfactual economies. In the first one, I partially shut down wives' participation response to the shock by setting $\kappa/\gamma \rightarrow 1$, keeping married women's participation rate in 2000Q1 unchanged. Because the model requires $\kappa > \gamma$, the shutdown is only partial, and wives' participation response to the shock is 59% smaller than in the baseline economy, not zero.⁵⁷ Each exercise is a full re-solve of the model with the corresponding parameter changed, while all other parameters (except χ whenever I partially shut down participation) are held at their baseline values (Table G.1).

The other three economies shut down migration. In the first one, I shut down migration by setting $1/\theta \rightarrow 0$, so that location choices no longer respond to differences in continuation values, while switching sectors within a state is still allowed. In the second one, I combine this change with the partial shutdown of wives' participation. In the third one, I shut down migration in the all-singles economy, so that the economy without migration has a counterpart without couples. Table G.1 lists every economy and what changes relative to the baseline economy.

⁵⁷The participation response depends on κ/γ , as equation (26) shows. Holding the participation rate fixed, the response scales with κ/γ , so lowering κ/γ shrinks the response proportionally. In the baseline economy, $\kappa/\gamma = 4.44$, and the model requires $\kappa > \gamma$, so the response can be made at most 4.44 times smaller. For computational reasons, I set $\kappa = 0.65$, which shrinks it by a factor of 3.39. Once wages adjust in general equilibrium, the participation response is 59% smaller. To keep married women's participation rate in 2000Q1 unchanged, I also recalibrate χ .

Table G.1: Economies Compared in the Quantitative Exercise

Economy	Couples	Migration	Participation	Change relative to the baseline economy
Baseline	✓	✓	✓	—
All-singles	—	✓	—	Couples split into two singles; θ recalibrated
All-singles, no migration	—	—	—	All-singles economy with $1/\theta \rightarrow 0$
No migration	✓	—	✓	$1/\theta \rightarrow 0$
No participation	✓	✓	partially	$\kappa/\gamma \rightarrow 1$
No migration & no participation	✓	—	partially	Both changes

Notes. A check mark indicates that the margin responds to the shock as in the baseline economy; a dash indicates that it is shut down or does not exist; “partially” indicates that it is partially shut down. I shut down migration by setting $\theta = 10^6$. Because the model requires $\kappa > \gamma$, I partially shut down participation by setting $\kappa = 0.65$ and recalibrate χ to keep married women’s participation rate in 2000Q1 unchanged.

The household block changes how the gains from the China Trade Shock are distributed, but not the size of the shock where trade operates. In Table G.2, I compare CDP with the baseline economy, the all-singles economy, the all-singles economy without migration, and the three economies in which I shut down migration, partially shut down participation, or both. Manufacturing jobs per capita fall by between 0.197 and 0.206 p.p. in every economy I study, so the decline in the baseline economy is at most 4.4% larger than in any counterfactual economy. Welfare in the rest of the world does not move either. The mean gain of the other 36 regions is between 0.156% and 0.158% in every economy, and their gains correlate with those in CDP at 0.997. Nor do the sectors that drive the shock change. I compute each sector’s contribution to the change in employment at $t = 199$, as in Figures 2 and 5 of [Caliendo et al. \(2019\)](#). Across manufacturing industries, the contributions to the manufacturing employment decline in the baseline and the all-singles economy have a rank correlation of 0.94, and across non-manufacturing sectors, the contributions to the non-manufacturing employment gain have a rank correlation of 0.98. In both economies, computers, electronics, and furniture lead the decline, and other services and health lead the gain.

Table G.2: Same Shock in Every Economy

	CDP	Baseline	All-singles	All-singles, no migration	No migration	No participation	No migration & no participation
<i>Manufacturing, $t = 199$</i>							
Manuf. jobs per capita (p.p.)	-0.228	-0.206	-0.202	-0.200	-0.202	-0.200	-0.197
Baseline relative to economy (%)	-9.9	—	+1.6	+3.0	+1.7	+2.7	+4.4
<i>Rest of the world (36 regions)</i>							
Mean welfare gain (%)	0.158	0.156	0.158	0.157	0.156	0.156	0.156
Corr. with CDP	—	0.997	0.997	0.997	0.997	0.997	0.997

Notes. Responses at $t = 199$. Manufacturing jobs per capita is manufacturing employment divided by population, expressed in p.p.; Baseline relative to economy is $100 \times (\text{baseline}/X - 1)$. CDP is the economy of [Caliendo et al. \(2019\)](#). Rest of the world: consumption-equivalent welfare gains of the 36 regions (35 countries and the rest of the world; China excluded), computed as in [Caliendo et al. \(2019\)](#) and summed over $t = 2, \dots, 199$. The economies are defined in Table [G.1](#).

G.2 Effects of Shutting Down Migration

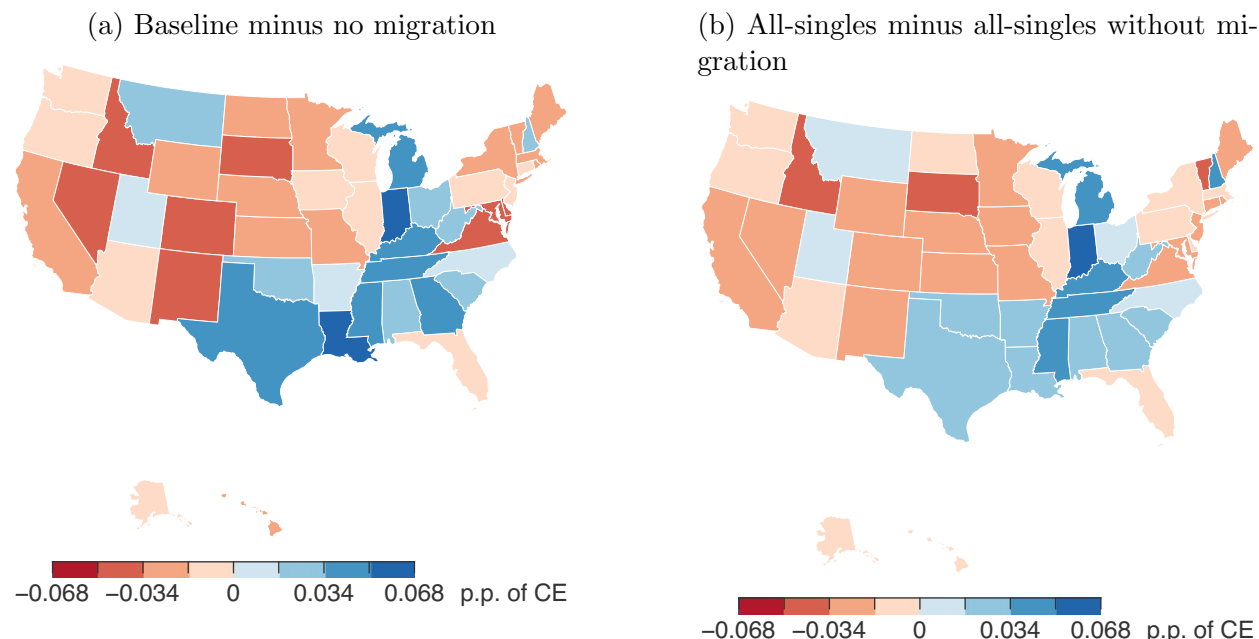
Migration mainly redistributes the gains from the shock across states. Relative to the economy without migration, aggregate welfare gains in the baseline economy are only 1% smaller (Table [G.5](#)), even though the employment response is 13% larger. Moving is how people reach jobs, not how they capture gains, and since sector switching is still allowed, a displaced worker still has their primary adjustment margin. Across states, however, welfare gains in the baseline economy are 38% less unequal (the coefficient of variation of state welfare gains is 0.28, compared with 0.45 without migration; Panel B of Table [G.5](#)), and the correlation between a state's welfare change when migration is shut down and its population response in the baseline economy is +0.98. Without migration, the states that were losing people gain less, led by Indiana, Louisiana, and Kentucky, and the states that were gaining people gain more, because their gains are no longer diluted by arrivals (Figure [G.1](#)). Couples make this redistribution larger. Without migration, the welfare gain of the people living in states losing people falls by 0.037 p.p. in the baseline economy and by 0.026 p.p. in the all-singles economy.

For residents of the states that people leave, migration matters more when people live in couples, because more of them would have left. Couples with an exposed husband gain more from migration than either spouse would as a single. When only the husband is exposed, migration raises the couple's gain by 3.5%, whereas it raises his counterfactual single's gain by 2.9% and hers by only 0.3% (Panel B of Table [G.6](#)).

Unexposed couples, by contrast, gain less with migration. Relative to the economy without migration, their gain in the baseline economy is 2% smaller (Panel B of Table [G.6](#)),

because they bear part of the cost of the mobility decisions of exposed households. When the exposed relocate, they disproportionately move to areas where the unexposed already live, and their arrival increases local labor supply and pushes local wages down. With migration shut down, nobody arrives, and the unexposed keep a tighter local market.

Figure G.1: State Welfare Gain from Migration



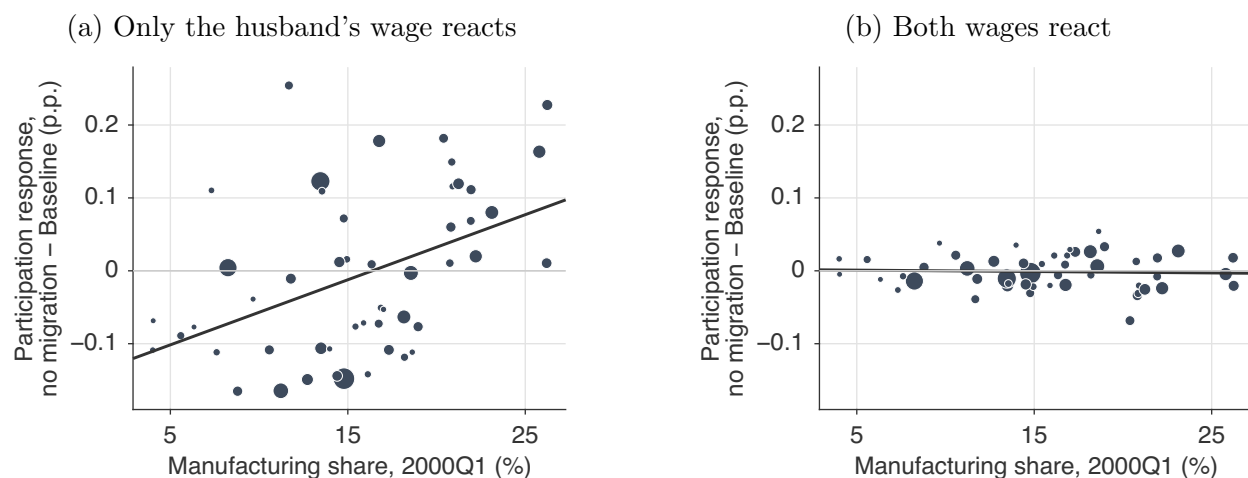
Notes. Change in state money-metric welfare, in p.p., for the people living in the state in 2000Q1, weighting every economy by the baseline money metrics. One common scale.

Participation does not make up for the lack of spatial mobility. Relative to the economy without migration, married women's participation response is 3.5% larger in the baseline economy (Panel C of Table G.4). Although this result may seem counterintuitive, it comes from how a couple decides whether the wife works. Because ρ is homogeneous of degree zero in wages, it depends only on the wife's wage relative to her husband's, not on their level, and shutting down migration moves both spouses' wages by nearly the same amount, leaving her relative wage intact to the third decimal. The participation response is larger in the baseline economy for every type of couple, by the least when the husband is exposed (2.9% when only he is exposed and 3.1% when both spouses are) and by the most for unexposed couples (3.6%). In states that lose people, shutting down migration reduces the shock's effect on men's employment rate from 0.10 to 0.03 p.p., whereas the effect on women's employment falls by a smaller amount, from 0.15 to 0.12 p.p.

Wives do not step in when migration is shut down, because general equilibrium undoes the partial-equilibrium incentive. Figure G.2 plots, state by state, the change in married women's

participation response when migration is shut down. If only the husband's wage reacted, wives' participation would rise most where manufacturing was concentrated (correlation $+0.45$, panel (a)). Once both spouses' wages react, this relationship disappears (-0.05 , panel (b)), and the change follows the population response to migration in the state ($+0.69$): participation falls most in the states people would have left, where both spouses' wages fall together.

Figure G.2: Why Wives Do Not Step In When Migration Is Shut Down



Notes. Each dot is a state, sized by its number of couples. The vertical axis is the change in married women's participation response at $t = 199$, in p.p., when migration is shut down, for the state's own married women. In panel (a), it is a partial-equilibrium calculation in which only the husband's wage takes its value from the economy without migration. The horizontal axis is the state's manufacturing share of employment in 2000Q1.

G.3 What the Wife's Participation Does

Every type of couple gains more because the couple can adjust whether the wife works. Relative to the economy in which I partially shut down participation, aggregate welfare gains in the baseline economy are 5% larger, and the average couple gains 8% more (Table G.3). The difference is largest when only the husband is exposed (11%), because these wives enter the market the most. A couple in which only the wife is exposed also gains more (5%), because the same margin also lets her leave the market and fall back on home production. Unexposed couples gain 7% more, because their wives also enter as women's relative wages rise.

Employment and migration when participation is partially shut down. Of the two margins, the wife's participation matters more for employment (Table G.4). Relative

to the economy in which I partially shut down participation, the employment response in the baseline economy is 32% larger, even though the manufacturing decline is only 3% larger. When couples can adjust whether the wife works, more wives enter the market, so the overall employment response is larger. In addition, through general equilibrium effects, married men's employment also responds more (Panel B of Table G.4).

When participation is partially shut down, couples with an exposed husband move slightly more. The couples' migration response rises from 0.0141 to 0.0146 p.p. when only the husband is exposed and from 0.0078 to 0.0080 p.p. when both are, whereas all other couples move less (Panel D of Table G.4). Moving does not make up for the wife's participation, however. Migration raises the gain of a couple in which only the husband is exposed by 3.5%, whether or not wives' participation is partially shut down (Panel B of Table G.6). Conversely, wives do not work more when migration is shut down. With migration, their participation response is 3.5% larger in the baseline economy and 2.8% larger when participation is also partially shut down. For couples with an exposed husband, the two margins are therefore asymmetric substitutes. They move more when the wife's participation is partially shut down, but wives do not work more when couples cannot move.

Valuing wives' time at home. When a couple has the wife enter the market, it gives up her home production. If I instead value a non-working wife's time as everyone else's, at the non-employment benefit y_i , and keep every decision unchanged, the aggregate welfare gain in the baseline economy would be 11% higher (Table G.5), because a wife who enters the market would then give up only y_i instead of her home production.⁵⁸

In the baseline economy, a non-working wife's time is valued as home production, through $\Phi_{o,t}$ in the couple's payoff

$$\frac{w_{i,km,t}^M}{P_{i,t}} \cdot \Phi_{o,t}$$

To measure how much of the gains from the added-worker effect this valuation absorbs, I recompute couples' welfare with every decision held fixed and two alternative values of $\Phi_{o,t}$. Under *market income only*, a non-working wife's time is worth nothing,

$$\Phi_{o,t}^{\text{Market}} = \mathcal{A}(1 + \rho_{o,t} r_{o,t}).$$

Under *valued like everyone else*, a non-working wife obtains the same value of non-

⁵⁸I measure y_i with state-level unemployment insurance benefits from the US Department of Labor and hold it fixed in real terms. The model's solution does not depend on its level; it enters only through this exercise and the 2000Q1 money-metric weights of non-employed individuals.

employment as everyone else, y_i ,

$$\Phi_{o,t}^{\text{Non-emp}} = \mathcal{A} \left[1 + \rho_{o,t} r_{o,t} + (1 - \rho_{o,t}) \frac{P_{i,t} y_i}{w_{i,k_m,t}^M} \right],$$

with y_i held fixed in real terms.

The wife’s participation raises welfare in almost every state, with or without migration. Figure G.3 maps how much more each state gains when couples can adjust whether the wife works, with migration (baseline minus no participation) and without it (no migration minus no migration & no participation), on a common scale. With migration, every state gains more in the baseline economy than when participation is partially shut down. Without migration, the same holds in 47 states, whereas Louisiana, South Carolina, and Texas gain slightly more when participation is partially shut down. The two maps correlate at 0.98 across states.

The wife’s participation also changes what singles gain. Relative to the economy in which I partially shut down participation, more married women work in the baseline economy, so women’s wages rise less. As a result, single women are the only group that gains less in the baseline economy, 8% less, while single men gain 2% more.⁵⁹

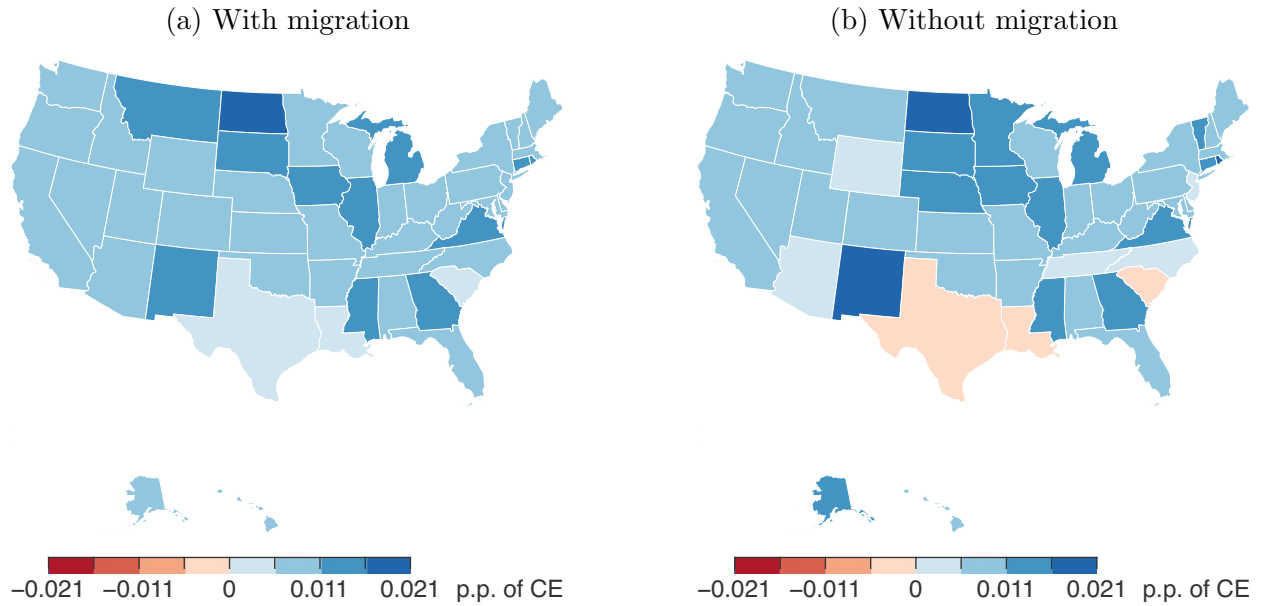
Table G.3: Welfare Effects of Shutting Down Migration and Participation

	Baseline (% CE)	No migration (%)	No participation (%)	No migration & no participation (%)
Aggregate	0.175	−1.0	+4.9	+3.6
Single men	0.157	−2.8	+2.4	−0.7
Single women	0.234	−0.8	−8.1	−8.8
Couples	0.170	−0.7	+7.8	+6.6
Neither	0.180	−1.6	+7.4	+5.2
Wife only	0.161	−0.7	+5.2	+4.2
Husband only	0.140	+3.5	+11.3	+15.2
Both in manuf.	0.125	+2.7	+8.3	+11.0

Notes. The first column reports the baseline economy’s money-metric consumption-equivalent gain (%); the next three columns report the baseline economy relative to each economy, $100 \times (\text{baseline/economy} - 1)$, weighting every economy by the baseline money metric at 2000Q1.

⁵⁹Relative to that economy, the female wage response in the baseline economy is 8% smaller and the male wage response 3% larger. Because men and women are complements in production, more working women also raise men’s wages.

Figure G.3: State Welfare Gain from the Wife's Participation



Notes. Change in state money-metric welfare, in p.p., for the people living in the state in 2000Q1, weighting every economy by the baseline money metrics. Panel (a) is baseline minus no participation; panel (b) is no migration minus no migration & no participation. One common scale.

G.4 Additional Tables

Table G.4: Responses to the China Trade Shock across Economies: All Groups and Economies

	Baseline	All-singles	All-singles, no migration	No migration	No participation	No migration & no participation
<i>Panel A. Manufacturing</i>						
Manuf. share of employment (p.p.)	−0.293	−0.291	−0.286	−0.287	−0.285	−0.279
<i>Panel B. Employment rate (p.p.)</i>						
Aggregate	0.112	0.132	0.119	0.099	0.085	0.073
Men	0.099	0.092	0.074	0.079	0.090	0.072
Women	0.124	0.170	0.161	0.117	0.080	0.075
Single men	0.106	0.092	0.075	0.082	0.104	0.081
Single women	0.158	0.170	0.161	0.143	0.171	0.157
Married men	0.096	0.093	0.074	0.079	0.086	0.069
Married women	0.111	0.170	0.161	0.107	0.043	0.041
<i>Panel C. Married women's participation (p.p.)</i>						
All couples	0.101			0.097	0.041	0.040
Neither	0.100			0.096	0.041	0.040
Wife only	0.101			0.097	0.041	0.040
Husband only	0.105			0.102	0.042	0.042
Both in manuf.	0.103			0.100	0.042	0.041
<i>Panel D. Migration</i>						
Migration response of the exposed (p.p.)	+0.0166	+0.0194	—	—	+0.0170	—
Share living in a different state because of the shock (%)						
Aggregate	0.150	0.130	—	—	0.148	—
Single men	0.151	0.150	—	—	0.150	—
Single women	0.127	0.116	—	—	0.123	—
Married men	0.159	0.151	—	—	0.158	—
Married women	0.159	0.116	—	—	0.158	—
Couples' migration response (p.p.)						
All couples	−0.0066			—	−0.0071	—
Neither	−0.0109			—	−0.0116	—
Wife only	−0.0062			—	−0.0066	—
Husband only	+0.0141			—	+0.0146	—
Both in manuf.	+0.0078			—	+0.0080	—
<i>Panel E. Wages</i>						
Female real-wage response (%)	0.405	0.362	0.365	0.405	0.442	0.442
Male real-wage response (%)	0.236	0.258	0.265	0.243	0.230	0.237
Relative wage r response (%)	0.169	0.104	0.100	0.162	0.212	0.205

Notes. Responses at $t = 199$, in levels. Panel A is in p.p. of employment and Panel B in p.p. of population. Panel C is the change in married women's quarterly participation rate, in p.p., by the couple's exposure at $t = 1$. In Panel D, the migration response of the exposed is the difference between the shares of manufacturing and non-manufacturing workers who have changed state at least once by $t = 199$, in p.p., counting each person once. Panel E reports employment-weighted log changes in real wages ($\times 100$).

Table G.5: Welfare Effects of the China Trade Shock across Economies: All Groups and Economies

	Baseline economy		Counterfactual economies				
	Home production	Wives' time valued as everyone else's	All-singles	All-singles, no migration	No migration	No participation	No migration & no participation
<i>Panel A. Welfare gain (% CE)</i>							
Aggregate	0.175	0.194	0.178	0.180	0.176	0.167	0.169
Single men	0.157	0.157	0.166	0.170	0.162	0.153	0.158
Single women	0.234	0.234	0.194	0.195	0.236	0.255	0.257
Couples	0.170	0.193	0.178	0.180	0.171	0.157	0.159
Married men	0.170	0.193	0.164	0.167	0.171	0.157	0.159
Married women	0.170	0.193	0.193	0.194	0.171	0.157	0.159
Couples, by exposure							
Neither	0.180	0.180	0.184	0.186	0.182	0.167	0.171
Wife only	0.161	0.022	0.174	0.175	0.162	0.153	0.155
Husband only	0.140	0.320	0.161	0.159	0.135	0.126	0.121
Both in manuf.	0.125	0.136	0.155	0.153	0.122	0.115	0.113
<i>Panel B. Spatial</i>							
CV of state welfare	0.278		0.204	0.327	0.448	0.289	0.462

Notes. Money-metric consumption-equivalent gains (%), summed over $t = 2, \dots, 199$. Each row represents the same people across all economies, and each economy weights each person by their baseline money metric in 2000Q1. In the economies with couples, married men and women carry the couple's welfare; in the all-singles economies, they are the same people as singles, and couples' rows average the two former spouses. The first two columns are the baseline economy: the first values a non-working wife's time as home production, as in the model, and the second values it as everyone else's, at the non-employment benefit y_i . In Panel B, CV is the population-weighted coefficient of variation of state welfare gains. Weighting the all-singles economy by its own wages instead, its aggregate gain is 0.177.

Table G.6: Couples and the Same Spouses as Singles, with and without Migration

	Couple (baseline)	Husband's counterfactual single	Wife's counterfactual single	Couple, no participation
<i>Panel A. Welfare gain (% CE), with migration</i>				
All couples	0.170	0.164	0.193	
Neither	0.180	0.172	0.195	
Wife only	0.161	0.168	0.179	
Husband only	0.140	0.134	0.190	
Both in manuf.	0.125	0.135	0.177	
<i>Panel B. Welfare gain with migration relative to the same economy without migration (%)</i>				
All couples	−0.7	−1.7	−0.3	−1.1
Neither	−1.6	−2.6	−0.6	−2.0
Wife only	−0.7	−1.4	−0.1	−1.0
Husband only	+3.5	+2.9	+0.3	+3.5
Both in manuf.	+2.7	+2.1	+0.5	+2.6

Notes. Couples are tagged by both spouses' sectors at $t = 1$; a non-working wife is tagged by her potential sector. The couple's welfare is based on the baseline economy; the husband's and the wife's counterfactual singles are the two former spouses in the all-singles economy. Panel A: money-metric consumption-equivalent gains (%), weighting both economies by the baseline money metric at 2000Q1. Panel B: welfare gain with migration relative to the same economy without migration, in %: the baseline economy relative to the economy without migration for the couple, the all-singles economy relative to the all-singles economy without migration for the spouses as singles, and the economy with participation partially shut down relative to the same economy without migration for the couple with participation partially shut down.